# Suggestions for Vineyard Fertili

## test plots recommended to determine most efficient fertilization pro

**Vineyard yields** were increased by 10% at a cost of about $15 per acre in experimental fertilizer plots in 11 California counties where an average crop increase ranged from 9.4% to 14%.

These yield increases resulted from a spring application of nitrogen in the form of ammonium sulfate amounting to 330 to 510 pounds per acre.

However, in one third of these vineyards the fertilizer gave no yield increase and in a few cases significantly lowered the yield. The largest increases have occurred in some of the dry land vineyards, ranging—in one case—up to 88% more crop.

There are a number of possible reasons why one third of the vineyards have not responded to this fertilization. The vines may be located on a soil such that microorganisms are fixing enough nitrogen from the air to supply all the needed nitrogen. Or on a relatively short-time basis, the organic matter in the soil may be decomposed at a sufficiently rapid rate to supply the needed nitrogen. Possibly vine growth may be limited by conditions such as salinity, alkalinity, high water table, mildew and insect infestations of phylloxera and nematodes on the roots or leafhopper and red spider on the leaves.

It seems logical to suppose that a chemical analysis would show what elements are lacking in the soil. This seemingly simple idea just doesn't work with the grapevine. The soil may be looked upon as being composed of rock particles in various stages of disintegration. It is only as the final stages are approached that the materials become available to the plant. One of the difficulties in soil analysis is to ascertain just what fraction of this disintegrating material is available. Another difficulty is ascertaining if the disintegrating process is proceeding fast enough to replenish the supply of materials needed by the growing plant. Besides these obstacles, the variation of the soil from top to bottom and from place to place makes it impractical to obtain anything like a representative sample of the soil that is actually used by the vine.

By plant tissue analyses it has been found that vines with tissues apparently high in nitrogen have responded to nitrogen fertilization. In other cases, with low nitrogen content, the vines have shown no increased growth or yield.

The present experimental data indicate that one might successfully predict the response of a vineyard to nitrogen in about two thirds of the cases. Since response has occurred in two thirds of the vineyards tested, it is evident that until more selective tests can be derived, tissue analysis is not generally useful for predicting fertilizer response.

### Pilot Plot

At present, lacking actual test results, it seems best to apply some form of nitrogen fertilizer if the vine is deficient in growth and the leaves are light in color.

The preferable procedure is to set up a pilot or test, plot. A nitrogenous fertilizer, such as ammonium sulfate should be applied—three-fourths pound to the vine—to every fourth row until six rows have been fertilized. The rows on either side of the treated row are to serve as guard rows. These guard rows will no doubt use some of the applied fertilizer. The yield record of each fertilized row is then compared to the average of the two check or untreated rows located beyond the guard rows. Averaging the check rows on both sides of the fertilized row helps to overcome the variation due to soil differences. It is to be expected that three or four of the comparisons thus made would yield more than the checks on a purely accidental basis. If all six, or even five out of the six, such comparisons indicate that a fairly constant yield increase has occurred in each case, there is little doubt that the fertilizer has produced some results. It is then possible to calculate a percentage yield increase from the averages which will indicate the probable extent of the response. If the yield increase is sufficient to more than pay the cost of the fertilizer and its application, it will be advisable to make a general application in the vineyard, providing always that the quality of the fruit has not been affected importantly.

**Suggested Rates of Application for Various Nitrogen Fertilizers**

*Where color development is important as in Tokay or Emperor table grapes, use one half the amounts suggested below if more than one annual application is to be made.*

| | Nitrogen in fertilizer | Amount to apply | Equivalent in pure nitrogen |
|---|---|---|---|
| | per cent | pounds | pounds |
| Calcium nitrate | 15.5 | 480 | 75 |
| Sodium nitrate | 16.0 | 470 | 75 |
| Urea | 42.0 | 178 | 75 |
| Ammonium sulfate | 21.5 | 350 | 75 |
| Ammonium nitrate | 33.0 | 227 | 75 |
| Liquid ammonia | 82.0 | 92 | 75 |
| Pomace | 1.0* | 16,000 | 150† |
| Cow manure | 1.0* | 16,000 | 150† |
| Chicken manure | 3.0* | 5,000 | 150† |

*Rough approximations.

† The higher amount is utilized to compensate for the slower availability to the plant. The amount should be decreased for annual application.

### Influence on Quality

The application of nitrogen fertilizer has tended to decrease the sugar content of the grapes only slightly—about 0.3%. The effect on acid content and berry size is likewise negligible. The only important effect has been the marked decrease in color development with the application of the amount of nitrogen fertilizer suggested over a period of two or three years. It appears unwise to apply more than one-half the amount recommended for other varieties if annual applications are to be made in Tokay and Emperor table grape vineyards.

There appears to be little difference among nitrogen fertilizers—other than varying rates of availability—in which form the fertilizer is applied, with two exceptions. Calcium cyanamide becomes toxic to the plants under certain conditions, hence caution in its application is advisable. Ammonia dissolved in the irrigation water may be distributed unevenly if the water is not applied uniformly. Urea, nitrate of lime or sodium, ammonium nitrate, ammonium sulfate, and manure are satisfactory. The main consideration is the cost per unit of nitrogen. The price per ton divided by the percentage as given on the tag will give the cost of 20 pounds of pure nitrogen.

The broadcasting of nitrogenous mineral fertilizers in midwinter is satisfactory, since rain or irrigation readily washes them into the soil. If the broadcasting is done by hand the fertilizer is best kept away from the vine so that clumps of weeds are not developed around the vine.

### Other Elements Required

The remaining elements which the vine requires from the soil—other than those which make water—for its development are zinc, postassium, phosphorus, magnesium, calcium, sulfur, iron, copper, manganese, boron, and perhaps molybdenum. Deficiencies of these elements

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## gram

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occur so rarely, if at all, in California vineyards that only trial plots are recommended.

## Tabulated Results

The accompanying table is an abbreviated review of much of the vineyard fertilization experiments carried on in various counties. The fertilizer applications were made annually in the early spring.

Ordinarily the plots consisted of six replications each of nitrogen as ammonium sulfate—three-fourths pound per vine—and of the same amount of nitrogen plus one and one-half pounds of treble superphosphate and one and one-half pounds of sulfate of potash. In some cases different combinations have been applied. The significant yield decrease at Guasti brought about by marl—a form of limestone—is an interesting demonstration of the complexity of these soil fertilization problems. It seems likely that some needed element has become less available to the plants perhaps because of increased alkalinity.

## Specific Suggestions

(1) If the vines are deficient in growth and the leaves are light green, apply nitrogen fertilizer, providing the vines are not suffering from diseases and insects and are properly cared for otherwise.

(2) Where the clusters are poorly filled and the grapes are on sandy soils, try daubing the fresh pruning cuts with a solution made by dissolving one and one-half pounds zinc sulfate in one gallon water.

(3) It is wise to leave six check or untreated rows scattered between treatments and to compare the yield and/or quality in order to find out if you are getting results out of your fertilization.

(4) Phosphate, potash, and other elements, such as iron, boron, copper, lime, and magnesium, have brought about yield responses so rarely, if at all, that only test plots are recommended.

(5) Ordinary applications of such fertilizers as potash and phosphate are not effective in appreciably increasing either the sugar content or the color in grapes, contrary to general statements to this effect.

(6) Increased crop usually results from increased growth providing the vines are properly pruned. Hence a fertilizer to increase growth is commonly that fertilizer which increases crop.

(7) General applications of sulfur, lime, limestone, gypsum, and miscellaneous cure-alls are likely to be ineffective or harmful. If you know that your soil is highly acid, highly alkaline, or that too much sodium is present, application may be made of finely ground limestone, finely ground sulfur, or gypsum respectively, with some basis for expecting improvement. The final result cannot be definitely predicted. Only an experimental test plot, properly carried out, can be utilized to evaluate the results.

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**Average Percentage Increased (+) or Decreased (—) Yield Occurring on Fertilizer Plots in California Vineyards***

| Location | Variety | Per cent change from cehck | | Number of years treated | Remarks |
|---|---|---|---|---|---|
| | | N | NPK | | |
| SAN BERNARDINO | | | | | |
| Guasti | Zinfandel | +0.9 | +10.7 | 1 | Marl application decreased yields significantly (—17%) |
| Guasti | Mission | —1.1 | +2.0 | 1 | |
| KERN | | | | | |
| Arvin | Ribier | +11.0 | +4.0 | 4 | |
| McFarland | Ribier | —9.3 | —12.3 | 3 | Decrease very significant in one year |
| McFarland | Molinera | +3.8 | —0.2 | 3 | |
| Delano | Malaga | +4.1 | —7.1 | 4 | |
| Delano | Thompson Seedless | +1.9 | 0.0 | 3 | |
| TULARE | | | | | |
| Exeter | Emperor | —1.6 | —3.0 | 3 | Decrease very significant in one year |
| Sultana | Thompson Seedless | +13.0 | +22.8 | 3 | Only 3 replications. NPK not significanlty larger than check |
| FRESNO | | | | | |
| Carruthers | Thompson Seedless | +5.5 | +1.3 | 3 | |
| Sanger | Emperor | +11.0 | +26.5 | 2 | P —12.8%, K +10.1%, PK +0.5% |
| Kerman | Thompson Seedless | +20.6 | +9.3 | 3 | |
| Kerman | Thompson Seedless | +11.5 | ..... | 1 | Manure application +3.7% |
| MADERA | | | | | |
| Madera | Thompson Seedless | —0.2 | —2.1 | 4 | No response to manure, boron, iron, copper, zinc, or manganese applied this year |
| Madera | Thompson Seedless | +11.4 | ..... | 1 | This plot on very shallow soil |
| Madera | Thompson Seedless | +4.4 | +4.7 | 1 | |
| STANISLAUS | | | | | |
| Salida | Thompson Seedless | +13.4 | +2.6 | 2 | |
| Keyes | Thompson Seedless | +10.8 | +2.4 | 2 | |
| Keyes | Thompson Seedless | —2.2 | —3.2 | 1 | |
| Modesto | Thompson Seedless | +12.3 | +11.7 | 3 | |
| Modesto | Thompson Seedless | +14.3 | +8.0 | (3) | Average of first two years |
| | | —6.0 | +35.0 | (3) | Third year NPK better than N by over 100:1 odds |
| SAN JOAQUIN | | | | | |
| Acampo | Tokay | +14.9 | +6.6 | 1 | |
| Lodi | Tokay | +24.0 | +10.5 | 1 | |
| Lodi | Tokay | +16.7 | +18.7 | 2 | |
| Acampo | Tokay | +19.9 | +15.0 | 3 | The shipping grapes, however, were decreased 27.6% and 35.4% respectively |
| SANTA CLARA | | | | | |
| Evergreen | Zinfandel | —5.6 | +3.4 | 3 | Low K in petioles and no increase |
| Los Gatos | Petite Sirah | +0.7 | —1.4 | 1 | |
| NAPA | | | | | |
| Spring Mt. | Green Hungarian | +38.0 | ..... | 1 | First year |
| | | +65.0 | ..... | 2 | Second year |
| | | +72.5 | ..... | .. | Third year no N applied |
| Spring Mt. | Grand noir | +17.9 | +8.0 | 5 | Very low P in petioles |
| Rutherford | Semillon | +3.7 | —3.7 | 1 | First year |
| | | —5.2 | +21.4 | 2 | Second year NPK over N better by odds over 50:1 |
| | | 0.0 | +23.8 | 3 | Third year |
| Rutherford | Cabernet Sauvignon | —5.9 | —10.3 | 1 | |
| | | +5.4 | +16.9 | 2 | |
| | | —7.6 | —4.5 | 3 | |
| Oakville | Petite Sirah | +0.8 | +4.3 | 1 | |
| St. Helena | Zinfandel | —2.1 | ..... | 1 | NK +1.5% and NP —13.8% |
| St. Helena | Zinfandel | —5.9 | ..... | 1 | P alone —7.2% and K —4.8% |
| SONOMA | | | | | |
| Alexander Valley | Golden Chasselas | +18.9 | ..... | 2 | NK +2.6% (data for second year) |
| Cloverdale | Zinfandel | +9.5 | +5.2 | 4 | |
| | | —4.0 | +14.4 | 5 | Fifth year result NPK significant by over 100:1 odds |
| Vineburg | Traminer | +2.2 | ..... | 1 | Manure —4.7 ,NP +0.3%, lime +19.4% |
| MENDOCINO | | | | | |
| Hopland | Carignane | +19.2 | +9.4 | 1 | |
| | | +22.4 | +42.0 | 2 | |
| | | +88.0 | +75.0 | 3 | |
| Redwood Valley | Golden Chasselas | +7.1 | —2.4 | 1 | |
| Calpella | Zinfandel | +9.7 | +0.4 | 1 | 10:10:5 commercial —0.9% |
| PLACER | | | | | |
| Roseville | Mataro | —9.2 | —9.6 | 2 | |
| Roseville | Carignane | +26.4 | +8.6 | 1 | |
| Roseville | Mataro | +25.0 | +5.7 | 2 | |
| Loomis | Mission | +35.7 | +23.0 | 2 | |

* Markedly inconsistent results are omitted.