# Effect Of Foliar Urea Applications On Leaf Nitrogen Content And Bud Retention In Pistachios

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The requirement for nitrogen is the greatest of all the soil or fertilizer derived elements (8). More crops require supplemental nitrogen than any other element (6). However, deciduous fruit and nut trees appear somewhat inefficient in their ability to extract soil-applied nitrogen (2,4) and the availability of soil applied nitrogen is unpredictable due to biological immobilization, leaching and denitrification (6). This situation may prevail in pistachios. Recent soil-applied nitrogen trials by Wolpert have demonstrated little alteration in tree growth or yield (personal communication). It has been suggested in other fruit crops that foliar fertilization could supplement soil fertilization and increase nitrogen utilization (7). In addition, foliar applications could supply nitrogen directly to foliage and fruit when needs are greater or a rapid response is desired.

Because foliar application is expensive and uptake insufficient to fulfill total nitrogen needs in most cases (5,7) foliar nutrient applications should be regarded as temporary supplements to soil fertilization.

Certain organs of a tree may require more nitrogen than does the entire tree at a given point (3). This may be the case in developing pistachio nuts during the heavy or "on" years of the alternate bearing cycle. Perhaps the nuts indirectly cause abscission of next season's buds by successfully out competing next season's floral buds for nitrogen. Conceivably then, foliar nitrogen sprays could fulfill both the developing nut's and bud's nitrogen needs, subsequently decreasing floral bud abscission and therefore alternate bearing. However, it is not known if pistachio leaves absorb foliarly-applied nitrogen. This experiment was designed to answer these two questions. Is foliarly-applied nitrogen absorbed and does it decrease floral bud abscission? The following results show that foliar urea and $KNO_3$ sprays increase total leaf nitrogen for a short period but have no effect on bud abscission.

## Methods

The experimental site was a commercial planting in SE Madera County. Sixty uniform, 14-year-old 'Kerman' on *P. atlantica* rootstock trees were randomly assigned the following treatments: control or water spray, 2041.2 grams of 13-0-46 $KNO_3$ dissolved in 50 gals of water, and 2041.2 grams of 40-0-0 urea dissolved in 50 gals of water. All treatments were applied at the rate of 10 gallons per tree to 15 trees each on April 22, 1985. Thirty fully expanded, terminal leaflets per tree were collected prior to spraying (April 22) one day after (April 23), 1 week past (April 29) and at 2-week intervals (May 6, 13 and 20; June 3 and 17; July 1 and 15) thereafter. Leaves from each tree were combined and analyzed separately for total nitrogen using the method of Carlson (1). Nitrogen results are calculated as a percentage of dry weight.

Buds were counted on 25 nut-bearing and 25 non-nut-bearing branches per tree. All branches were more than 2.2 cm in diameter as recent investigations have determined branches above this diameter behave independently of the rest of the tree in terms of the alternate bearing cycle (personal communication, J. Wolpert). Bud retention was calculated as the percentage set floral buds retained through Aug. 15.

## Results and Discussion

Results of the nitrogen treatments on total leaf nitrogen are given in Table 1. Prior to treatment (April 22) the trees had normal to slightly low total nitrogen content. One day after treatment (April 23) the total nitrogen content of the urea and $KNO_3$ treated trees had significantly higher total nitrogen levels. These higher levels persisted, though steadily decreasing, through April 29, May 6

**TABLE 1.** Total nitrogen as a percent of dry weight over time.*

| | Date Sampled | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment** | **April 22** | **April 23** | **April 29** | **May 6** | **May 13** | **May 20** | **June 3** | **June 17** | **July 1** | **July 15** |
| Control | 2.24a | 2.15a | 2.98a | 3.07a | 2.78a | 2.54a | 2.59a | 2.49a | 2.54a | 2.37a |
| Urea | 2.04a | 4.34 b | 4.17 c | 3.52 b | 3.01 b | 2.62a | 2.67a | 2.52a | 2.46a | 2.42a |
| $KNO_3$ | 2.15a | 4.36 b | 3.78 b | 3.35 b | 2.66a | 2.50a | 2.55a | 2.44a | 2.51a | 2.35a |

*Letters following values indicate significant differences at F = .01. Values with same letter are not significantly different.

and May 13, but by May 20 the total nitrogen content of treated and untreated trees were insignificantly different.

These results indicate foliarly applied urea and $KNO_3$ can be absorbed by new fully expanded pistachio leaves in early spring. The results also indicate that these increased levels of total nitrogen can persist as long as a month. Both urea and $KNO_3$ treatments, however, resulted in a marginal leaf burn though defoliation did not occur. This indicates the potential for supplying nitrogen foliarly is limited by foliage tolerance. The burn was not thought to be biuret as low biuret urea was used (5).

How these treatments affected bud retention is demonstrated in Table 2. Urea and $KNO_3$ sprays made no difference in bud retention on fruiting or non-fruiting branches. As expected bud retention was consistently higher on non-fruiting branches. These results indicate early spring foliar nitrogen applications will not prevent bud abscission. Since the leaf total nitrogen levels dropped to control levels by May 20, well before July when bud abscission usually begins, it can conceivably be argued that the sprays were too early. Therefore, this is not a valid test of foliar nitrogen treatment effects on bud abscission. The way to determine this would be to apply foliar treatments later in the spring, perhaps timing them to coincide with nut fill. However, later sprays may result in decreased uptake due to more developed leaf cuticles (3). As the shoots were fully extended and leaves fully expanded by mid-April the total absorption should not be increased due to increased leaf area.

At this point there are no additional reasons to pursue foliar nitrogen treatments for pistachios. Critical levels for total leaf nitrogen have not been established but nitrogen deficiency is not a problem. If in the future ground water supplies become contaminated with nitrogen the investigation of how nitrogen foliar sprays can best supplement ground applications might be feasible. For now, foliar nitrogen application is at best, an expensive, possibly injurious and inefficient way to fertilize a pistachio.

## Conclusions

The results of this experiment indicate foliar treatments of low biuret urea and $KNO_3$ in early spring result in increased total nitrogen levels for approximately one month. Neither treatment affected bud retention and therefore alternate bearing.

## Literature Cited

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**TABLE 2.** Bud retention as a percent of buds set.*

| | Branch Type | |
|---|---|---|
| **Treatment** | **Fruiting branches** | **Non-fruiting branches** |
| Control | 44.42a | 66.51a |
| Urea | 44.01a | 68.62a |
| $KNO_3$ | 38.15a | 68.36a |

*Letters following values indicate significant differences at F = .01. Values with the same letter are not significantly different.