Integrated Cranberry Crop Management for Wisconsin

Cranberry

Crop Management Newsletter

Volume XIX
Number 8
August 20, 2006

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NITROGEN FERTILIZATION AND YIELD COMPONENTS

The goal of most cranberry growers is to produce as many berries as possible with the least input or cost or maximizing return on investment. Achieving this goal requires management that transforms cranberry yield components and sunlight into cranberries. Yield components are the potential yield and in combination with sunlight, water, nutrients, temperature (environment), make carbohydrates or the harvest. Approximately half the yield potential can be turned into cranberries.

Cranberry yield components are: 1) total number of uprights, 2) flowering upright number, 3) flower number, 4) berry number, and 5) individual berry weight. Let's examine how you can manipulate yield components that control cranberry yield.

Nitrogen fertilizer is applied to achieve and maintain tissue sufficiency. When vines have a sufficient N concentration, nitrogen will not limit yields. Understanding the changes nitrogen makes to yield components should help growers manage nitrogen application. A few years ago we completed research that helped us understand the relationship between N fertilization and yield. We identified a cranberry bed in south coastal Oregon that was seriously deficient in nitrogen. For three years, plots in this bed were given either 0, 20, 40 or 60 lb/a applied N. Cranberry yield components were measured after three years of fertilizer application. Yield components, yield component ratios, and yield are given in Table 1.

Table 1. The influence of nitrogen application rate on cranberry yield and yield components for Stevens cranberries grown in south coastal Oregon after three years of treatment.

Table 1 shows that in a nitrogen deficient cranberry bed, application of N increases total upright number, flowering upright number, flower number, and yield or total berry weight. It also increased tissue N concentration (data not shown).

Based on prior research, the two important ratios calculated from these components are floral induction (proportion of flowering uprights per total uprights) and fruit set (Fruit number per flower number). Addition of N to a deficient cranberry bed did not change the proportion of flowering uprights. About one-third the total uprights flower, regardless of the N rate. Fruit set increased from 28 to 48 % or from about one-quarter to one-half when sufficient N is supplied (Table 1, line 8)

Table 1. The relationship between nitrogen fertilization and yield components of cranberry from an N deficient bed in coastal Oregon.

	Yield component	N Rate lb/a			
Line		**0**	**20**	**40**	**60**
1	Total upright number/sq ft	274	334	378	443
2	Flowering upright number/sq ft	74	110	126	143
3	Flower number/sq ft	282	369	400	555
4	Berry number/sq ft	76	128	191	264
5	Berry weight, grams/sq ft	113	202	315	485
6	Floral induction or proportion of fruiting uprights, %	27	31	33	32
7	Flowers/flowering upright	3.8	3.6	3.2	3.9
8	Fruit set, %	28	35	48	48
9	Berry size, grams	1.5	1.6	1.6	1.8
10	Yield increase from increased berry size, bbl/a	0	5	0	52
11	Yield increase from increased berry number, bbl/a	0	80	100	131

Such a large increase in the number of fruit produced from the flowers present (fruit set) indicates a change in the cranberry plant. The likely change is additional leaves to transform carbon from the atmosphere into plant energy for growth and storage (carbohydrates). Average upright length increased from 2 inches to 2 ¾ inches as N rate increased from 0 to 60 lb/a. This upright length is consistent with other recommendations for cranberry fertilization

When 60 lb N/a was applied, 3.9 flowers/flowering upright were counted. At this N rate, the fruit set was 48% or fruit was formed on half the 3.9 flowers (Table 1, line 7). Each flowering upright produced two berries/flowering upright, the theoretical maximum fruit set based on the amount of carbon each upright can transform into carbohydrates and the amount of carbon in a mature fruit.

Let's examine the source of yield or limitation to yield. If each flowering upright will produce two berries and the proportion of flowering uprights to total uprights is constant, then the total upright number is critical. High yielding Stevens beds typically have 400 to 500 uprights per square foot.

As N application increased and as the vines became N sufficient, fruit set increased (Table 1, line 8). If we extrapolate the increase in yield from our small samples to an acre, we see an increase of 80 bbl/a as N increases from 0 to 20 lb/a and an increase of 100 bbl/a resulting from having MORE berries as N increases from 20 to 40 lb/a N fertilizer (Line 11). This is caused by an increase in fruit set and by a slight increase in flowering/fruiting uprights.

Similarly, as N fertilizer increased there was a small increase in berry size (Line 9). If we extrapolate to yield per acre, the increase in yield resulting from **LARGER** berries was 52 bbl/a (line 11).

Some growers focus on increasing berry size. After fruit set, they want to "pump up" berries with fertilizer. The research results represented in Table 1 strongly suggest that there is more yield to be gained from increasing berry numbers (either through fruit set or floral induction) than from fruit size. Remember, carbohydrates, not fertilizer nutrients make berries. Berry size is a less important yield component. It rarely increases or decreases yield. Table 1 shows a slight increase in berry size from nitrogen application. The

increase in berry size did not increase yield when the N rate was increased from 0 to 20or from 20 to 40 lb/a. Berry size only slightly increased yield, 50 bbl/a, when the N increased from 40 to 60 lb/a. The increase in yield from berry size was about 1/3 the yield increase from an increase in berry number.

In this article we learned that:

- When N fertilizer is applied to overcome a deficiency vine growth and yield increase.
- Adequate N results in more fruit and larger fruit.
- Yield increases are greater from increasing berry number than from increasing berry size.

John Hart, Oregon State University
Teryl Roper, UW-Madison

CRANBERRY TISSUE AND SOIL SAMPLING

Tissue testing is the backbone of any nutrition management plan for cranberry marshes. Taking routine tissue samples for analysis can detect low nutrient concentrations before visible symptoms or yield reduction occurs. Tissue testing can be used to predict the fertilizer needs of your crop, diagnose problems, and to evaluate the effectiveness of your fertilizer program.

Taking tissue samples is easy. Three principles guide collecting tissue samples so that the information from the analysis is interpretable and relevant to the plantings where they were taken. The three principles are:

- Take the sample at the correct time
- Collect the correct tissue
- Take a representative sample

Sample at the right time. The correct time to collect cranberry tissue samples is in late summer to early fall, usually August 15 until September 15. Plants must be sampled at the proper point in time in order to correctly interpret the results. Nitrogen, for example, is relatively high in new leaves in the spring, levels off in midseason and then declines in the late summer and fall. Interpretations are based on knowing the relationship between nutrient levels in a particular part of a "standard" tissue in a specific time in the growing season. A tissue sample taken in the spring could show excess nitrogen compared to late summer standards and a sample taken in the late fall could show a deficiency even if it were adequate in late summer.

Sample the correct plant part. The correct tissue to collect for cranberries is current season growth on both fruiting and non-fruiting uprights, not including fruit. Sampling a different plant part will also lead to incorrect interpretations of the analysis. For example, the nitrogen content of one-year-old leaves is lower than for current season leaves. If one-year-old leaves are included in a sample nitrogen deficiency may be indicated, while if only current season leaves are sampled an adequate amount or an excess may be shown.

Take a representative sample. A representative sample is collected by taking samples across an entire bed, not just in one corner or along one edge. Either begin at one corner and walk diagonally to the other corner, or walk a zig-zag pattern across a bed and collect 10-12 sub-samples as you go. Each sub-sample consists of 5-15 uprights. The sample should be representative of the planting because the results of the test can be no better than the sample sent in for analysis. The amount of tissue the lab actually tests is less than a teaspoon, so it is very important that the sample be characteristic of the bed. Don't sample diseased, damaged, insect infested or abnormal tissue. If you suspect a nutrient related disorder, sample when you see symptoms. Submit a sample of abnormal appearing tissue along with a sample not showing the symptoms that is collected on the same day. By taking two

samples, one from a normal area and one from an affected area you'll be able to compare the two and draw conclusions.

Interpretation:

Within 10-14 days you'll receive a report from the laboratory. You can interpret your report by comparing to the values in Table 1. By taking samples from each management unit each year you can follow upward and downward trends while keeping tissue in the sufficiency range. Downward trends can be mitigated with additional fertilizer. Upward trends may signal concerns about excessive vine growth that can be stopped before it occurs. Tissue samples taken this year guide your fertility program next year.

Table 1. Cranberry tissue nutrient content guidelines for producing beds.

Nutrient	Normal range *percent*	Nutrient	Normal range *ppm*
N	0.9 – 1.1	B	15 – 60
P	0.1 – 0.2	Fe	>20
K	0.4 – 0.75	Mn	>10
Ca	0.3 – 0.8	Zn	15 – 30
Mg	0.15 – 0.25	Cu	4 – 10
S	0.08 – 0.25		

Procedure:

Before you begin, gather the supplies and equipment for the job. You'll need a pair of scissors or pruning shears, a permanent marker, and a sufficient quantity of large envelopes or paper bags. Plan ahead of time where you'll take samples so you can walk your pattern on each bed collecting as you go.

1. Begin at the corner of the first bed. Walk into the bed 15-20 feet and collect the first sample. Grab a handful of uprights including both fruiting and non-fruiting uprights.

2. Cut off the uprights where current season growth begins. You may have some fruit attached. These should be removed later.

3. Pick off any fruit remaining on the uprights and place the uprights in a paper bag or envelope.
4. Walk another 30-50 feet and repeat the procedure. Do this until you have collected 10-12 sub-samples in a bed.
5. For each bed you should have collected about a cup of plant tissue.

6. Label the bag with the bed identification, date and farm name.

7. Allow the samples to air dry for a day or two before mailing to the lab. Don't wash the samples. Be sure to fill out the sample information sheet that the lab will provide for you.
8. Promptly mail the samples to the lab of your choice. Mail early in the week to prevent samples sitting in a post office over the weekend. Your County Agricultural Extension office can help you with this.

Soil Sampling

The basic principles for soil sampling are much the same as for tissue sampling. The principles are:

Sample at the correct time. The correct time to collect soil samples is the same time as tissue samples—August 15 to September 15.

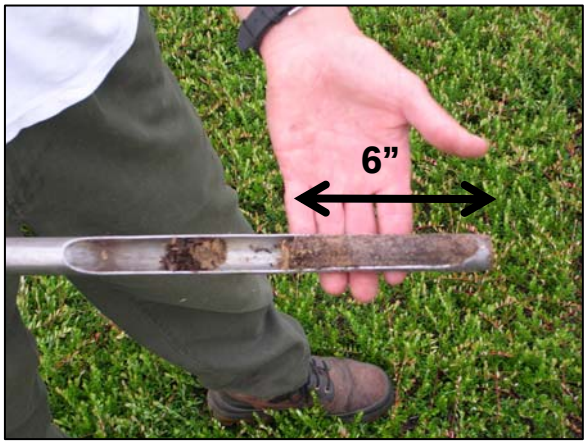
Sample to the correct depth. Soil samples should be collected to a depth of six inches.

Take a representative sample. Samples should be taken at random across the entire bed, not just in one corner or along one edge.

The procedure is simple. Before you begin collect the supplies and tools that you'll need. These include a soil probe with a mark at 6 inches, a plastic bucket to hold samples, paper or heavy plastic bags, and a permanent marker.

Begin at one corner of a bed. Walk into the bed 15-20 feet and collect the first sample. Insert the probe to a depth of 6 inches and remove the probe. Remove the duff layer, then empty the contents of the probe into the bucket.

Walk another 30 to 50 feet and repeat the procedure. Do this until you have collected 10 to 15 cores across a bed. 10 cores is the minimum. As beds increase beyond 5 acres collect an additional sample core per acre.



Your total sample should consist of several cups of soil. Mix them together well to break up

the cores and to create a uniform blend. Place about two cups of soil into a paper or heavy plastic bag. Label the bag with the bed identification, date, and farm name.

Promptly mail the samples to the lab of your choice. To meet NRCS guidelines, soil samples should be sent to WDATCP approved labs. For up-to-date information about approved soil test labs contact the WSCGA office or NRCS. Approved labs use appropriate soil test procedures and are checked regularly for accuracy and reproducibility of results.

Interpretation

A routine soil test will report soil pH, % organic matter, and will provide estimates of plant available phosphorus and potassium. Because cranberry beds are high in iron and aluminum soil test P is usually not interpretable. As a rule of thumb, soil test P should be about 25 ppm and soil test K should be about 100 ppm.

When a soil test accompanies a tissue test it is another tool in the ongoing management of a fertility program. When samples are collected from each fertility management unit each year trends can be followed over time and adjustments made as necessary.

Teryl Roper, UW-Madison Extension Horticulturist

True education does not consist merely in the acquiring of a few facts of science, history, literature, or art; but in the development of character. True education awakens a desire to conserve health by keeping the body clean and undefiled. True education regulates the temper, subdues passion and makes obedience to social laws and moral order a guiding principle of life.

David O. McKay

It isn't always others who enslave us. Sometimes we let circumstances enslave us; sometimes we let routine enslave us; sometimes we let things enslave us; sometimes, with weak wills, we enslave ourselves. Sometimes we partake of detrimental things that we think will soothe our nerves, minds, or imaginations – things we think will help us to escape from reality. But no man is free if he is running away from reality. And no man is free if he is running away from himself.

Richard L. Evans