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# EFFECT OF SPRAYING SOME NUTRIENTS AND GIBBERELLIC ACID ON LEAF MINERAL CONTENT, FRUIT CHARACTERS AND YIELD OF LE-CONTE PEAR TREES

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## ABSTRACT

This investigation was carried out on Le-Conte pear trees, to study the effect of spraying potassium oxide ($Ko_2$), Urea and gibberellic acid ($GA_3$), alone or in combinations on fruit set percentage, yield., leaf mineral contents and fruit characters. Fruit quality was also studied after cold storage for one or two months.

Results revealed that, all treatments gave significant increase in fruit set percentage and yield. Spray ($Ko_2$ 1.5 ml/L (or) 3.0 ml/L $GA_3$ 20 ppm), was superior for all results comparing to other treatments. Spraying of urea 1% + $GA_3$ 20 ppm gave better results than spraying with $Ko_2$ 1.5 ml/L (or) 3.0 ml/L + $GA_3$ 20 ppm. No differences were found for the two concentrations of $KO_2$.

Urea plus $GA_3$ treatments in both seasons significantly increased leaf (N) content and decreased leaf (K) content. Concerning leaf (P) content, there was no clear differences between all treatments.

During cold storage of pear fruits, firmness and total acidity were less than before storing and that of control. Total soluble solids were increased during cold storage.

## INTRODUCTION

Le-Conte pear is one of the important deciduous fruit cultivar grown in Egypt. This cultivar suffers from several factors which have a negative affection its production. One of these factors depression of pear yield was occurred during the last 20 years. The growers used some nutrient element (i,e macro element) or some growth regulators ($GA_3$) in order to increase yield of Le-Conte pear.

Several studies were carried on the application of macro nutrients spray in order to correct plant nutritional status, enhancing vegetative growth in order to increase yield (Kropp and Ben, 1981). A highely significant increase in fruit set percentage of Le-Conte pear was obtained by Kabeel et al (1998). They cleared that the spraying (N+ P+ K+ Mg+ Fe+ Zn+ Mn), gave a highly significant increament in fruit set percentage, tree yield in Kg., fruit characters and leaf mineral content compared with control.

Plant growth, fruit characteristics and yield were improved with spraying by mixture of N+ P+ K solutions (Srinivas and Naik, 1988 on French bean; Hussien et al., 1988 on contaloupe; Kropp and Ben, 1981 on apple). Mohamed, (1992) presented that application spray of potassium nitrate and orthophosphoric acid have an effect on Anna apple production. Gobara, (1998) stated that combined spray of calcium, potassium, boron, zinc, copper and iron fertilizers three times during the growing season was favourable in both yield and quality of Le-Conte pear trees.

The use of plant hormones could lead to increase pollination success for some cultivars (Allen, 1967; Dubois and de Vries, 1986). When $GA_3$ was applied to the stigma of various garden roses at the rate of 250 ppm ten days after pollination, the fruit set was increase in most crosses and fewest seeds per fruit (Ogilvie, et al., 1991).

Luckwill (1969) suggested that the amount of flowering was determined by the balance of flower- promoting (cytokinins) and flower-inhibiting hormones (gibberellins) . Dennis and Nitsch, (1966) identified two gibberellins in apple seeds, . Marino and Greene (1981) found more gibberellines in spurs bearing fruit than in those lacking fruit. Mclaughlin and Greene, (1991) suggested that spraying $GA_{4+7}$ to Delicious" apple trees at full bloom (FB)+ 5; FB + 74 and FB + 22 days, reduced appendage development and flower bud formation on spurs . One spray of $GA_{4+7}$ at 150 mg-liter at FB+ 42 days reduced appendage formation and the percentage of flowering sprus but not as effectively as earlier repeat sprays of $GA_{4+7}$ at 50 mg-liter$^{-1}$. Mokhtar and Khalil (1998) stated that the highest fruit set percentage was noted for plum trees sprayed with 20 ppm ($GA_{4+7}$).

Gibberellic application at post-bloom increased fruit length: diameter (L/D) ratio and juice soluble solids, but did not influence flesh firmness of Golden Delicious apples (Looney et al., 1992).

As regard to the effect of $GA_3$ it has at least three important actions. The first one, is that GA intensifies an organ ability to function as a nutrient sink. A second one is that GA3 ability to increase the synthesis of IAA in plant tissues. The third one involves synthesis acceleration of hydrolytic enzymes as amylase and other hydrolytic enzymes in aleurone cells (Addicott and Addicott, 1982).

The aim of this study is to compare the effect of spraying some nutrients i,e $KO_2$ and Urea or gibbrillic acid on fruit set, yield and fruit characteristics of Le-Conte pear trees.

## MATERIALS AND METHODS

This study was carried out during two successive seasons (1997-1998) and (1998-1999) on Le-Conte pear trees, grafted on *Pyrus communis* rootstock. Trees were planted in the Experimental Orchard of the Nubaria Horticultural Research Station at 5 meters apart in a clay calcareaus soil (31% Ca Co3 and pH= 7.8). The orchard was planted in 1965 and the trees were rejuvenated in 1992 by pruning.

The selected trees were nearly equal in vigour, and treated with normal agricultural practices. The trees were sprayed with different treatments, in the two seasons, as follows:

**Table 1 : Schedule of treatment**

| Treatments | Time of application | | | |
|---|---|---|---|---|
| | bud swelling | 70 % fullbloom | fruit diameter 2 cm. | 3 weeks before harvest |
| 1. Tap water (Control) | + | + | + | + |
| 2. Potassium oxide 1.5 ml/L ($K0_2$ 1.5 ml/L) | + | + | + | + |
| 3. Potassium oxide 3.0 ml/L ($K0_2$ 3.0 ml/L) | + | + | + | + |
| 4. Gibberellic acid 20 ppm ($GA_3$ 20 ppm) | | + | + | + |
| 5. $Ko_2$ 1.5 ml /L + $GA_3$ 20 ppm | | + | + | + |
| 6. Ko2 3.0 ml/L + $GA_3$ 20 ppm | | + | + | + |
| 7. Urea 1% + $GA_3$ 20 ppm | | | + | + |
| 8. Urea 1% + $Ko_2$ 1.5 ml/l | | | + | + |
| 9. Urea 1% + $Ko_2$ 3.0 ml/L | | | + | + |
| 10. Urea 1% + $KO_2$ 1.5 ml/L + GA3 20 ppm | | | + | + |
| 11. Urea 1% + $Ko_2$ 3.0 ml/L + $GA_3$ 20 ppm | | | + | + |

**$Ko_2$ : pottassium oxide** **$GA_3$ : gibberellic acid**

Treatment were replicated four times in a completely randomize blocks design. Each replicate consisted of two trees, totalling eighty eight trees. The following parameters were determined in the two successive seasons :

1. Fruit set percentage ; The total number of flowers at full bloom were determined in 10 shoots at random tree. After a month, data were recorded for fruit set.
2. Yield per tree: Fruits were harvested at maturity stage (the end of August), from each tree of various replicates and yield was recorded, in number and weight in kilogram.
3. Chemical analysis for leaves: Leaf samples were collected in mid-August of both seasons, each sample consisted of 30 leaves, taken from the middle shoots and washed several times with tap water, rinsed with distilled water and then dried at 70C to a constant weight. Leaf dried materials were ground in a stainless steel rotary knife mill 20 mesh. It was digested with sulphric acid and hydrogen peroxide according to Evenhuis and Dewaard (1980). Suitable adequate were then taken for the determination of N.P.K. Nitrogen and phosphoras were colorimetrically determined according to Evenhuis (1976), and Murphy and Riley (1962) , K was determined against a standard Hame Photometer (Corning 410).
4. Fruit quality : including I : physical properties : fruit weight (gm.), fruit dimensions (diameter and length in cm), fruit firmness was estimated by Magness- Taylor type pressure tester which has a standard 5/16 of inch plunger and recorded as pound/inch2.

II. Chemical properties : T.S.S% by hand ATAGO (A.T.C.I) hand refractometer. Acidity was determined (as malic acid) by titration with 0.1 normal sodium hydroxide with phenol-phthalene as an indicator, according to A.O.A.C 1980.

After harvesting, fruits of each treatment were placed in two cartoons boxes (42 x 32 x 10cm), each box contained 40 fruits. The boxes were kept

in the refrigerator at 0+/- 1 C with relative humidity 90%. The fruits were checked for sorting the decayed fruits periodically every month, and fruit samples were also taken after month and after two months for studying fruit characters (Firmness, T.S.S and acidity).

Data were statistically analysed according to Snedecor and Cochran (1990), and L.S.D test at 0.05 level was used for comparison between treatments

## RESULTS AND DISCUSSION

**1. Effect of some mineral nutrients and gibberellic acid on fruit set and yield :**

It is clear from the data in Table (2) that spraying with the combination of $Ko_2$ 1.5 ml/L (or) 3.0 ml/l+ $GA_3$ 20 ppm significantly improved the percentage of fruit set than any treatment of spraying in the two seasons. It ranged between 5,0% to 5,20%, while the lowest percentage was for the trees sprayed with tap water (control)which ranged between 3.31% to 4.17% As regards to the percentage of fruit set for other treatments, it was found that spraying of GA3 20 ppm alone gave 5.20% and 4.94% for the two seasons respectively. Spraying $KO_2$ at 1.5 ml/l or 3.0 ml/l alone gave the same percentage ranged between 4.10 to 4.63 % for the two seasons under study. The other treatments of spraying (urea 1 % combined with $GA_3$ 20 ppm or combined with $KO_2$ 1.5 ml/l (or) 3.0 ml/l) gave a slight significant differences for percentage of fruit set and ranged between 3.94% to 4.69%.

**Table 2: Effect some mineral nutrients and gibberellic acid application on fruit set and yield (in number and kilogram per tree) of Le-Conte pear during 1998 and 1999.**

| Treatments | fruit set % | | No. of fruits / tree | | Yield / tree (Kg.) | |
|---|---|---|---|---|---|---|
| | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 |
| Control | 4.17 | 3.31 | 137.50 | 122.30 | 12.58 | 12.94 |
| $KO_2$ 1.5 ml/L | 4.43 | 4.10 | 140.30 | 132.40 | 14.94 | 14.84 |
| $KO_2$ 3.0 ml/L | 4.63 | 4.13 | 141.30 | 133.30 | 14.64 | 15.49 |
| $GA_3$ 20 ppm | 5.20 | 4.94 | 144.50 | 136.30 | 20.56 | 21.03 |
| $KO_2$ 1.5 ml/L+ $GA_3$ 20 ppm | 5.19 | 5.13 | 150.30 | 148.00 | 29.93 | 30.54 |
| KO, 3.0 ml/L + " " " | 5.20 | 5.0 | 151.80 | 148.30 | 30.62 | 30.30 |
| Urea 1% + " " " | 4.77 | 4.65 | 139.30 | 140.80 | 23.10 | 23.16 |
| Urea 1% + $KO_3$ 1.5 ml/L | 4.69 | 3.94 | 139.50 | 136.00 | 22.99 | 22.23 |
| Urea % + $KO_2$ 3.0 ml/L | 4.69 | 4.08 | 146.30 | 136.50 | 24.36 | 23.18 |
| Urea 1%+ $KO_2$ 1.5 ml/L+ $GA_3$ 20 ppm | 4.14 | 4.04 | 140.80 | 140.30 | 19.98 | 22.11 |
| Urea + $KO_2$ 3.0 ml/l + " " " | 4.17 | 4.07 | 140.00 | 138.80 | 19.64 | 21.84 |
| L.S.D at 0.05 % | 0.112 | 0.274 | 6.350 | 7.749 | 1.201 | 1.711 |

It is obvious from the data in Table 2 that spraying urea 1% + $Ko_2$ 1.5 ml/l (or) 3.0 ml/l + $GA_3$ at 20 ppm resulted in significant increase in yield compared with untreated trees (control). Yield reached 150.30 and 151.80 fruit/tree and 148.00 and 148.30 fruit/tree in 1998 and 1999 seasons respectively, 29.93, 30.62 Kg/tree and 30.54, 30.30 Kg/tree in the two

successive seasons respectively. Trees sprayed with water (control) gave 137.50, 122.30 fruit/tree and 12.58, 12.94 Kg/tree in the two seasons, respectively.

These results are in agreement with those obtained by Kabeel et al., 1998 who worked on macro and micro nutrients alone in combination on fruit set and yield of Le-Conte pear tree. Gobara, 1998 supported the beneficial effect of nutrients on improving the Nutritional status of the trees and reducing pre harvest fruit drop surely reflected on improving the yield of Le-Conte pear. In harmony with the present results are the results obtained by Nijar, (1985).

**2. Effect of some mineral nutrients and gibberellic acid on the leaf contents of N, P. and K .**

Data in Table (3) clearly shows that significant increase in leaf N, when trees were sprayed with (urea 1% + $Ko_2$ 1.5 ml/L (or) 3.0 ml/L + $GA_3$ ppm) or when were sprayed with (Urea 1% + GA3 20 ppm. Trees were sprayed with $Ko_2$ 3.0 ml/L gave the lowest value of N. It is mention that the spray of KL on trees of Le-Conte pear decreased the leaf N content. As regards to leaf content of P, it was found that trees sprayed with tap water (control) had a high value of P while the lowest value was for trees sprayed with $GA_3$ 2o ppm only. Similar results were observed in both seasons. It is obvious from the data in Table 3 that spraying with $KO_2$ only (1.5 ml/L or 3.0 ml/L) gave high value of K in leaf contents. The lowest value of K was obtained from treated with urea 1%+ $GA_3$ 20 ppm. for the first season. The differences between all spraying treatments were insignificant for K. in leaf contents in the second season.

**Table 3: Effect some mineral nutrients and gibberellic acid application on the leaf contents of N, P and K of Le-Conte pear during 1998 and 1999.**

| Treatments | N % | | P % | | K % | |
|---|---|---|---|---|---|---|
| | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 |
| Control | 1.423 | 1.435 | 0.201 | 0.197 | 1.060 | 1.040 |
| $KO_2$ 1.5 ml/L | 1.345 | 1.360 | 0.185 | 0.182 | 1.160 | 1.140 |
| $KO_2$ 3.0 ml/L | 1.332 | 1.340 | 0.182 | 0.179 | 1.121 | 1.180 |
| $GA_3$ 20 ppm | 1.555 | 1.590 | 0.161 | 0.172 | 0.970 | 1.010 |
| $KO_2$ 1.5 ml/L+ $GA_3$ 20 ppm | 1.543 | 1.585 | 0.174 | 0.174 | 1.130 | 1.120 |
| KO, 3.0 ml/L + " " " | 1.553 | 1.565 | 0.170 | 0.172 | 1.140 | 1.140 |
| Urea 1% +" " " " | 1.615 | 1.615 | 0.175 | 0.180 | 0.870 | 0.970 |
| Urea 1% + $KO_3$ 1.5 ml/L | 1.550 | 1.585 | 0.189 | 0.186 | 1.130 | 1.140 |
| Urea 1% + $KO_2$ 3.0 ml/L | 1.553 | 1.592 | 0.191 | 0.186 | 1.120 | 1.150 |
| Urea 1% + $KO_2$ 1.5 ml/L+ $GA_3$ 20 ppm | 1.630 | 1.615 | 0.167 | 0.176 | 1.120 | 1.130 |
| Urea + $KO_2$ 3.0 ml/Ll + " " " | 1.630 | 1.610 | 0.163 | 0.176 | 1.140 | 1.150 |
| L.S.D at 0.05 % | 0.0450 | 0.0300 | 0.0004 | 0.0004 | 0.0790 | N.S. |

It could be concluded that the increase in N and K resulted from spraying Urea 1% or $KO_2$ 1.5 ml/L (or) 3.0 ml/L might be attributed to quick absorption of the leaves.

These results are similar to those obtained by Mohamed, (1992) who worked on K for Anna apple trees, Sister et al., (1956) explained the positive influence of such elements on growth and development of pears .

**3. Effect of some mineral nutrients and gibberellic acid on fruit characters;**

Physical characters: It could be stated from the data in Table (4) that fruit weight was increased by all treatments comparing with the control in the two seasons. The highest values of fruit weight were from trees treated with spraying (Urea 1% + $KO_2$ 1.5 ml/L (or) 3.0 ml/L + $GA_3$ 20 ppm), in the two seasons. Spraying of (Urea 1% plus ($KO_2$ 1.5 ml/L (or) 3.0 ml/L) or plus ($GA_3$ 20 ppm) in descending order was very effective in increasing fruit weight.

Considering fruit dimensions (fruit height and diameter) it is also affected by different spraying, data in Table (4) showed that all the treatments gave a high significant increase in diameter and length of fruit in the two seasons as compared with untreated trees (Control).

Significant variations were detected in fruit firmness for all treatments. Untreated trees had markedly effect for increasing firmness while the two tertiary spraying gave lowest valus in the two successive seasons.

These results are in agreement with that mentioned by Looney et al., (1992) who worked on gibberellins and Kroop and Ben, (1981), who worked on urea.

Chemical fruit characters: Table (4) showed that spraying (Urea 1%+ KO2 1.5 ml/L (or) 3.0 ml/L + GA3 20 ppm), caused a positive effect on percentage of total soluble solids and decreasing the percentage of total acidity. Untreated trees (control) gave the lowest percentage of T.S.S and highest percentage of acidity. These are in confirmity with that previously mentioned by Ahmed et al ., (1996); Mohamed and Ahmed, (1991) and Gil et al., (1994) on improving the quality of pome fruits.

**4. Fruit quality after storage:**

The results presented in Table (5) shows that firmness, T.S.S % and acidity for pear fruits after one and two months from cold storage. The maximum values for firmness of fruits were obtained as a result of spraying with tap water (control), while the minimum values were for tertiary spraying (Urea 1% + $Ko_2$ 1.5 ml/L (or) 3.0 ml/L + $GA_3$ 20 ppm) These results were true in 1998 and 1999 seasons. It is mentioned that the values of firmness decreased after two months from storage for all treatments and for control. This decrease of firmness could be a result of change complex. insoluble carbohydrates like protopectine, cellulose and hime-cillulose to simple soluble carbohydrates like pectin.

Concerning the results of total soluble solids for all treatments Table (5) revealed that after one (or) two months from cold storage increasing in its percentage. The hieghest values were for tertiary spraying while the lowest values for control. The decreased for acidity continued during storage of fruit

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for all treatments. The high percentage for untreated trees, (control) while the low percentage for the tertiary spraying. The increase in the T.S.S. percentage is due to the degradiation of complex insoluble compounds like starch to simple soluble compounds like sugar.

Generally, it could be concluded that storage of fruits for all treatments gave good results for its characters and the tertiary spraying was a best treatment for fruit quality.

These results confirm with earlier reports (El-Seidy, 1994) since the fruit firmness decreased with the progress of storage time and temperature for “Le-Conte” pear fruits. Similar results concerning the effect of storage fruits on improving the quality of pome fruits were obtained by Hussein (1972) on Le-Conte pear; Ebd-EL-Migid (1986) on Le-Conte and Keifer pears .

In general, The two tirtry spraying treatments gave satisfactory results for fruit set, yield nd fruit characters. The treatments of $GA_3$ 20 ppm plus urea 1% gave best result comparing with treatments of GA3 20 ppm plus KO2 1.5 ml/L (or) 3.0 ml/L.Yet no differences between the two concentrations of $KO_2$ was obtained, so, it must be use the lowest concentration. Fruit quality improved after cold storage for one or two months for all treatments.

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## تأثير الرش ببعض العناصر وحامض الجبرليك على محتوى الأوراق من العناصر المعدنية والمحصول و صفات ثمار الكمثرى الليكونت

**آمال السيجنى و بهان محمود خليل**

**معهد بحوث البساتين - مركز البحوث الزراعية**

اجريت هذه الدراسة بمحطة بحوث البساتين بالنوبارية على اشجار الكمثرى الليكونت المطعومة على اصل كميونس خلال موسمى 1998 - 1999 ولقد تم دراسة تأثير الرش بأكسيد البوتاسيوم - اليوريا - حامض الجبرليك أما منفردة أو مختلطة.

ولقد تم رش أشجار المقارنة بالماء (كونترول).

ولقد أوضحت النتائج الآتى :

1 - تفوقت الرشة الثنائية ( اكسيد بوتاسيوم (5ر1 مل/لتر أو 3 مل/ لتر) + حامض جبرليك 20 جزء فى المليون) ، فى نسبة العقد والمحصول وعدد الثمار والوزن وكذلك صفات الثمار .

2 - تفوقت المعاملة بالرش فى (يوريا 1% + حامض جبرليك 20 جزء فى المليون) عن المعاملة بالرش (باكسيد بوتاسيوم 5ر1 مل/لتر أو 3 مل/ لتر + حمض الجبرليك) فى جميع الصفات تحت الدراسة .

3 - لم يؤثر اختلاف التركيز بمادة اكسيد البوتاسيوم الى اختلاف فى النتائج .

4 - أدى تخزين الثمار لمدة شهر أو شهرين الى تقليل الصلابة والحموضة فى الثمار - وزيادة فى نسبة السكريات الكلية - ولقد تفوقت ثمار كل المعاملات عن ثمار اشجار المقارنة .

5- أدت المعاملة بالرش بخليط اليوريا 1% مع الجبرليك 20 جزء فى المليون الى زيادة معنوية فى المحتوى النتروجينى بالأوراق وإنخفاض محتوى الأوراقمن البوتاسيوم - وكانت الفروق فى محتوى الفوسفور بالورقة بسيطة .

**Table 4: Effect some mineral nutrients and gibberellic acid application on fruit characters of le-Conte pear during 1998 and 1999.**

| Treatments | fruit weight gm | | fruit diameter cm | | fruit length cm | | Firmness pound/in$^2$ | | T.S.S. % | | Acidity % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 | 1998 | 1999 |
| Control | 91.00 | 105.75 | 4.5 | 4.6 | 5.3 | 6.4 | 17.0 | 16.8 | 11.2 | 11.3 | 0.464 | 0.461 |
| Ko2 1.5 ml/L | 106.50 | 122.00 | 4.7 | 4.7 | 6.5 | 6.8 | 16.0 | 14.8 | 11.7 | 11.8 | 0.425 | 0.422 |
| Ko2 3.0 ml/L | 103.75 | 116.25 | 4.6 | 5.2 | 6.8 | 7.2 | 16.5 | 14.5 | 11.6 | 11.5 | 9.425 | 0.421 |
| GA3 20 ppm | 142.38 | 154.50 | 5.3 | 5.7 | 6.8 | 8.0 | 15.3 | 13.0 | 11.7 | 11.8 | 0.399 | 0.396 |
| Lo2 1.5 ml/L + GA3 20 ppm | 142.00 | 157.75 | 5.3 | 5.7 | 6.8 | 7.9 | 15.3 | 14.0 | 11.8 | 11.6 | 0.361 | 0.358 |
| Ko2 3.0 ml/L + GA3 20 ppm | 140.25 | 157.50 | 5.3 | 5.6 | 6.8 | 7.9 | 14.0 | 13.8 | 11.5 | 11.5 | 0.359 | 0.356 |
| Urea 1% + GA3 20 ppm | 166.50 | 169.75 | 6.8 | 6.5 | 7.4 | 8.2 | 13.5 | 12.8 | 11.5 | 11.6 | 0.356 | 0.354 |
| Urea 1% + Ko2 1.5 ml/L | 164.75 | 164.25 | 6.7 | 6.4 | 7.3 | 8.2 | 14.0 | 13.3 | 11.5 | 11.5 | 0.356 | 0.355 |
| Urea 1% + Ko2 3.0 ml/L | 166.00 | 163.50 | 6.7 | 6.4 | 7.4 | 8.0 | 14.3 | 13.3 | 11.6 | 12.0 | 0.354 | 0.354 |
| Urea 1% + Ko2 1.5 ml/L + GA3 20 ppm | 199.25 | 206.25 | 7.1 | 7.4 | 8.4 | 8.8 | 12.0 | 12/0 | 11.9 | 12.1 | 0.328 | 0.328 |
| Urea 1% = Ko2 3.0 ml/L + GA 20ppm | 201.75 | 204.25 | 7.3 | 7.2 | 8.7 | 8.7 | 12.8 | 12.8 | 12.2 | 12.2 | 90.313 | 0.311 |
| L.S.D at 0.05 % | 5.25 | 5.46 | 0.05 | 0.10 | 0.02 | 0.14 | 1.3 | 1.7 | 0.17 | 0.26 | 0.0004 | 0.0004 |

**Table 5: Effect some mineral nutrients and gibberellic acid application on fruit characters of le-Conte pear after cool storage for one and two months during 1998 and 1999.**

| Treatments | Firmness pound/in2 | | | | | | T.S.S % | | | | | | Acidity % | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1998 | | | 1999 | | | 1998 | | | 1999 | | | 1998 | | | 1999 | | |
| | 0 | one | two | 0 | one | two | 0 | one | two | 0 | One | two | 0 | one | two | 0 | One | two |
| Control | 17.0 | 15.0 | 12.8 | 16.8 | 15.5 | 13.8 | 11.2 | 11.5 | 11.9 | 11.3 | 11.8 | 12.4 | 0.464 | 0.362 | 0.331 | 0.461 | 0.362 | 0.337 |
| Ko2 1.5 ml/L | 16.0 | 14.5 | 12.0 | 14.8 | 14.0 | 12.3 | 11.7 | 11.9 | 12.3 | 11.8 | 12.2 | 13.0 | 0.425 | 0.369 | 0.332 | 0.422 | 0.353 | 0.328 |
| Ko2 3.0 ml/L | 16.5 | 13.8 | 12.3 | 14.5 | 13.8 | 12.3 | 11.6 | 12.1 | 12.3 | 11.5 | 12.0 | 13.0 | 0.425 | 0.368 | 0.331 | 0.421 | 0.326 | 0.274 |
| GA3 20 ppm | 15.3 | 13.5 | 12.3 | 13.0 | 12.8 | 11.8 | 11.7 | 12.2 | 12.4 | 11.8 | 12.7 | 13.5 | 0.399 | 0.372 | 0.332 | 0.396 | 0.325 | 0.269 |
| Ko2 1.5 ml/L + GA3 20 ppm | 15.3 | 13.0 | 12.0 | 14.0 | 12.8 | 11.5 | 11.8 | 1`2.3 | 12.6 | 11.6 | 12.6 | 13.4 | 0.361 | 0.324 | 0.285 | 0.358 | 0.310 | 0.262 |
| Ko2 3.0 ml/L + GA3 20 ppm | 14.0 | 12.5 | 11.0 | 13.8 | 12.3 | 10.8 | 11.5 | 12.3 | 12.7 | 11.5 | 12.3 | 13.7 | 0.359 | 0.314 | 0.293 | 0.356 | 0.310 | 0.256 |
| Urea 1% + GA3 20 ppm | 13.5 | 12.3 | 10.8 | 12.8 | 12.0 | 10.5 | 11.5 | 12.1 | 12.6 | 11.6 | 12.4 | 13.3 | 0.356 | 0.317 | 2.286 | 0.354 | 0.305 | 0.264 |
| Urea 1% + Ko2 1.5 ml/L | 14.0 | 12.0 | 10.8 | 13.3 | 11.8 | 10.3 | 11.5 | 11.8 | 12.3 | 11.5 | 12.3 | 13.5 | 0.356 | 0.314 | 0.276 | 0.355 | 0.310 | 0.276 |
| Urea 1% + Ko2 3.0 ml/L | 14.3 | 11.8 | 10.3 | 13.3 | 11.5 | 10.0 | 11.6 | 11.9 | 12.5 | 12.0 | 12.5 | 13.6 | 0.354 | 0.321 | 0.275 | 0.354 | 0.310 | 0.265 |
| Urea 1% + Ko2 1.5 ml/L + GA3 20 ppm | 12.0 | 10.5 | 9.3 | 12.0 | 10.8 | 9.5 | 11.9 | 12.3 | 13.0 | 12.1 | 12.8 | 13.8 | 0.328 | 0.281 | 0.222 | 0.328 | 0.283 | 0.215 |
| Urea 1% = Ko2 3.0 ml/L + GA 20ppm | 12.8 | 10.0 | 9.0 | 12.8 | 10.5 | 8.8 | 12.2 | 12.8 | 13.8 | 12.2 | 13.1 | 14.4 | 0.313 | 0.270 | 0.215 | 0.311 | 0.281 | 0.215 |
| L.S.D at 0.05 % | 1.3 | 1.07 | 1.27 | 1.7 | 1.99 | 1.24 | 0.17 | 0.22 | 0.25 | 0.26 | 0.36 | 0.52 | .0004 | 0.014 | 0.001 | .0004 | 0.026 | 0.026 |