How to Improve Lemon Cypress As A Pot Plant Using GA3 And Urea

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Abstract:
Lemon cypress "Cupressus macrocarpa" is a handsome pot plant used widely. The required for the commercial production is insufficient to meet the demand as a result of slow growth of that plant. Therefore, a trial was done to use urea and GA3 to induce rapid growth. The present study was directed towards the effect of GA3 at certain levels (0, 125, 250 and 500 ppm) as foliar sprays separately or in combination with soil addition of urea at the rates of 2.5 or 5 g/plant beside the control. The experimental design was complete randomized block design in a split plot with three replicates during the 2007 and 2008 seasons. The study included the desired pot plant characteristics and explained on the mineral as percentages of N, P, K, Ca and Mg, as well as total carbohydrate and protein in the leaves. The obtained results indicated that spraying 250 ppm GA3 and soil adding 5 g Urea/plant to improve lemon cypress as a pot plant under the condition of this experiment.

KEYWORDS: Cupressus macrocarpa, Urea, GA3, Growth regulators, leaf mineral content.

Introduction:
Cupressus macrocarpa C.V. Goldcrest is a Monterey Cypress cultivar, endemic to Monterey Bay on the central coast of California, Hogan and Frankis (2009). It is a handsome ornamental tree tolerates high salts and excellent choice for seaside plantings. It can be pruned to form a hedge whilst smaller cultivars such as 'Goldcrest' are grown in containers.

Several investigators reported that GA3 spraying on Cupressus sempervirens; El-Sallami and Makary (1997) and on Eucalyptus; Scurfield and Moore (1958) within the range of 100 to 300 ppm improved plant growth parameters to certain limits except stem diameter and number of branches per plant. El-Keltawi et al (2012) found that foliar sprays of GA3 at 100 ppm resulted in significant increment of all vegetative parameters and...
nutrient contents of Monterey Cypress plants. Meanwhile, calcium and total carbohydrate contents were decreased with the application of 100 ppm GA3. Emrah et al (2010) found that application of urea nitrogen at 15, 25 and 50 g/tree on Fraxinus angustifolia had a large and positive effect on diameter and growth height during the first three years, without significant differences between the treatments in terms of tree diameter and growth height.

Recently El-Keltawi et al (2012) reported that fertilizing Cupressus macrocarpa.C.V. Goldcrest plants with Krestalone(19-19-19+1) NPK+MgO at 0, 5 and 10 g/plant enhanced all recorded plant growth characteristics.

Therefore, Monterey Cypress growth is characterized with slow growing rate, particularly during juvenile years. The presented study directed to investigate the effect of foliar spray of GA3 and Urea as soil addition separately or in combination on the growth parameters and chemical composition of the Monterey Cypress leaves.

Materials and Methods:
A pot experiment was carried out during the two successive seasons of 2007 and 2008 at the Floriculture Experimental Farm, Faculty of Agriculture, Assiut University, Assiut, Egypt.

1- Materials:
A-Plant materials: Homogeneously two-years old vegetivle propagated Cupressus macrocarpa, seedlings obtained in 15cm polyethylene bages from commercial nursery in the Mansoreya area of Giza, Egypt were used.

B - Potting media: Growing medium was clay( Local soil of Floriculture Experimental Farm, Faculty of Agriculture, Assiut University, Assiut, Egypt) mixed with cattle manure at a ratio of 3:1(v/v), respectively. The constituents and characteristics of the media used are represented in Table (1).

C - Chemical fertilizers: Urea (46.5% N) distributed by Factory of Fertilizers Abo Qir, Alexandria, Egypt was used.

D – Growth regulators :
- Gibberellic acid : Berlex tablets containing 1 gram Gibberellic Acid as GA3. a.i. Imp. Chem. Ind.Ltd ,ICI , product was used.

Materials and Methods:

Table (1): Constituents and characteristics of the used medium at the beginning of the experiment:

<table>
<thead>
<tr>
<th>Particle size Distribution (%)</th>
<th>pH</th>
<th>EC</th>
<th>Calcium carbonate (%)</th>
<th>Organic matter (%)</th>
<th>Total nitrogen (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay</td>
<td>52.47</td>
<td>3.28</td>
<td>8.23</td>
<td>6.10</td>
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<tr>
<td>Silt</td>
<td>32.86</td>
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<td></td>
<td>7.72</td>
<td>1.74</td>
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<tr>
<td>Fine sand</td>
<td>8.23</td>
<td></td>
<td></td>
<td>6.10</td>
<td>2.74</td>
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<tr>
<td>Coarse sand</td>
<td>6.10</td>
<td></td>
<td></td>
<td>1.15</td>
<td>0.23</td>
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</table>

<table>
<thead>
<tr>
<th>Soluble cations mg/100g soil</th>
<th>Soluble anions mg/100g soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl</td>
<td>Mg</td>
</tr>
<tr>
<td>0.72</td>
<td>0.28</td>
</tr>
</tbody>
</table>
2. Methods:

On March of both seasons, uniform healthy seedlings, which had been grown in peat-moss in 15cm plastic bags were transplanted singly into 25cm diameter clay pots filled with clay soil mixed with cattle manure as { 3 (clay soil) : 1 (cattle manure). Plants were grown under lath shade condition until the end of the experiment for both seasons. All plants were fertilized with Urea (0.0, 2.5, 5.0 g/plant, and sprayed with Gibberellic acid (0, 125, 250, and 500 ppm) at biweekly intervals. Gibberellic acid was applied as foliar spray until the point of run off starting one month after potting. Each spray from each concentration of GA3 followed by adding the urea one day later. Control plants were sprayed with distilled water. Irrigation, weeding and other agricultural practices were carried out for the experiment as usual.

Experimental design:

The present experiment was arranged in a complete randomized block design (split-plot), where it consisted of 12 treatments (3 Urea rates x 4Gibberellic acid concentrations) replicated three times and each contained 4 plants (4 pots). The treatments of Urea fertilizer (control, 2.5 and 5 g) were considered as main-plots and Gibberellic acid concentrations (0, 125, 250 and 500 ppm) as sub-plots.

Collected data and analysis:

A – Vegetative parameters:

At the end of the experiment (at the beginning of December); data recorded were plant height (cm), number of branches per plant, stem diameter (cm) and foliage fresh and dry weight per plant (g).

B – Chemical analysis:

Leaf mineral nutrients content:

Plant samples were collected, prepared and digested according to Piper (1967). The following nutrient minerals were estimated:

- Nitrogen content was determined using the modified micro Kjeldahal method, Black et al. (1965).
- Phosphorus content was determined spectrometrically, Jackson (1973).
- Potassium content was determined by the flame photometer method, Jackson (1973).
- Calcium and Magnesium contents were determined by titration method, Jackson (1973).
- Protein percentage was estimated according to the method by Ranganna (1978).
- Total carbohydrate percentage: was calorimetrically determined, Fales (1951).

IV- Statistical analysis:

Data were subjected to statistical analysis using “F” test according to Snedecor and Cochran (1973) and L.S.D. value for comparisons according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Vegetative growth:

Data presented in Tables (2 and 3) showed that different
growth measurements were markedly affected by the various treatments. Concerning the specific effect of gibberellin (GA3) application (Tables 2 and 3), it was observed that plants treated with any concentration, showed better results comparing to untreated ones during both seasons. It was noticed that increasing the concentration of GA3 led to a significant increase in plant height, branch number and foliage fresh and dry weights, with the best results attained by applying GA3 at 250 ppm. Applying the highest concentration (500 ppm) showed lower values. Meanwhile, the highest concentration of GA3 (500 ppm) exhibited the thickest cypress plants.

Similar results were obtained by El-Salami and Makary (1997) on Cupressus sempervirens, L. Seedlings, Ibrahim et al (2010) on croton plants; and on Anna apple trees Mostafa and Saleh (2006).

However, such increase in plant height might be due to that GA3 enhancement cell division and /or cell elongation within stem tissues leading to more height and internode length. GA3 might promote cell enlargement and help in cell division. Similar results were obtained by Awad (1973) on roses, which showed that GA3 at the lowest concentration increased branch number. Meanwhile, GA3 may enhance the lateral buds growing to lateral branches by activating cell division.

Under the conditions of the present study, feeding lemon cypress with Urea at 5g/plant resulted in the highest values of vegetative measurements compared with the other treatments or the control.

The increase in plant growth due to using Urea could be explained that the effect of its nutrient contents could stimulate the biosynthesis of enzyme, protein and other fractions. The constituents of Urea are quite enough for increasing the growth. These results are in agreement with those obtained by Mazher et al (2008) on Taxodium disticum, Garciano et al (2006) on Eucalyptus grandis, and Emrah et al (2010) on Fraxinus angustifolia.

With regard to the interaction effects between GA3 and Urea fertilizer on growth measurements, data showed that applying a combination of 250 ppm GA3 and 5 g Urea /plant gave the best results of different growth measurements (Tables 2 and 3).

**Nutrient contents:**

Nutrient contents of cypress branches showed considerable responses to Urea and GA3 (Tables 4 and 5). The highest concentrations of N, P, K and Mg and the lowest Ca were obtained from plants received Urea and GA3, either medium or high level. Such results pointed out that these levels were the most suitable ones as they furnished plants with N, P, K and Mg at adequate levels and consequently obtaining the best plant growth. From the above mentioned results it
could be noticed that there was a close relationship between the nutrient contents in branches of cypress plants and their growth characters. Clearly, there are many possible roles by which these nutrients stimulate the growth of cypress seedlings. Among their vital roles are being constituents of plant tissues, catalysts in various reactions, osmotic regulators and performing an active role in biosynthesis of enzymes and amino acids; Devlin and Witham (1983).

Several reports concluded that GA$_3$ showed enhancement effect on increasing plant nutrient contents. Broughton and McComb (1967) demonstrated that GA$_3$ stimulated the synthesis of protein which was reflected in increasing the plant growth and consequently the absorption of N, P, K and Mg increased. Demisova and Lupinovich (1961) reported that GA$_3$ application increased the rate of mineral transport from the root system to the areal parts of plant.

El-Sallami and Makary (1997) recorded that, spraying *Cupressus sempervirens*, *L*. seedlings with NPK as a foliar fertilizer at the rates of (0.0, 0.2, 0.4 and 0.6%) increased the contents of N, P, K, Mg and Fe in cypress branches, while Ca content showed a negative effect. Barros *et al.*, (1975) pointed out that *Eucalyptus saligna* treated with NPK (3-15-3) at a rate of 5g/plant/month had improved contents of N, P and K. Meawad (1981) mentioned that GA$_3$ increased total N, P and K contents in gladiolus leaves.

On *Thuja orientales*, El-Sallami and Mahros (1997) reported that, the leaf contents of N, P, K and Mg were generally increased by mineral nutrition, especially at the rate of 6 g(6-8-6) per plant. El-Mahrouk (2000) on *Swietenia mahogoni*, *L*. found that, the percentages of N, P, and K in the leaves were increased by increasing different fertilizer treatments.

Concerning the interaction between GA$_3$ and Urea, the combined treatment of GA$_3$ (250 ppm) plus Urea (5g) proved to be the most effective on producing better nutritional status.

**Total carbohydrates and protein contents:**

It is clear from the data given in Table (6) that total carbohydrates were decreased with increasing the concentration of GA3 during both seasons. The reduction in total carbohydrates by using GA3 could be explained through the role of GA3 in decreasing the photosynthetic pigments in the branches, led to a decrease in the synthesis of sugars and starch, and consequently less accumulation of carbohydrates in plant organs. In this connection, some authors reported that application of GA3 decreased total carbohydrate content in plant; El-Khateeb and Selim (1988) on *Thuja orientalis*, *L*. and Matter (1992) on carnation.

On the contrary, fertilizing the cypress plants with Urea
increased total carbohydrates in leaves. Either Urea rate at 2.5 or 5 g/pot increased total carbohydrate comparing to the control. Meanwhile, the higher level of Urea (5g/pot) was more effective in this respect. These results could be attributed to the role of all nutrients in this commercial fertilizer at their suitable rate in raising the physiological activity of the plant and consequently increasing the photosynthates in branches. Similar results were obtained by Mantrova and Nikitina (1972) who stated that the optimum NPK rates stimulated carbohydrate synthesis which was accumulated in rose plants. On Thuja oriintales L. El-Sallami and Mahros (1997) reported that, the leaf content of total carbohydrate were generally increased by mineral nutrition, especially at the rate of 6 g(6-8-6) per plant. Mohamed et al. (1987) reported that NPK fertilizer increased the total soluble sugars in leaves of Eucalyptus camaldulensis.

Concerning the interaction effect, the highest total carbohydrate contents were determined in plants treated with the combination of Urea at 5g/pot and GA3 at 0 (control).

On the other hand, protein content is typically related to the results obtained form nitrogen content in branches. This is obviously due to the statistical method by which protein content was calculated through multiplying nitrogen content by 6.25. Therefore, the best treatment regarding protein content is Urea at 5 g/pot and GA3 at 250 ppm.

References:


El-Sallami, I.H. and B.S. Makary (1997): Response of \textit{Cupressus sempervirens}, L. seedlings to Gibberllic acid and foliar nutrition of Assiut J. of EL-


Mantrova E.Z. and G.N. Nikitina (1972): The characteristics of nutrition and carbohydrate metabolism in roses growing on their own roots in relation to winter hardness. Agrokhini-
El-Keltawi N.E et al 2012


<table>
<thead>
<tr>
<th>GA3 ppm</th>
<th>Urea g/plant</th>
<th>Plant height (cm)</th>
<th>No. of branches/plant</th>
<th>Stem diameter (cm)</th>
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<td>71.9</td>
<td>69.2</td>
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</tr>
<tr>
<td></td>
<td>2.5</td>
<td>92.4</td>
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<td></td>
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<td>75.6</td>
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<tr>
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<td>0</td>
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<td>78.8</td>
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<td></td>
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<td>101.5</td>
<td>98.7</td>
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<td>118.2</td>
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<td>120.8</td>
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<td>85.8</td>
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<td></td>
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<td>127.5</td>
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<tr>
<td>mean</td>
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<td>109.3</td>
<td>106.7</td>
<td>70.5</td>
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<td>Means of Urea levels</td>
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<td>82.7</td>
<td>62.1</td>
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<td>106.5</td>
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<td></td>
<td>5</td>
<td>126.9</td>
<td>123.1</td>
<td>89.3</td>
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</table>

L.S.D. at 5% of GA3 8.2 7.7 10.2 8.5 7.5 11.4 8.0 7.3 11.0 9.2 8.3 11.5

Table (3) Effect of GA3 application and Urea fertilizer on fresh and dry weight of *Cupressus macrocarpa* during 2007/2008 seasons

<table>
<thead>
<tr>
<th>GA3 ppm</th>
<th>Urea g/plant</th>
<th>Fresh weight (g)</th>
<th>Dry weight (g)</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>96.5</td>
<td>99.0</td>
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<td></td>
<td>2.5</td>
<td>114.3</td>
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<td>110.2</td>
<td>113.2</td>
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<td>125</td>
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<td>110.3</td>
<td>112.6</td>
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<td>120.8</td>
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<td>121.1</td>
<td>124.2</td>
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<td>115.8</td>
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<td>136.3</td>
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</table>

L.S.D. at 5% of GA3 6.0 7.4 6.2 5.6

Urea 5.8 6.1 5.4 4.0

GA3 x Urea 7.1 8.6 8.3 7.2
Table (4) Effect of GA3 application and Urea fertilizer on Nitrogen, Phosphorus and Potassium contents in leaves of *Cupressus macrocarpa* during 2007/2008 seasons

<table>
<thead>
<tr>
<th>GA3 ppm</th>
<th>Urea g/plant</th>
<th>N%</th>
<th>P%</th>
<th>K%</th>
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<tbody>
<tr>
<td>0</td>
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<td>2.78</td>
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<td>3.55</td>
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L.S.D. at 5% of

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<th>GA3</th>
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<td>0.03</td>
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<td>0.05</td>
<td>0.06</td>
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Table (5) Effect of GA3 and Urea fertilizer on Calcium and Magnesium contents in leaves of *Cupressus macrocarpa* during 2007/2008 seasons

<table>
<thead>
<tr>
<th>GA3 ppm</th>
<th>Urea g/plant</th>
<th>Ca%</th>
<th>Mg%</th>
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<tr>
<td></td>
<td></td>
<td>2007</td>
<td>2008</td>
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L.S.D. at 5% of

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<th>0.24</th>
<th>0.29</th>
<th>0.27</th>
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<tbody>
<tr>
<td>Urea</td>
<td>0.22</td>
<td>0.21</td>
<td>0.24</td>
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<td>GA3 x Urea</td>
<td>0.36</td>
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### Table (6) Effect of GA3 application and Urea Fertilizer on Total Carbohydrate and Protein Content of Cupressus macrocarpa during 2007/2008 seasons

<table>
<thead>
<tr>
<th>GA3 ppm</th>
<th>Urea g/plant</th>
<th>Total Carbohydrate (% D.M.)</th>
<th>Protein Content</th>
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<tr>
<td></td>
<td></td>
<td>2007</td>
<td>2008</td>
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<td>29.1</td>
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<td>21.5</td>
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<table>
<thead>
<tr>
<th>GA3 ppm</th>
<th>Urea g/plant</th>
<th>Total Carbohydrate (% D.M.)</th>
<th>Protein Content</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>2007</td>
<td>2008</td>
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<table>
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<th>Urea levels</th>
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<th>Protein Content</th>
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<td>18.4</td>
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<tr>
<td>2.5</td>
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<td>20.8</td>
</tr>
<tr>
<td>5</td>
<td>29.7</td>
<td>22.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Urea</th>
<th>GA3 x Urea</th>
</tr>
</thead>
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<td>2.56</td>
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<td>3.32</td>
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</table>
تحسين نمو السرو الليموني باستخدام حمض الجبريليك واليوريا

أ.د/ نعيم عيسى القطتاوى (1)، أ.د/ عبد الرزاق إبراهيم إنجاز (1).

قسم الزينة - كلية الزراعة - جامعة سوهاج - مصر (1).
كلية الزراعة - جامعة جنوب الوادي - مصر (2).

إن أشجار السرو الليموني تستعمل على نطاق واسع كنباتات نباتية جذابة. لكن نموها البطيء يحول دون أن تكون نباتات تجارية. لذلك أجريت هذه التجربة لدراسة استعمال اليوريا والجابريلين لزيادة سرعة نمو النباتات. إما بالنسبة للجابريلين فقد استعمل بمعدلات (0، 125، 250 و 500 جزء في المليون) سواء بدون أو مع اليوريا والتي تضاف إلى النتر في مستويات (0، 2، 2.5 و 5 جرام/نبتة). وجمعت النتائج في قطعات كاملة العشائية بثلاث مكررات وذلك في موسمي 2007 و 2008 وشملت التجربة دراسة تأثير المحمول السابق على النمو الخضري والمنشآت الكيميائية للنباتات. أظهرت النتائج التي تم الحصول عليها تأثيرًا إيجابيًا كبيرًا للعاملين عند مستوى 250 جزء في المليون سواء على قياسات النمو الخضري أو على محتوى العناصر الغذائية من النتر، الفوسفور، البوتاسيوم، الماغنيسيوم والبوتاسيوم معاً تحتوي كلاً من الكالسيوم والكربوهيدرات. وقد كان تأثيره سلبيًا مقارنة بالمستويات الأخرى. لذلك يمكن التوصية باستخدام الجابريلين عند مستوى 250 جزء في المليون مع 5 جم يوريا/نبتة لتحسين نمو السرو الليموني.