

I. Background Information

A nitrogen budget accounts for all N inputs and outputs on the farm. Mostly, N is removed from the farm in the crop and comes back in the form of compost, irrigation water, cover crop, and fertilizer.

Nitrogen deficiency is rare in California orchards

In well managed orchards nitrogen deficiency is rare. Most farmers apply plenty of nitrogen fertilizer. Many farmers also have the opportunity to reduce costs, keep good yields, and increase tree health by reducing application rates of N fertilizer.

Post harvest applications of N are not used by the tree

In university experiments with deciduous nut trees, labeled N applied post harvest was not absorbed by the tree. Even the following spring, N applied the previous fall was gone and no N could be found in the tree's wood, roots, leaves, or nuts. Labeled N applied in spring and summer was found in the tree.

Every orchard is different in its nitrogen requirements

Some scientific studies in walnuts and pistachios have shown that even after five years without any applied fertilizer (0 lbs. N/acre), there was no difference in yield from trees fertilized up to 320 lbs. N/acre. However, this does not mean that fertilization can be skipped for 5 years in your orchard, although it is possible in some cases. Trees always need nitrogen every year, but trees can get nitrogen from other sources besides annually applied chemical fertilizer. These alternative sources of N include nitrate in well water, legume cover crops, composts, manures and natural soil fertility.

Table 1. If leaf N is in the low range, increase fertilizer rates. If leaf N is in the high range, decrease fertilizer application rates.

Crop	Low leaf N %	High Leaf N %
Walnuts	<2.3%	>2.7%
Almonds	<2.2%	>2.5%

Sources: Walnut Production Manual, p. 200. Almond Production Manual, p. 193.

As an extreme example, some BIOS growers have not applied any chemical nitrogen fertilizer for many years, yet still have good leaf tissue N levels and great yields. Their trees are receiving nitrogen from the well water (in some cases over 100 lbs. N/acre), a legume cover crop, a fertile soil with high organic matter content, and sometimes a small amount of additional applied compost.

In most orchards, applied chemical fertilizer will still be needed, but often at a reduced rate. Leaf tissue analysis and a nitrogen budget are two methods to scientifically determine the optimal rate of fertilizer application.

Leaf Tissue Analysis

Leaf tissue analysis, from leaf samples collected in July, can be used to guide nitrogen fertilizer decisions. Table 1 below gives guidelines for increasing or decreasing nitrogen fertilizer rates based of leaf tissue N concentration. Out of 50 walnut and almond BIOS orchards that submitted leaf samples in 1998, only one (2%) was in the low range, yet one half (50%) of the 1998 samples were in the high range. Fertilizer rates can be safely reduced when leaf N is in the high range.

The best information from leaf tissue analysis is gained when samples are collected at the same time in the growing season, year after year. If the trend is a higher and higher leaf tissue N, then fertilizer rates can be reduced. When deciding how much to reduce or increase the N fertilization rate, a nitrogen budget is helpful (see next section).

It is impossible for a single range of leaf tissue N values to be accurate for all of California. In some areas of California, walnut leaf N will never go above 2.3%, even when hundreds of pounds of excess fertilizer are applied! So even if leaf analysis shows N in the good range, in some cases the trees may still be receiving excessive amounts of fertilizer. A nitrogen budget is helpful in this case because actual tree nitrogen needs can be estimated.

Trust your leaf sample results. If your leaves are in the high range, reduce the amount of applied nitrogen fertilizer by the amount indicated from your nitrogen budget.