

Grapes

Nitrogen is the nutrient most often limiting grape production in Arizona; yet the N requirement per acre is much lower than most other horticultural and field crops. Deficiency symptoms are difficult to identify in the field unless the deficiency is severe. In these cases, symptoms would include a uniform, pale green to yellow-green color of the foliage and reduced shoot growth. A moderate N deficiency is most common, and is characterized merely by reduced vigor.

Observations of annual vine growth and the size and color of leaves are helpful in determining the N needs of vines. Petiole analysis from mature vines can also be used to monitor the nitrogen status of a vineyard. Soil analysis before vineyard establishment can be useful in determining the suitability of a particular site for grape production, as well as indicate the need for nitrogen in the first years after planting.

• New vineyards

Adequate supplies of nitrogen are needed to promote rapid growth and development of young nonbearing vines. Use Table 40 as a guide to N applications in young vineyards.

Table 40.
Nitrogen fertilizer requirements of grape vines for the first and second growing seasons depending on soil and vineyard conditions.

Soil and vineyard conditions	Annual N Rate*
	lbs./acre
Sandy loam to loam soils or following well-fertilized crops	0 - 20
Loamy sand soils	25 - 30
Coarse sandy soils	40 - 50

*Use the higher rates if a preplant soil test for $\text{NO}_3\text{-N}$ is below 4 ppm N, and use the lower rates if the $\text{NO}_3\text{-N}$ level is above 20 ppm N.

Nitrogen applications in excess of these rates may result in late-season vine growth that may be susceptible to frost injury, particularly in cooler locations.

• Mature vineyards

The overall vigor of vines and the appearance of the leaves are the best indicators of N status. Deter-

mination of the nitrate-nitrogen ($\text{NO}_3\text{-N}$) concentration in selected petiole samples can also be useful in monitoring the N status of grapes. Obtain samples at the 'full-bloom' stage. The petioles (leaf stems) from the leaves opposite the clusters toward the base of the shoots should be collected (Figure 45). A sample should contain 40 to 50 petioles taken at random from any uniform area within the vineyard. Samples should be placed in a paper bag and dried at about 150°F (65°C) or refrigerated as soon as possible and submitted to a laboratory for $\text{NO}_3\text{-N}$ analysis.

Use Table 41 to guide N application rates for mature vineyards.

Table 41.
Suggested nitrogen application rates for mature grape vineyards based on soil and vineyard conditions.

Soil and vineyard conditions	Annual N Rate*
	lbs./acre
Deep, sandy loam to loam soils or high-vigor varieties.	0 - 40
Sandy loam soils or medium vigor vines	50 - 60
Sands and loamy sand soils or marginal vineyards. Split application best.	60 - 100

*These rates should only serve as a guide to N applications and should be adjusted depending on laboratory petiole results, vine performance, and grower judgement.

Excess N can result in lush, dark green foliage and excessive vine growth, an abundance of immature canes with less desirable fruiting wood characteristics, reduced fruit set at the bloom stage, white salt-like deposits or burning at the margins of older leaves, and increased susceptibility to winter injury. Similar symptoms can also result from other nutritional or weather-related problems. Use analysis of leaf petiole nitrate to confirm an excessive N level in the plant (Table 42).

• Timing of N applications

Nitrogen should be applied during the late winter to early spring to ensure an adequate supply during vine growth. Late-season applications should only be used with caution to avoid excessive late-season growth which may be more susceptible to winter in-

Table 42.
Interpretation of grape petiole NO₃-N values
obtained at the full bloom stage of growth.

Petiole NO ₃ -N	N Status*
ppm	
below 350	Deficient
600 - 1200	Adequate
above 2000	Excessive

**Desirable levels may vary among different varieties. Some table grape growers prefer somewhat higher levels of petiole N when greater vine vigor is needed.*



Figure 45.
Collect grape petiole samples at the full-bloom
stage from leaves opposite clusters toward the
base of the shoots (above).

jury. Nitrogen can be applied in one or more applications. Split applications are recommended on sandy soils where leaching of nitrogen below the root zone is a problem.

- **Using different forms of N**

Ammonium (NH₄) forms of N such as ammonium phosphate, anhydrous and aqua ammonia, or ammonium sulfate will become available for plant uptake with the second irrigation following application. Nitrate and urea forms of N are available after the first irrigation. Caution should be used when applying anhydrous and aqua ammonia to avoid plant injury from ammonia toxicity, especially on very sandy soils.

- **Methods of application**

Nitrogen should be applied directly in the irrigation water or else placed such that water movement will carry soluble N into the root zone. Solutions of ammonium sulfate, ammonium nitrate, calcium nitrate, and urea can be injected into both surface and pressurized irrigation systems. Anhydrous ammonia or aqua ammonia should be used with non-pressurized, surface irrigation systems only. The uniformity of N applied with irrigation water will only be as good as the uniformity of water applications.

Dry N fertilizers should be applied in spots or bands 1 to 3 feet from the vines and incorporated below the soil surface either mechanically or with a surface irrigation. Incorporation is especially important to reduce volatilization of ammonium forms of N.

Spot treatment of weaker vines, or vines in especially sandy areas may be required to maintain the desired level of vigor within an entire vineyard.

- **Nutrient removal**

A harvest of 10 tons of grapes per acre will contain about 20 lbs. N.