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The Relationship Between Covercrops and Vine Nutrition

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Winter legume covercrops increase the nitrogen (N) status of grapevines, and the response can be similar to applying 50 pounds of inorganic N fertilizer to the vineyard. Winter nonlegume grass and cereal covercrops which are incorporated in March or early April have little effect on vine N levels, although incorporation in June or July may lower N levels. Summer grasses and permanent sods compete with grapevines for both nutrients and water and can reduce vine growth after a few years.

In the San Joaquin Valley, recent covercrop trials were conducted in several Thompson Seedless vineyards to demonstrate the effects of covercrops on vine nutrition. The nitrate nitrogen (NO_3-N) concentrations in grapevine leaf petioles sampled at bloom on the third year of a Tulare County trial are shown in Table 1. The various covercrop treatments resulted in distinct differences in vine N concentration, and the following discussion explains why this occurred.

Legumes (vetch, clover, medic, bean, pea)

Winter legume covercrops fix N from the air and convert it into forms that plants can use. About 75% of the N that accumulates in the biomass of a legume originates from the air (not the soil), and this represents a new source of N for the vineyard.

Covercrop trials in vineyards have shown that Lana vetch planted in every row (50% of the vineyard floor planted to covercrop) accumulates about 75 pounds of N per vineyard acre. The nutritional benefit of incorporating this covercrop is similar to applying 50 pounds of inorganic N fertilizer to the vineyard. Planting the covercrop in every other row, rather than every row, would cut the benefit in half.

With covercrops, the aboveground biomass contains about 90% of the total N accumulated. Typical dry weight and aboveground N accumulation for various covercrops grown in San Joaquin Valley vineyards are shown in Table 2.

Nonlegume Winter Grasses (barley, oats, rye, brome)

Nonlegume winter grass and cereal covercrops which are incorporated in March or early April have little effect on vine N levels, although incorporation in June or July may lower N level.

Grass and cereal covercrops usually provide less than 25 pounds of N per vineyard acre, and the N originates from the soil, not the atmosphere; consequently, it does not represent a new source of N to the vineyard. Winter cereals and grasses which are incorporated in March or early April have little net effect on vine N status.

Incorporating grass covercrops in June or July, when they have a high carbon:nitrogen ratio, can lower vine N levels. When residue contains less than 1.5% N on a dry weight basis, microorganisms will use some soil N to decompose it. In March or April, grasses and cereals contain more than 1.5% N, and decomposition is rapid since microorganisms are amply supplied with N from the residue. However, by June or July, these same grasses and cereals are mature, have accumulated much more biomass, but contain only 0.5% to 1.0% N. This results in a much slower rate of decomposition, and microorganisms must use some soil N to help decompose the residue. As much as 20 pounds of soil N per acre can be tied up for about 4 to 6 weeks in the process of decomposing a ton of low N residue, and during this period this N is not available for vine uptake.

This was demonstrated in the vineyard covercrop trial, Table 1. Blando brome was grown as a self-reseeding grass, and it was mowed during the frost danger period. After mid-April, it was allowed to grow and mature (competing with vines for nutrients and water during the process), and in June it was incorporated into the soil. Microorganisms tied up some soil N to decompose the low N residue during June and July. This competition with the grapevine for soil N reduced the N status of the vines.

Nonlegume (summer grasses and permanent sods)

Sudangrass (a summer grass), native summer grasses, and perennial rye grass and fescue sods compete with grapevines for both nutrients and water during the summer months. Permanent sod is the most competitive, followed by sudangrass, and then native summer grasses. Permanent sod and sudangrass can definitely lower vine N levels as demonstrated by the results of the vineyard covercrop trial, Table 1.

The competition between perennial sod and grapevine intensifies with each additional year the sod is allowed to grow. Vine vigor and production can begin to drop after a few years of sod competition, and level of other nutrients such as calcium, sulfur, iron, and boron may be reduced.
To manage excess N and vine vigor, perennial sods or sudangrass can be beneficial, but under normal conditions, these covercrops are generally too competitive.

Closing Remarks

Covercrops can increase or decrease the nitrogen status of grapevines. Winter leguminous covercrops such as vetches, clovers, medics, beans, and peas increase N. Winter grasses and cereals incorporated in March or early April generally have no net effect on vine N status.
Permanent sods, summer grasses, and winter grasses that are incorporated in June or July can lower vine N levels.

Table 1. Influence of leguminous and nonleguminous covercrops on the N status of Thompson Seedless after three years.

Covercrop	Date covercrop was incorporated	Nitrate-N in bloom petioles (ppm)
Vetch	April	1522 a
Control - no covercrop	----	1116 b
Barley	April	1010 bcd
Permanent sod	----	750 cde
Blando brome - reseed	June	690 de
Sudangrass	Sept.	622 e

Treatment means followed by different letters are significantly different at the 5% level.

Table 2. Comparisons of aboveground dry weight and nitrogen accumulation in legume and nonlegume covercrops when planted in a six-foot strip in every row.

Covercrop	Date sampled	Dry weight (lb/a)[1]	Dry Weight N (%)	N accumulated (lb/a N)[1]
Lana vetch	April	2500	3.0	75
Crimson clover	April	2500	2.5	62
Barrel medic	June	1500	2.5	37
Barley	April	1000	2.0	20
Barley	June	2500	1.0	25
Blando brome	June	600	1.0	6

[1]Values represent pounds per vineyard acre.