CROPTECH GRAPE PROGRAM

FACT SHEET

RECOMMENDATION FOR GRAPE

Young vines (first two years)

N	Poor	Medium	Good	High		Poor	Medium	Good	High
30 – 50	100	50	20	0		150	125	65	20

*Nitrogen applications should be monitored with tissue analysis and is dependent on soil type and amount of available nitrogen released by soil and organic material.

Mature Vines

N	Poor	Medium	Good	High		Poor	Medium	Good	High
40-100	100	50	30	0		150	125	65	20

Nitrogen levels in vines should be monitored using a tissue-testing program. Nitrogen should be split 20 –30 pounds early season and the rest applied once fruit set has established crop load. Manage nitrogen application and additional application based on tissue information. Do not over apply N.

The timing of flower initiation in the vine occurs 12-15 months before the fruit is harvested. At about the same time as flowering is occurring in the vine, the tissue in the buds on the canes is commencing to differentiate; the buds become either fruitful or vegetative for the following season. The differentiation continues for much of the season, but is most active between flowering and veraison. Therefore and stress to the vine during this period can affect two crops – it can directly affect the current crop, or indirectly affect the following season's crop.

The priority nutrients during flowering and fruit set in vines are Zinc, Boron, and Phosphorus. Nutrient stress during the early part of the season can cause early bunch stem necrosis, excessive flower abortion (coulure) or poor fruit set resulting in many small shot berries (millerandage).

Photosynthesis

Vine leaves have an active photosynthetic life of around 70 days. When bud burst in the spring shoots grow slowly at first but then there is a burst of vegetative growth. The maximum photosynthetic activity is about 6 weeks and declines from there. Therefore the younger leaves on each shoot do most of the work although they do not start to function until they are fully expanded.

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Nitrogen, Magnesium, Iron, and Manganese are the most critical nutrients to ensure good photosynthetic activity, as they are all essential in the production of chlorophyll.

Nitrogen

Nitrogen is most critically needed by grapevines during the period of rapid shoot growth in the spring through bloom and early berry development. The need for N declines from midsummer to senescence. Grapevines and deciduous trees depend heavily on redistribution of N previously stored in roots, trunk, and canes or limbs to support spring growth. Since grapevine's need for N is most critical in the spring and highly dependent on storage, it can be inferred that fertilizer should be applied when the vine can best absorb and incorporate it as part of the N reserve while minimizing N loss form the soil (leaching, denitrification).

Timing of fertilizer application becomes important to ensure that the vine has enough N to support the fruit load and growth for that season without excessive growth and yet enough Nitrogen at the end of the season to supply the necessary reserves for next springs growth. Maintaining low levels of N in the vineyard to enhance sugar quality only starves the vine leading to more winter injury and death and poor bud growth the next season. Research has shown that a healthy vine will with stand greater environmental pressure than a vine that has been starved.

Application of Nitrogen to the vine crop is dependent on variety, soil type, age of crop and environmental issues that change day-to-day, year-to-year. All nitrogen programs for maximum results should be monitored with tissue analysis throughout the season and adjusted accordingly. A&L recommends that you apply part of your nitrogen early prior to bud break and another application after fruit set. The vine will not take much Nitrogen up early but it is a good practice to have some Nitrogen in the system to ensure that nitrogen will be available when the root begins to take it up.

The second application will be timed during some of the most rapid growth phase and can be adjusted based on growth and crop load. Further application of N by foliar feeding should be based on tissue analysis.

Crop removal – Estimated nutrient removal in pounds per ton crop

N	P	K	Ca	Mg	Mn	Fe	Zn	Cu	B
5.5	2	10	1.0	0.4	.005	.01	.02	.002	.01

Calcium & pH

At low pH most of the major nutrients are tied up quickly and unavailable to the crop. Micronutrients except for Mo are however very available and can be toxic in some cases. Al and Fe become very available at low pH and in the case of Vine growth soils that have high Al will affect the growth of the vine. Grape vines are very sensitive to Al and in low pH soils it becomes more available.

The ideal pH for most crops is between 6.2 – 6.8 as the essential nutrients are more available and Al is less available. Although in the grape crop pH alone is not the only criterion for making a calcium recommendation to the crop. Consideration for calcium application should be made based on the base saturation of Ca in the soil. In some cases an additional application of calcium from gypsum may be required to supply a good soluble source of calcium to promote good root growth and open up the soil.

Without good Ca levels quality, disease resistance, vine health and hardiness will suffer. Ideal ranges for most crop production (based on soil test results) are 65 – 70% saturation of Calcium.

Lime is best applied to the vineyard prior to establishment to correct pH. If you lime a vineyard you must monitor the pH and add additional lime from time to time to maintain the proper pH. Granular lime application in the fall at 300 to 400 pounds per acre can accomplish this.

Phosphorus

Phosphorus deficiency symptoms are relatively uncommon in most grape production areas, but deficiencies can occur, especially in acid soils in cooler regions. Many grape soils are deficient in phosphorus and rapidly fix any applied phosphorus.

Phosphorus is important for cell division and growth. It is needed for photosynthesis, sugar and starch formation, in energy transfer, and movement of carbohydrates within the plant.

Where phosphorus is deficient shoot and root growth are reduced and leaves are small and dark green, possibly with red to purple margins. The leaf margins turn down and in a severe deficiency leaves develop red spots. Reduced vine vigor and yield decline are associated with low phosphorus levels.

For adequate Phosphorus supply maintain soil levels in the good to high range and monitor Al levels. An annual application of phosphorus is recommended to build soils to and adequate level and maintain levels. Do not plant grapes in soils with less than 30 ppm Bray P1 phosphorus.

Potassium

Plants need potassium for the formation of sugars and starches, for the synthesis of proteins, and for cell division. Potassium in the plant regulates the cell pH and maintains turgor within the cell. Plants that have adequate levels of potassium will withstand drought and other environmental extremes much better. Maintaining adequate potassium levels directly relates to yield and sugar quality in the grape and it also aids in protecting the plant from disease and insect pressure and increasing the vines winter hardiness.

Begin to monitor potassium levels early. If a season is cold and wet in the spring, or hot and dry, potassium uptake in the plant will be reduced and potassium levels in early leaf tissue will be low. Care must be taken at this time to supplement potassium at this time or it will be difficult to correct later and will lead to further problems.

In seasons where potassium deficiency is left in the early stages and progresses increased insect pressure from sucking insects will be a problem.

The demand for potassium is highest in mid summer as the fruit begins to ripen when greater amounts accumulate in the fruit. This crop induced potassium deficiency is common in both table grapes and wine grapes, especially on acidic soils. Potassium deficiency can also occur at this time of year with the variety Pino Noir being particularly sensitive, resulting in poor berry colour at harvest.

The symptoms are fading or yellowing of the leaf colour beginning at the leaf margin and progressing inwards between the main veins. These yellow areas then bronze or redden and eventually may blacken. Marginal burning or curling may occur in severe cases. The vines may defoliate, especially if they are carrying a heavy crop or are stressed by moisture. In such cases yields are reduced and the fruit may fail to develop full colour or to reach maturity.

Maintain soil levels in the 4 – % base saturation range for C.E.C. less than 7 and in the 3 – 5% base saturation range for soil between 7 and 20 C.E.C. An annual application of K is recommended to maintain levels and build. In soils with low K levels in season application of Sulfate of Potash or Sulfate of Potash magnesia are excellent potash source to supply K.

More important than just the level of K is the K/Mg level of the soil. Maintain K/Mg between .2 and .35. If K/Mg is below .2 than potassium is short in availability to the crop regardless of the potassium reading. If K/Mg is above .35 than Mg is in short supply. This relationship is important as too much K can induce GSN.

An excess of potassium in grapes neutralizes the tartaric and malic acids in the must and can cause a lack of acidity. A lack of acidity leads to poor storage potential of the wine especially if the lack of acidity is not compensated by a good tannin structure. As a result of this factor many vineyard managers have shown a reluctance to use potassium fertilizer. In some cases this has led to low and sometimes deficient content of potassium in the vine that can lead to excessive acidity.

Monitor crop levels beginning early and apply foliar Potassium Carbonate if levels are low. Potassium carbonate materials are the most effective foliar potassium for plant uptake and have the lowest phytotoxicity.

Magnesium

Magnesium deficiency occurs on light, acid soils with a low magnesium content, sandy soils with a relatively high potassium content, calcareous (high calcium, high pH) and soils where the K/Mg is greater than .35. High applications of potassium or nitrogen can induce magnesium deficiency symptoms on soils that originally contained enough magnesium.

Magnesium plays a major role in the production of chlorophyll and the conversion of Phosphorus to energy and sugar. If magnesium levels are low in the early season the energy required to grow is limited and the phosphorus requirement for flowering will be limiting.

At the mid ripening stage the developing fruit has a high requirement for calcium and magnesium, which they obtain from the grape stalk, while the requirement for potassium is relatively low. It is therefore easy for the grape stalk to become depleted of calcium and magnesium and enriched with potassium if the correct balance is not maintained. The major reason that magnesium is a priority nutrient during fruit swelling and ripening is because of its importance in preventing GSN.

Early foliar sprays of magnesium are essential to prevent magnesium deficiency. An application of Sulfate of potash magnesia in spring will supply a good level of K and Mg for this crop. Further monitoring of tissue levels to determine Mg requirements is essential. Soil levels of Mg should be greater than 10% or Mg deficiency will occur. If soil levels are less than 125 ppm a minimum of 50 pounds per season of Mg will be required to build soils and maintain Mg levels in the plant.

Tissue magnesium is somewhat misleading in some cases in that a magnesium deficiency may show up as a rapid increase in magnesium in the leaf. Elevated Mg levels in tissue samples may indicate magnesium is being held in the plant in chlorophyll and not being used by the plant in the conversion of phosphorus. Monitor P levels as well as Mg to determine Mg requirements.

Manganese

Manganese deficiency occurs most commonly on high pH alkaline soils and or soils where Mn levels are less than 30 ppm. It is a relatively immobile element in the plant.

Mn serves as an activator for enzymes in growth processes. It assists in chlorophyll formation; thus leaf chlorosis is an early deficiency symptom.

Symptoms can appear in 2 to 3 weeks after bloom on severely deficient vines. A mild to moderate Mn deficiency will not appear until mid summer to late summer. The symptoms begin on the basal leaves as a chlorosis between the veins. Increasing chlorosis develops between the primary and secondary veins; the veinlets tend to retain a green border. This a somewhat distinct herringbone chlorosis pattern can ultimately develop on Mn deficient leaves.

These symptoms should be distinguished form those of zinc, iron and magnesium deficiencies. Zinc deficiency symptoms first appear on newer growth and include some leaf malformation. Iron deficiency also appears on newer growth and causes a much finer network of green veins in the yellowing leaf tissue. As with Mn deficiency magnesium deficiency chlorosis first appears on the basal leaves, but it is more extensive between the primary and secondary veins, developing into more complete yellowish bands, lacking the herringbone pattern.

On soils low in Mn an application of Mn fertilizer in the spring application is required to build levels. An application of foliar Mn should also be applied as the soil application will not be effective until later. Soil application will be required for 2 – 3 years until levels are detected in soil analysis. Monitor foliar requirements with tissue analysis.

Zinc

Zinc deficiency is common in many vineyards. In grapes zinc is essential for normal leaf development, shoot elongation, pollen development, and the set of fully developed berries.

Zinc may be deficient in soils with low zinc levels such as very sandy soils or where the topsoil has been removed. Zinc is less available in alkaline soils and zinc supplementation is nearly always necessary in these situations. Zinc availability can also be restricted in high phosphorus soils or where high rate of phosphorus fertilizer have been used.

The first symptoms of zinc deficiency are small leaf blades with opened petiolar sinuses and sharp teeth. The leaf blades are often asymmetric, on half of the leaf being larger than the other. The leaves develop an interveinal chlorotic pattern, can be reddish in black or red cultivars, exposing the veins as a darker green colour. Even the veinlets retain a uniform-width border of green unless the deficiency is quite severe.

On grapevines zinc deficiency can seriously affect the set and development of the berries. This leads to reduced yields or to lowered acceptability of table grapes and the production of poor quality must in wine grapes. Vines deficient in zinc tend to produce straggly clusters with few berries. The berries usually range in size from normal to small to very small. Shot berries often remain hard and green and fail to ripen. Some varieties will show very little leaf symptoms unless the deficiency is very sever although the effects on bunches and berries will be evident.

Zinc levels in the soil should be greater than 5 ppm or an application of 5 pounds per acre should be applied in the spring fertilizer application to build to these levels. Even in soils with 5 ppm an application of early foliar zinc is recommended because zinc is not available in cold soils early and the roots are inactive. Maintain zinc levels throughout the season and monitor with tissue analysis. Adequate levels of zinc in tissue will aid in hardening the vine for the winter and protecting the bud from winter injury. Also maintaining high tissue zinc levels will increase bud reserves for next spring.

Boron

Boron deficiency occurs mainly in vines grown on acid or high pH soils, poorly drained soils or where soils are dry for an extended period of time. In grape vine, low boron limits pollen germination and normal pollen tube growth, thus reducing fruit set.

Boron deficiency symptoms are fairly complex and depend on the time of the year during which they occur. They are first found in the youngest tissues. The shoots may grow in a zigzag manner with numerous laterals growing form the stunted shoots giving a bush appearance. The growing tip may die on severely affected shoots. In severe cases brown lesions may appear on the internodes, which when cut lengthwise reveal hollow brown areas in the pith.

Fruit symptoms of boron deficiency are the easiest to recognize. Severely affected vines may have no crop , while other clusters appear to burn off or dry around bloom time. Leaving only cluster stems, sometimes with occasional berries. Many clusters may set numerous small seedless berries that persist and ripen. Clusters may be full or straggly, and may include normal sized berries as well as “shot berries” and berries with flattened bases.

Shot berries caused by low boron level should not be confused with those caused by zinc deficiency. Clusters from zinc deficient vines have shot berries of normal shape, typical of the variety, and most of these berries remain hard and green. They are also more varied in size than those caused by boron deficiency.

Boron levels should be 1.5 ppm in soil. In soils less than 2 ppm a spring application of 1 lb/ac boron should be applied. This application should be applied as a liquid broadcast on the soil. Sol U bor at 5 pounds of product (20% B) per sprayed acre. This application unless boron levels exceed 2 ppm is an annual application.

Further boron may be required as a foliar treatment to the grape crop. Tissue analysis will monitor further boron requirements in the tissue. Never apply more than ¼ pounds per acre of actual boron as a foliar.

In dry seasons even when boron has been applied to the soil or the soil contains high boron, boron deficiency may occur.

Late season application of boron will help the crop mature and fortify the bud for over wintering.

Tissue Values Leaf Blade

3 weeks pre bloom	Bloom	Veraison

Foliar Fertilization of Grapevines

The grapevine is a crop that responds well to foliar fertilization. Foliar fertilization helps correct a nutrient deficiency before it becomes a problem if it is identified ahead of time by soil and tissue analysis.

Soil analysis helps to identify hidden hungers and allows us to put into place a pro-active foliar program.

N %	3.2-3.7
P %	.4 - .55
K %	1.2– 1.6
Ca %	1 – 3
Mg %	.25 - .6
S %	.35 - .5
B ppm	35 – 60
Cu ppm	6 – 20
Fe ppm	40– 300
Mn ppm	30– 100
Zn ppm	35 - 70

N %	2.3-2.8
P %	.25-.45
K %	1.2-1.6
Ca %	1-3
Mg %	.25-.6
S %	.35-.5
B ppm	35-60
Cu ppm	6-20
Fe ppm	40-300
Mn ppm	30-100
Zn ppm	35-70

N %	2.2-4
P %	.15-.3
K %	.8-1.6
Ca %	1-3
Mg %	.25-1
S %	.35-.5
B ppm	30-100
Cu ppm	6-20
Fe ppm	40-300
Mn ppm	25-200
Zn ppm	30-60

Supplementation of nutrients following a tissue program will help detect the needed nutrient that is required or becoming short in supply prior to it creating a yield or quality problem. A well-planned foliar program supports the ground applied fertilizer program and helps the grower overcome environmental conditions that may be causing nutrient shortages.

When a crop load is heavy the need for foliar supplementation will become more critical.