



## Nitrogen Fertilization of YOUNG TREES

### Application Timing

Fertilizer should not be applied to recently planted trees until spring after the trees leaf out. Further applications, if needed, can be made every 4-6 weeks.

### Application Rates

Nitrogen fertilizers need to be applied with care to young trees, as high N concentrations in soil solution may burn the roots. A good rule is to apply no more than one ounce of N per tree per year of growth with a single application. For the first application to first leaf trees, even less than one ounce of N should be applied. The rate should also be reduced for stunted trees and in hot weather when the trees take up a lot of water. Under these conditions, lowering the rates per application and instead increasing the number of applications reduces the risk of leaf burn.

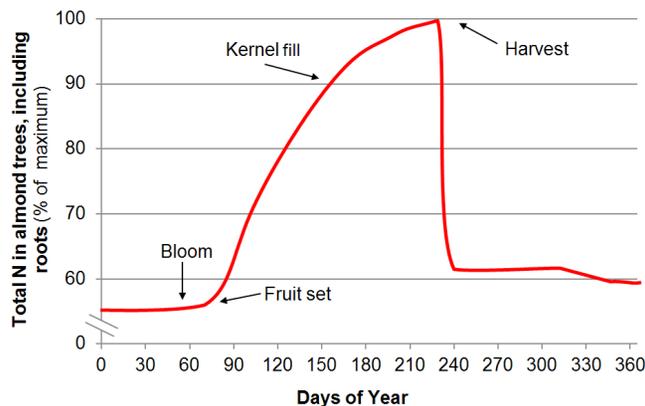
A total annual application of up to 4 ounces/tree to first-leaf trees may increase growth, while higher rates have no benefits.

### Fertilizer Type

To reduce the risk of root burn, granular fertilizers should be used for first-leaf trees. To second-leaf trees, liquid fertilizers, such as UN-32 or CAN 17 can be applied.

## Almond Nitrogen Uptake and Partitioning

### Seasonal N Uptake



Information regarding almond fertility management, including soil and leaf analysis, placement, fertilizer source, phosphorus and potassium are available at:

<http://apps.cdfa.ca.gov/frep/docs/guidelines.html>



### SELECTED REFERENCES

Brown, P.H., Saa Silva, S., Muhammad, S., 2012. Development of leaf sampling interpretation methods for almond and development of a nutrient budget approach to fertilizer management in almond.

Doll, D., 2011. Fertilizing young almond trees – a few tips. <http://thealmonddoctor.com/2011/03/25/fertilizing-young-almond-trees-a-few-tips/>

Saa Silva, S., Muhammad, S., Sanden, B., Laca, E., Brown, P., 2012. Almond early-season sampling and in-season nitrogen maximizes productivity, minimizes loss. [http://www.almonds.com/sites/default/files/content/attachments/almond\\_early-season\\_sampling\\_and\\_in-season\\_nitrogen\\_application\\_maximizes\\_productivity\\_minimizes\\_loss.pdf](http://www.almonds.com/sites/default/files/content/attachments/almond_early-season_sampling_and_in-season_nitrogen_application_maximizes_productivity_minimizes_loss.pdf)



# ALMOND NITROGEN Fertilization Guidelines

Online nutrient guidelines for almond and other crops, as well as relevant references, are available at:

[apps.cdfa.ca.gov/frep/docs/guidelines.html](http://apps.cdfa.ca.gov/frep/docs/guidelines.html)

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Daniel Geisseler and William R. Horwath, Department of Land, Air and Water Resources, UC Davis, gathered and organized the guideline information through FREP research contract 11-0485.



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## Nitrogen Fertilization at BLOOM (SPRING)

### Planning Annual Applications

The required annual N application rate depends on the expected yield. In a four-year study carried out at multiple sites, Brown and coworkers found that the amount of N removed at harvest with hulls, shells, leaves, debris, and kernels averages 68 lbs/1000 lbs of kernel yield.

Almond trees also need nutrients for the growth of perennial parts, such as roots, trunk and branches. The N in the perennial parts of 9 to 13 year old trees increased annually by 25-30 lbs/acre.

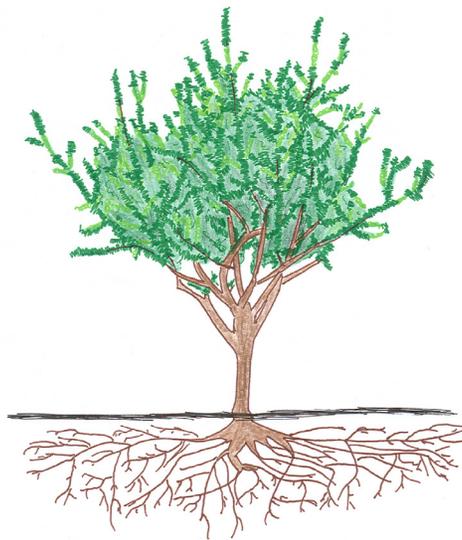
The N fertilizer application rate is the N demand minus N from other sources (e.g. irrigation water or manure) divided by an estimated N recovery factor. The N recovery factor may range from 0.5 when N is broadcast to 0.8 with fertigation.

### Splitting Applications

In a study carried out with FREP support, Brown and coworkers found very little soil N uptake before 50% leaf out. During this period (January to mid-March), the majority of N used for flowering, leaf formation and early nut growth comes from N stored in the branches, trunk and roots.

Forty of tree nitrogen demand occurs between spring flush and nut fill (mid- May) and 45% occurs during the summer, with the remainder required after nut maturity.

With about 80% of the N in the fruits taken up before mid-June, most N needs to be applied between March and June/July.



## Nitrogen Fertilization during FRUIT DEVELOPMENT (SUMMER)

### Application Timing

The N demand of almonds is highest between bloom and mid-June. During this period, it is very important to provide the trees with sufficient N. Most of the N is taken up by the end of June. For the subsequent kernel growth, most N is translocated from the hull and shell to the kernels.

Nitrogen applied late in the season after kernels have developed will be directed into the hull and has no effect on yield. In contrast, it may increase the risk of hull rot.

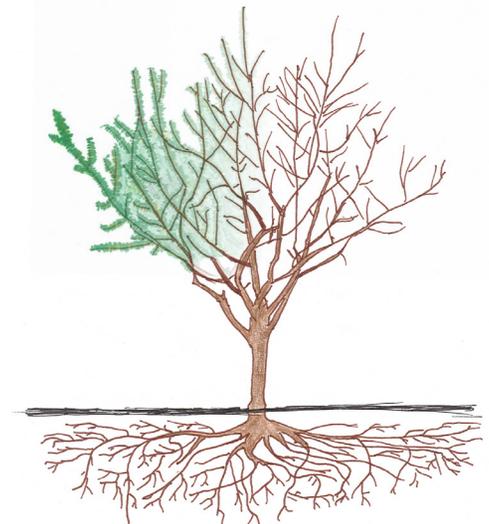
### Application Rates

Based on their research, Brown and coworkers developed an almond fertilization model, which recommends applying 30% of the total N in March/April, 40% in May/June, and 30% in June/July. In order to minimize nitrate leaching losses, the first application should be done after leaf-out.

### Leaf Analyses

Recent research has shown that samples taken in April can be used to predict the July leaf N status. The results can be used to make in-season fertilization adjustments. Measured or predicted July leaf N concentrations between 2.2 and 2.5% are generally adequate. Guidelines for utilizing the early season sampling can be found at:

[http://fruitsandnuts.ucdavis.edu/Weather\\_Services/Nitrogen\\_Prediction\\_Models\\_for\\_Almond\\_and\\_Pistachio/](http://fruitsandnuts.ucdavis.edu/Weather_Services/Nitrogen_Prediction_Models_for_Almond_and_Pistachio/)



## Nitrogen Fertilizer Application POST-HARVEST (FALL)

### Application Timing

A post-harvest application supports the development of next year's blossoms, immature fruits and earliest leaves. The application should be made once fruits have split or as soon as possible after harvest to ensure that the N is taken up before leaf fall. If a significant leaf loss has occurred already due to pest pressure or drought, the last application should be reduced or skipped. The post-harvest N application can be reduced or eliminated when the July leaf N concentrations are 2.6% or higher or if yields have been low. The amount of N taken up between leaf fall and leaf-out is minimal due to lack of transpiring leaves.

### Application Rates

Generally not more than 20% of the annual fertilization is applied after hull split through early post-harvest. For more information about N management in almonds, please visit the following web page:

<http://apps.cdfa.ca.gov/frep/docs/guidelines.html>



For more information about N management in almonds and references, please access the following web page:

<http://apps.cdfa.ca.gov/frep/docs/guidelines.html>