Foliar Urea Increases Citrus Yields

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Introduction

Citrus trees flower in response to low temperatures experienced during the winter. Research has shown that flower number is consistently correlated with the duration of the low-temperature period. It has been found that the ammonia content of the leaves increases during the period of low temperatures. Basic research suggested that winter foliar applications of low biuret urea (LBU) could increase flowering. Three years of field research confirmed that winter foliar applications of LBU increased orange yields without reducing fruit size. Unocal Plus® was used as the source of LBU since it has the lowest biuret content now available.

Table 1
Leaf ammonia content and flower number increased when sprayed with LBU.

<table>
<thead>
<tr>
<th>Weeks of low-temperature treatment</th>
<th>Increase in leaf ammonia content</th>
<th>Increase in flower number</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>166</td>
<td>194</td>
</tr>
<tr>
<td>6</td>
<td>215</td>
<td>230</td>
</tr>
</tbody>
</table>

Basic research

Citrus trees flower in response to low temperatures experienced during the winter. Controlled-environment chambers have been used to apply low temperatures in a quantitative manner so that changes in plant growth regulators, carbohydrates and nitrogen compounds could be monitored in relation to floral intensity. The results showed that only the ammonia level in the leaves could be correlated with low temperatures and floral intensity. There was no correlation between the leaf concentration of total nitrogen or nitrate; the effect on flowering is specifically related to the increased ammonia concentration.

The ammonia status of citrus leaves can be artificially increased through the foliar application of urea. Because of the well-known adverse effects of biuret, LBU is recommended for use on citrus. We used Unocal Plus in our research.

We were able to increase both the ammonia concentration and flower number of five-year-old "Washington" navel orange trees by spraying them with LBU. Trees were subjected to short periods of cold treatment which would result in minimal flowering and then sprayed with LBU (Table 1). Note the correlation between the increased ammonia content and the increased flower number.

Because of the well-known adverse effects of biuret, low biuret urea is recommended for use on citrus.

In addition to increasing the flower number, the foliar application of LBU also increased the proportion of flowers borne on leafy inflorescences.

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The winter foliar application of LBU is a profitable practice. We conducted a cost-benefit analysis using the following values: (1) The 1989-90 average price of $3.20 per carton, (2) the average cost of 1.5 gallons of Unocal Plus per acre, (3) spray rig at $25.00 per acre for the highest cost per acre, and (4) plane at $1,000 per acre to give upper and lower range reported as net return in Tables 3 and 4. It is important to stress that the values reported in Tables 3 and 4 are the increases in yield and economic return due to the winter application of LBU compared to the standard grower practices. The values are cumulative totals over the three years of the study.

This analysis understimates total net return because it does not take into account the increased fruit in carton sizes 72 and 86. Also keep in mind that yields were greatly reduced in the 1990-91 season due to the freeze in December of 1990.

Foliar application of nutrient uptake efficiency compared to soil applications and reduce the potential for nitrogen losses.

Dr. Steven E. Petrie
Unocal Plus is the name for Unocal's Premium Liquid Urea Solution (20-0-0). Unocal Plus is the pre-form source for foliar applications of nitrogen to crops. Foliar applications of nitrogen increase nutrient uptake efficiency compared to soil applications and reduce the potential for nitrogen losses.

Unocal Plus is specially formulated to reduce the potential for phytotoxicity from biuret and free ammonia. Biuret is a common constituent of urea; it is formed during manufacture and is of little concern when the urea is used for soil applications. Soil microorganisms break down the biuret and it actually supplies plant available nitrogen.

Foliar applications of biuret are another matter completely. Biuret can be phytotoxic, particularly when applied to perennial crops such as citrus and other tree crops. For sensitive crops, the general guideline is to apply as little biuret as possible. Unocal Plus has the lowest concentration of biuret of any commonly available urea source. Typical analyses show less than 500 ppm; this is much less biuret than in common "low-biuret" urea.

Unocal Plus is also safer because the potential for free ammonia is greatly reduced. A special phosphate-based buffer is used to maintain the solution pH. Safety is further assured by the addition of a pH-sensitive dye. Should free ammonia form, the dye changes color from yellow to red indicating the presence of free ammonia.

The addition of acid based materials will lower the solution pH and restore the proper pH to eliminate free ammonia. The pH-UHR® products from Unocal are excellent choices to lower the solution pH. Unocal Plus is one of the safest forms of foliar nitrogen available. It is specially manufactured in a process which removes most biuret and free ammonia. It contains a buffer to minimize formation of free ammonia and a pH-sensitive dye to reveal the presence of any free ammonia which does occur. In short, Unocal Plus is the preferred source for foliar nitrogen applications.

Unocal Plus®
Product Stewardship - What Our Industry Is Doing

Dr. Steven E. Petrie
Product stewardship will continue to be one of the "buzzwords" of the 1990's as increasing environmental pressures are brought to bear on fertilizers. What have we in the fertilizer industry been doing to lose good product stewardship? In a word PLENTY.

Researchers, agronomists, field representatives and everyone else involved in the manufacturing, distribution, and use of fertilizers has been actively promoting good product stewardship in a wide variety of ways.

Many Best Management Practices such as soil testing, plant analysis, timely application of the appropriate amount of fertilizer and so forth have been developed with the cooperation of private industry, Land Grant agricultural colleges, and the USDA. The wide-spread adoption and utilization of these BMP's is due in large measure to our efforts in the field, working closely with growers.

Unocal has published a general BMP guide as well as a detailed BMP booklet for wheat. We will also be publishing BMP booklets for potatoes and citrus in the future.

The Certified Crop Adviser program is being developed by the American Society of Agronomy working closely with representatives from private industry. This program will help increase the professionalism of crop advisors and demonstrate practical knowledge of environmental sound soil management and crop production. This program has wide-spread support in the industry even though it will mean increased costs.

Unocal has representatives on the National Steering Committee of the CCA program as well as the California State Board and is active in the Pacific Northwest region.

In California, the fertilizerindustry was the driving force behind the special fertilizer mill tax specifically targeted to establish the Fertilizer Research and Education Program (FREE). Funds generated by this tax on fertilizers are used to support research and education programs designed to improve fertilizer use and efficiency and reduce the environmental impact of fertilizers. How many other industries would have worked so hard to increase taxes on themselves?

Many new products and services are being developed specifically because they offer the opportunity for reduced environmental effects. Examples include slow release fertilizers, improved formulations for foliar applications such as Unocal Plus, and variable application rate technology. Private industry is taking a leadership role in promoting improved product stewardship. We are working hard to improve the efficiency of our products and reduce the potential for adverse impacts on the environment. We are conducting innovative research into improved fertilizer formulations, more efficient application techniques, and other methods to increase crop yields and quality. We don't know all the answers yet but private industry will be a crucial part of the solution that is developed.

Solution Sheet

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Soil testing for nitrogen has not been used in the corn belt of the western U.S. Measuring available soil nitrogen was thought to be of little value when a thunderstorm can dump three inches of rain in a few hours. This would readily leach the available nitrogen and greatly reduce the value of any soil test reading for nitrogen.

We in the western U.S. do a good job of managing our fertilizer nitrogen.

Economic and environmental pressures have combined to force a new look at soil testing for nitrogen in the corn belt. There has been a tremendous amount of research in the corn belt during the last 7 or 8 years on soil testing for nitrogen using what is called the "pre-sidedress nitrogen test" or PSNT. A soil sample is collected just prior to sidedress application of nitrogen and the nitrogen concentration measured and correlated with the response to sidedress nitrogen application.

Some of the studies have found that growers can reduce their standard sidedress nitrogen application rates from 50-75 lb/A with no yield reduction in the corn crop.

Some of the studies have found that the PSNT can be a useful and accurate tool to predict the need for additional sidedress nitrogen. The critical level reported in the studies varies depending on many factors. There are also studies which show little correlation between the PSNT value and the response to additional sidedress nitrogen.

This is a straightforward concept, yet the application to production agriculture is proving difficult. Many questions remain about which species are best planted as cover crops, how to manage them, and how to maximize their nitrogen uptake, when and how to use them in preparation for the spring crop, how much nitrogen do they take up under different conditions, and when is the nitrogen they take up released to the spring crop, and so on.

The use of cover crops may be a recommended Best Management Practice in the future but, at the present time, there is little accurate information to provide growers. Because of this lack of basic information, no recommendations can be made concerning the use of cover crops but research is continuing.

Site-Specific Farming
A number of papers and other presentations dealt with the concept of varying the application of production inputs (e.g. fertilizer, pesticides, etc.) throughout the field to match the specific soil, pest and crop needs at a particular location within the field.

"Variable Application Rate Technology", or VART, offers the potential for greatly increased input efficiency.

The use of cover crops may be a recommended Best Management Practice in the future.
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Adoption of VART for fertilizers is being driven directly by the farmer's need to lower production costs through reduced fertilizer application rates where appropriate and, indirectly, by environmental consideration. The application of nutrients based on soil sampling is a recommended BMP; the use of VART permits the concept to be applied to much smaller management units than an individual field.

The ASA publishes the Agronomy Abstracts, which is a compilation of summaries of all papers presented at the meetings. Contact the ASA for more information on the papers referred to in this article.

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We now have several reprints available from past Solution Sheet issues. These reprints have all been updated in content, and are available from the Solution Sheet editor.

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Potato Quality
Updated from articles appearing in Solution Sheet, vol. 1, no. 2, and vol. 5, nos. 7, 8, and 9

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