Effect of Soil pH on Concord Vine Growth and Root Biology

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In many Concord vineyards in New York, vine size has been one of the limiting factors to increased production as the industry goal strives for increased yields while maintaining juice quality. A recent survey of vineyards in the Lake Erie Regional Grape Belt conducted by Phil Throop, extension agent, illustrates the soil pH and nutrient availability of those vineyards.

According to the survey of soil tests (Fig. 1), 53% of the vineyards had a soil pH of 4.5 or lower with relatively high available aluminum and relatively low available phosphorus, calcium, and magnesium. 81% of the measured vineyards had soil pH of 5.0 or lower and 93% of them had a pH lower than 5.5, the Cornell recommended soil pH for Concord vineyards. Despite these acidic vineyard soils, petiole analyses from the same survey show adequate petiole P, Ca, and Mg at all soil pH levels. It is possible that there is a decrease in vine size at the low soil pH which concentrates nutrients in the tissue giving similar petiole values in low and high pH grown vines. Alternatively, Concord roots may have adapted a strategy for efficient nutrient acquisition at low soil pH. If Concord roots have adapted a strategy to survive and produce at low soil pH, identifying that strategy could be beneficial in vineyard management.

Fig. 1. Distribution of Soil pH in 300 Soil Tests in the Lake Erie Region
Fig. 2. Effect of soil pH on one year old Concord vine dry weight

In 1998, a preliminary study of the effect of soil pH on Concord root and vine growth was conducted on young Concord vines planted in 25 gallon pots with soil pH ranging from 3.5 to 7.0. There was a strong reduction in vine size as the soil pH dropped from a pH of 4.5 to 3.5 (Fig. 2). According to Phil Throop’s 1997 soil survey, vineyard soils in the Lake Erie region show an increase in available aluminum to levels generally considered toxic to root growth as the pH drops below 4.5. Soil and tissue nutrient analyses from the 1998 pot study are currently being run to investigate this and other nutrient availability relationships. Although there were no differences in vine size from a soil pH of 4.5 to 7.0 in the pot study, there were some differences in rhizosphere pH and phylloxera infection.

Fig. 3. Rhizosphere pH modification in Concord roots

By comparing the bulk soil pH and the rhizosphere soil pH, vines growing in a bulk soil pH of 4.0 raised the rhizosphere pH over 0.5 pH units. Conversely, vines in a bulk soil pH of 7 decreased the rhizosphere pH by 0.5 pH units. There was little difference between bulk and rhizosphere pH in plants growing in pH 5.5. In well aerated soils, modification of rhizosphere pH is most often attributed to the amount of H+ and HCO3− secreted by the roots as a result of differential cation-anion uptake.

Identification of phylloxera infection was not a primary objective of the 1998 research project; however, striking differences in root morphology under the different soil pH levels prompted us to score roots according to phylloxera damage. As the vines were excavated at the end of the growing season, roots were scored for phylloxera as 'light,' 'moderate,' or 'heavy.' All the root systems had at least a few phylloxera nodosities on the fine roots; however, the heaviest infection was on roots in a soil pH between 6 and 7. It is unknown whether the phylloxera were attracted to the neutral soil pH or the larger root systems of those vines. Furthermore, within the population of vines grown in soil pH 6-7, roots with the lowest infection had the largest vine size of all the vines in the study.

Results from the 1998 soil pH experiment suggest that Concord vine growth does respond to soil pH, which is probably a function of soil nutrient availability and root activity. For 1999, we are proposing to expand this project into a field experiment to study the effect of soil pH on the vine size, nutrition, and yield of Concord grapevines.

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FINGER LAKES VINEYARD NOTES 2
NITROGEN FERTILIZATION - DETERMINING
THE NITROGEN STATUS OF VINEYARDS

Timothy E. Martinson

In a previous article (Vineyard Notes #2, 1999), I outlined some of the reasons why efficient nitrogen use is important in vineyards. In this article, I will take a look at how we measure nitrogen in vineyards, and why the results are often difficult to interpret.

Tissue and soil testing is used to determine the need for various fertilizer elements, but not for nitrogen. Though petiole tests for total nitrogen are available, we do not recommend routine testing of petioles for N, nor reliance on nitrate concentrations reported in standard soil tests. Instead, recommendations are that nitrogen needs be judged by vigor (rate of shoot growth) and canopy fill. Why are petiole and soil tests not considered to be reliable indicators of nitrogen needs?

Petiole tests. Determining the content of potassium, magnesium, boron, and other elements in plant tissues through petiole tests provides a good picture of plant needs. This is because the concentration of these elements varies predictably over the growing season, and they remain relatively stable in the soil. It is relatively easy to predict the vine’s response (as measured by petiole analysis) to a given amount of fertilizer. Nitrogen, in contrast, is mobile, and is chemically converted by bacteria in the soil to different forms (making it more or less available to plants for uptake). This makes it harder to relate numbers obtained in petiole tests to vine response. Effects on the vine are heavily influenced by soil type (N moves faster through permeable, coarser soils than heavy soils, for example).

The two types of tissue tests used in the world are Total Nitrogen and Nitrate-N. Cornell Laboratories use the Total N test, which measures all the nitrogen present. Two problems with this test are 1) Total N doesn’t vary within a wide range. In a California experiment, Total N in nitrogen-deficient grapevines was only 10% less than in vines with adequate nitrogen. A large sample is needed to detect real differences. 2) Nitrogen promotes shoot growth. The total amount of N present in a fertilized vine will be greater than in a small, nitrogen-deficient vine, but the concentration is diluted over a larger amount of tissue — just as dilution lowers brix levels after rainfall when berries swell. A more practical consideration for growers is timing. Total N is best measured at bloom, by sampling leaves opposite flowers. For other nutrients, the most appropriate timing for collecting samples is before harvest - probably the worst time to measure nitrogen in grape tissues.

Determination of Nitrate-N is widely used in California, but not here. Nitrate-N shows a greater range of variation, and a more consistent response to fertilizers - probably because nitrate is the major form in which nitrogen is taken up by grapevines. Why is it not used here? The short answer is climate. Nitrate-N tests work well in the Central Valley of California for major varieties such as Thompson Seedless because the climate is reliable, soils (and irrigation) are uniform, and critical levels have been established through 40 years of field trials. They would be unreliable here, because nitrate levels are sensitive to sunlight (different results on cloudy days), variety (some varieties accumulate 6 times as much nitrate in petioles as others), and rainfall effects (water uptake can temporarily lower nitrate levels). This is a test best suited to desert climates with consistent sunlight and major acreage of a few varieties. Those characteristics do not describe the Finger Lakes.

Soil Tests. Nitrate levels (lb. of NO₃-N/acre) are reported on samples run through the Cornell Nutrient Analysis Laboratory. Do these offer any guidance? The answer is no, for several reasons:

- Nitrate concentrations vary dramatically over the growing season. As mentioned previously, soil bacteria chemically convert nitrogen into different forms (e.g. ammonium is converted to nitrate, which is the most common form taken up by roots). Bacteria become active when the soil warms up. A German study found that soil nitrate levels measured at bud break had no relation to nitrate levels prebloom. Levels were highest between bloom and veraison - reflecting bacterial action, and lower during the cooler months. What you get from a soil test will depend on the time of year in which samples are collected.

- Tillage and ground cover affect nitrate levels. Tillage can increase nitrate concentration. Ground cover can tie up or release nitrates at different times of the year. These can affect nitrate concentrations found in soil samples.
Handling of soil samples. Nitrate levels can change rapidly from the time they are collected to the time they are tested (the bacteria, again). Unless a sample is frozen from collection to analysis, results won’t reflect what was present when soils were tested.

Despite these limitations, measuring nitrate present in the soil makes some sense as a way to ensure adequate availability and avoid excess application. If it can be demonstrated that a sufficient amount of nitrate is present in the soil, a grower could safely omit or reduce nitrogen application in a given block. Before that can be done, however, a rapid method for measuring nitrate in soil at the appropriate time must be available. Collecting soil samples, sending them to the laboratory, and waiting for results won’t produce accurate results, or allow for mid-season adjustments at the appropriate time.

Nitrate meters. Corn and row crop growers are starting to use what is called pre-sidedressed nitrogen testing (PSNT) to determine N needs. This method of determining soil nitrate uses an inexpensive hand-held electronic meter (much like a pH meter) to rapidly determine approximate nitrate concentrations in soil. It may have potential for in-season determination of nitrogen needs—particularly where split budbreak and postbloom applications are used. It may be of use in indicating, for example, when the postbloom application could be safely reduced or eliminated. No standards for interpreting these tests exist for grapes. We will be making some preliminary measurements this summer in the Finger Lakes using this instrument.

All current methods for determining nitrogen status of vineyards have serious problems that limit their usefulness for guiding N fertilizer application rate. Basically, there is still no substitute for judging canopy fill, vigor, and knowing the history of your vineyard. For native and hybrid grape growers, the general consensus among researchers is that many growers could cut back their nitrogen use from 100 lb/acre actual N to 60-70 without noticeable effects on production. Efficient nitrogen use, as I mentioned in the previous article, will become more important in the future from an environmental standpoint. My suggestion is to experiment with adjusting nitrogen rates in a few rows or acres, and observe what happens for yourselves.

PREPARING THE AIRBLAST SPRAYER FOR WORK

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Checking the sprayer. Surveys have shown that many farmers are using inaccurate sprayers; faulty sprayers contribute to increased drift levels and waste money through inefficiency and overuse of chemicals.

Sprayers must be regularly checked over to ensure that proper maintenance has been carried out and that no outstanding repairs need to be done. Before attempting any work on a machine make sure that it is fully supported on stands and that all necessary protective clothing is on hand.

The cost of replacing a faulty pressure gauge which has been indicating at 15% below the actual pressure is recouped in around two hours’ operation.

Maintenance measures such as fitting a new set of nozzles at the beginning of each season also save money. Even when there is overdosing by as little as 5%, the cost of a new set of nozzles would be recovered in less than a day’s work.

CAUTION

♦ Take great care when adjusting a sprayer while the tractor engine is running.
♦ Always ensure that the fan is stationary before approaching the rear of the sprayer.
♦ Engage the hand brake when leaving the tractor seat.

Fitting the sprayer to the tractor. The selected tractor must always be powerful enough to operate the sprayer efficiently under the working conditions that will be encountered. All its external services—hydraulic, electrical and pneumatic—must be clean and in working order. Tractors fitted with cabs must have efficient air filtration systems. All protective guards
must be in place. Trailed sprayers are often close-coupled to the tractor, so it is essential that the drawbar and the PTO shaft are correctly adjusted for turning. PTO shafts must be disengaged when making very tight turns.

**Checking the operation of the sprayer.** Part fill the tank with clean water and move the sprayer to uncropped waste ground. Remove the nozzles. Although not using any chemical at this point, get into the habit of wearing a coverall, gloves and a face visor when working with the sprayer. Engage the PTO and gently turn the shaft, increasing speed slowly to operating revs. Test the on/off and pressure relief valves, and check the agitation system. Flush through the spray lines, then switch off the tractor. Refit the nozzles and check the liquid system again for leaks.

It is a valuable exercise to assess the spray deposits at various points in the canopy and on upper and lower leaf surfaces of the trees to be sprayed. This is particularly important if the foliage is dense or if the trees are grown in beds of three or more rows. Water-sensitive papers or fluorescent tracers are available for this purpose. An increase in spray volume or adjustment of the nozzles and their locations may be necessary in order to achieve the correct deposits.

**Pre-season maintenance.** Follow the checklists before you begin spraying:

**Hoses**

*Have you checked...*

- for splits and cracks
- connections to ensure they are water-tight
- for hose chafe, particularly in routing clips

*Action: Replace damaged hoses.*

**Filters**

*Have you checked...*

- for missing filter elements and seals
- for leakage
- for blocked or damaged filters

*Action: Replace any damaged or blocked filter.*

**Tank**

*Have you checked...*

- for fractures and any other damage
- the tank sits firmly in its mount
- the securing straps are correctly adjusted

- the agitation is working
- the tank is clean

*Action: See the supplier/manufacturer now about fractures and any other repairs.*

**Controls**

*Have you checked...*

- the control circuitry (electrical, hydraulic or air) for correct operation
- valves for both internal and external leaks

*Action: Replace leaky valves, which waste money and are potentially dangerous to operators and the environment.*

**Pump**

*Have you checked...*

- lubrication levels
- for leakage
- the air pressure in the pulsation chamber (if fitted) is at the recommended level
- the pump rotates freely without friction or noise.

*Do so by rotating manually or starting at low speed (corrosion may cause seizing up).*

**Pressure gauge**

The pressure gauge is vital for indicating whether the nozzles are delivering the correct amount of chemical per unit time while spraying. If you have any doubts about the pressure gauge, replace it or refer the problem to the manufacturer or supplier.

**Nozzles**

*Have you checked...*

- all nozzles are the same
- all nozzles are in good condition, with no leaks around the bottom
- all nozzles are clean and free from obstruction

*(note: clean with a soft brush or airline - don’t damage nozzles by using wires or pins)*
- the pump rotates freely without friction or noise.

*Do so by rotating manually or starting at low speed (corrosion may cause seizing up).*

*Action: Always ensure the correct nozzles and operating pressure are selected before use. Have two or three sets of nozzles in stock to meet different spray qualities at different volume rates. Inspect nozzles throughout the season to avoid faults which could prove both costly and damaging to the environment if they develop unchecked. Using water only, set to ‘spray’ at the specified pressure and collect the output from each nozzle in turn for a period of 60 seconds. Record each output and replace those outside the 5% tolerance around the manufacturer’s chart value.*
Calibration
Where your sprayer has automatic controllers to monitor
the speed of the sprayer and the flow, pressure and area
sprayed, have you checked...
♦ they are in good condition and properly maintained
♦ they are frequently calibrated for accuracy, with cali-
   bration being checked after every 250 acres’ use
♦ for leaks, blockages, variations in pressure or any mi-
   nor damage during spraying

A recommended calibration technique is summarized
as:
♦ Read the label
♦ Measure the forward travel speed of the tractor with
   the booms out and over the field to be sprayed
♦ Calculate the nozzle output required
♦ Select the appropriate nozzle set
♦ Set the appropriate pressure
♦ Measure the nozzle output against time

Routine maintenance. The following checks should be
carried out routinely:
♦ All hoses are tightly connected and free from sharp
   bends; cracked or damaged hoses must be replaced.
♦ All controls move freely and are fully adjustable.
♦ Pressure gauge reads zero.
♦ Pump can be turned over by hand.
♦ Fan turns freely and is not obstructed; bearings are
   sound and lubricated.
♦ Air pressure in pump accumulator (if fitted) is cor rec-
   tly adjusted.
♦ Drain plugs and clean filters are in position.
♦ Tires on trailed machines are sound and correctly in-
   flated; wheel nuts are tight.

NEW PRODUCTS FOR 1999 VINEYARD PEST
MANAGEMENT

Tim Weigle
Grape IPM Extension Specialist

Several new products have been added to the New York
and Pennsylvania Pest Management Recommendations for
Grapes for the 1999 growing season. Rick Dunst, man-
ager of the Vineyard Lab in Fredonia and primary author
of the weed management portion of the Recommends pro-
vides the following overview of recently added herbicides.

1) Touchdown®. Touchdown® (sulfosate) is a non-
selective systemic herbicide which has been approved
for use in bearing and non-bearing vineyards. The active
ingredient sulfosate is chemically similar to that of
glyphosate, the active ingredient in Roundup®. Touch-
down® contains 5 lbs. of sulfosate per gallon while
Roundup® contains 4 lbs. of glyphosate per gallon.
Evaluation in New York and elsewhere indicates very
similar activity of Touchdown® and Roundup® on weeds
when applied at the same rate of active ingredient. For
example, a 0.8 qt. application rate of Touchdown® would
be expected to provide weed control similar to that ob-
tained with a 1 qt. application of Roundup®.

Touchdown® applications should be made to avoid con-
tact with fruit or green grapevine tissue. Applications
made after grape bloom require the use of shielded equip-
ment and can be made until 14 days prior to harvest.
Touchdown® should be applied in 3-30 gallons of water
per acre. Recommended rates range from 0.8 to 6.4 pints
per acre depending on weed species and size - consult
the label for specific recommendations. Addition of non-
ionic surfactant and/or ammonium sulfate may enhance
the performance of Touchdown® in some circumstances.

2) Goal®. Goal® (oxyfluorfen) has been labeled for
vineyard use for several years. It is essentially an expen-
sive substitute for Princep® (simazine), generally pro-
viding good control of most broadleaf weeds but some-
what weak in controlling summer annual grasses. In re-
cent trials in New York vineyards, Goal® has generally
provided better control of pigweed species than Princep®
(simazine), Karmex® (diuron), and Solicam®
(norflurazon).

Goal® must be applied prior to bud break to avoid injury
to vines. In newly planted vineyards, vines must be at
least 3 years old or be established on a trellis wire at least
3 feet above the soil surface. The labeled use rate is 5-8
pints per acre. Typical vineyard practice would be to
tank mix with another herbicide such as Solicam®
(norflurazon) or Surflan® (oryzalin) that would provide
good control of summer annual grasses.

3) Gallery®. Gallery® (isoxaben) is registered for non-
bearing vineyards only - do not apply within onyear of
harvesting fruit. Currently, Gallery® is not registered
for use in New York. Of the limited selection of preem-
genence herbicides registered for use during vineyard es-
What does this mean to you? Not much if you are following a good pest management strategy. This bill could potentially be more useful in the tree fruit industry where tree-row volume spraying allows growers to spray dwarf trees at lower rates per acre when compared to standard size trees. It will also be beneficial when using the new sprayer technology which senses gaps in the row (missing vines or trees) and shuts the sprayer off when a target isn’t available. Caution should be taken when reducing rates. Benlate and Bayleton are good examples of what can happen when reduced rates of fungicides are applied to existing infections. It may work well for a year or two but resistance to these materials developed quickly (powdery mildew in this example) and the materials were essentially lost for use in the New York grape industry. On the other hand, research and experience has shown that grape leafhopper is much easier to kill than grape berry moth. Time and effort was expended by the entomologists at Geneva and extension field staff to get the information needed to get a 2ee which allowed the use of reduced rates of insecticides for leafhopper. With this new bill, once the research has been conducted it can be quickly transferred into grower vineyards. Once again, I will caution that this 2ee bill should not be used as a blanket reason to reduce rates. ♦

1999 Finger Lakes Crop and Pest Management Updates

Timothy E. Martinson

We will begin posting weekly pest management and crop development updates, also known as Code-a-phone messages, via E-mail and telephone messages starting in late April. The telephone message will be available 24 hours a day. If you would like to receive updates by e-mail, please call our office or send an e-mail message with your name and e-mail address to me at tem2@cornell.edu. I will put you on the distribution list. Distribution is limited to enrollees and subscribers to Vineyard Notes. ♦

Grape Code-A-Phone Number

315-536-5549

(Available starting April 26)
CONVENTION THANKS

Timothy E. Martinson

In spite of the snow, the 50th Annual Finger Lakes Grape Growers Convention was attended by 255 people, out of an advance registration of 290. The snow prompted us to accelerate the afternoon session, and cancel the wine & cheese reception. Thanks to all the speakers, exhibitors, and processors that donated wine and juice for the convention. They are:

EXHIBITORS

Agri- Business Insurance Agency
Agway - Lyons
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American Nurseries
Applied Agricultural Technologies
BASF
Bayer Corp.
The Birkett Mills-Yates Bldg.
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Helena Chemical Co.
Improcrop Ltd.
Innovative Fence & Trellising Supplies
RE & HJ McQueen Inc.
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National Bank of Geneva
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RMC Equipment Inc.
Rohm & Haas
Sensor Instruments Co., Inc.
Slawson Safety Equipment Inc.
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TFE Co.
Yates County SWCD
Zeneca Ag Products

WINE DONATIONS

Barrington Cellars
Cayuga Ridge Estate Winery
Fox Run Vineyards Inc.
Fulkerson’s Winery
Hazlitt 1852 Vineyards
Heron Hill Winery
Hosmer Winery
Hunt Country Vineyards
Johnson Estate Winery
Lamoreaux Landing Wine Cellars
Leiderfrost Vineyard
Lucas Vineyards
McGregor Vineyard
Prejean Winery
Silver Thread Vineyard
Swedish Hill/Goose Watch
1998-1999 Winter Low Temperatures in the Finger Lakes

- January 2, 1999
- January 14, 1999
- January 31, 1999
- February 23, 1999
- March 8, 1999

M=Missing data for the temperature monitors

FINGER LAKES VINEYARD NOTES
Upcoming Events

May 19, 1999. 2-6 PM. Spring Pesticide Update. Plans are underway for the annual spring spray meeting and pesticide update. This field meeting will again be held at Lance Fullager Vineyard Supply, and will feature pest and product updates from University and Industry participants, a demonstration of new shielded herbicide sprayers, and a barbecue. Pesticide certification credits will be available. Look for details in the next Finger Lakes Vineyard Notes.


The objective of this program is to provide information and hands-on activities on enjoying and managing forests and rural properties. Learn how to manage a woodlot, attract birds and wildlife, landscape your property, identify trees and shrubs, maintain a healthy pond, manage deer problems and much more. Contact Cornell Cooperative Extension - Yates Association at (315)536-5123 for further information.

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