



# Cranberries

(*South Coastal Oregon*)

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**T**he goal of cranberry fertilization, as for any high-value crop, is to remove limitations to yield and quality by supplying the crop with ample nutrition in advance of demand. Consider the fertilizer needs of each cranberry bed rather than treating your entire acreage the same way.

Insufficient nutrition is only one cause of reduced yields. Saturated or dry soils; high temperatures; frost; shading; weed, insect, or disease pressure; or herbicide injury also reduce yields. Fertilization will not compensate for these problems. On the other hand, if adequate nutrition is present, fertilizing is an unnecessary expense and potentially detrimental to the environment.

Foliar fertilization of cranberries is practiced by growers with little evidence supporting its benefits. Although fertilizers may enter through leaves, there is little information about how this method compares to standard practices.

Fertilizer need should be determined through soil and tissue analyses in conjunction with weather records, crop yield and fruit quality, and an assessment of pest problems. Production costs, environmental stewardship, and governmental regulation also should be considered. Fertilization should be based on yield or quality response, experience, and economics.

This nutrient management guide provides information for cranberry fertilization in Coos and Curry counties, where cranberries are planted in irrigated beds of sandy soil placed on top of high-organic-matter or clay subgrade. Uniform irrigation is essential for optimum cranberry growth since moist but not saturated soils are required.

Plants indicate low nutrient supply through reduced growth and yield. Nutrient supply below crop demand can lead to visible nutrient deficiency symptoms. Routine collection and analysis of soil and tissue samples are helpful in detecting low nutrient concentration before visible symptoms and yield reduction occur. An Extension publication, FG 74, *Analytical Laboratories Serving Oregon*, provides information about laboratories that offer soil and tissue testing services. It is available in local Extension offices or can be ordered from OSU Extension and Experiment Station Communications. See "For More Information" on page 5 for ordering instructions.

## Using Soil and Tissue Tests

Routinely monitor soil for pH, phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), boron (B), and zinc (Zn). Annually test cranberry tissue for total nitrogen (N), P, K, Ca, Mg, sulfur (S), B, Zn, copper (Cu), and manganese (Mn). Tissue tests help to assess fertilizer requirements during the following growing season.

Many laboratories also provide analyses for additional micronutrients such as iron (Fe). These analyses may be helpful in problem or "troubleshooting" situations, but are difficult to interpret from routine sampling.

Soil and tissue tests are best used to evaluate a program of several years duration rather than for a single year. Fertilization of a perennial crop such as cranberries may not affect tissue analysis levels for 1 to 2 years after application. Therefore, record keeping is a vital part of soil and tissue analysis interpretation. In addition, recording data on fertilizer applications, weather, and yield is helpful.

## Soil and tissue sampling

Obtain soil samples during the dormant season after flood management and before bud break. Obtain 10 to 12 cores from the same area from which tissue samples are taken. Avoid poorly drained areas, high spots, or other nonrepresentative areas. Sampling depth should be 4 inches on new or young beds or 6 inches, including surface duff, on mature, well-established beds. Sample problem areas separately.

Obtain cranberry tissue samples by clipping current season growth from a mixture of fruit-bearing and non-fruiting uprights. Twenty tips each from 10 locations representative of the bed are needed. The total sample will consist of 200 tips per bed. Do not wash the sample or separate leaves and stems before submitting the tissue sample to the laboratory. Collect tissue samples during mid-August to mid-September, prior to harvest. See EM 8610, *Cranberry Tissue Testing for Producing Beds in North America*, for more information.



## Interpreting test results

Soil and tissue analyses won't identify an exact amount of fertilizer to apply. However, they are useful for evaluating nutrient sufficiency and fertilizer applications.

Cranberry tissue test values are divided into below normal, normal, and above normal categories. The categories are based on nutrient ranges from other cranberry growing areas, grower observations, Oregon cranberry tissue analyses, and limited Oregon field trials. If a tissue concentration is below normal or deficient, fertilization with the appropriate nutrient is recommended.

The standard fertilization schemes that follow involve a series of applications that can be modified depending on soil and plant analyses, vigor, and crop performance.

## Nitrogen (N)

### Bearing beds

Adequate tissue N levels are necessary to maintain growth, crop production, and flower bud development for next year's crop. Excess N leads to excessively vegetative growth, which restricts flower bud formation and delays fruit maturity.

Nitrogen fertilization rates are based primarily on field observation and to a lesser extent on plant analysis. Soil testing for N is not a reliable indicator of perennial crop N status.

Leaf analysis alone does not indicate whether N fertilization is required but can be used with an assessment of plant growth and productivity to determine N status. Normal growth for flowering uprights is 2 to 4 inches per year above the bud break point. Flowering upright growth less than 2 inches is below normal. Conversely, flowering upright growth greater than 4 inches is above normal.

Above normal N and high vigor indicate over fertilization of N. Below normal N and low vigor indicate a need for more N. Above normal N and low vigor suggest another growth-limiting factor such as poor drainage. Below normal N and high vigor can occur in beds with little or no crop. Table 1 provides a guide to cranberry N tissue concentrations.

Table 1.—Percent leaf N for mature beds in August-September. Standards for 'McFarlin,' 'Stevens,' and 'Crowley' cultivars combined on a dry weight basis.

Leaf N (%)	Status
<0.90	Below normal
0.90–1.10	Normal
>1.10	Above normal

Cranberries respond best to ammonium N. Usually, broadcast applications of dry materials are spread more evenly than applications made through sprinkler systems.

To avoid plant injury, apply materials to dry vines, then rinse with irrigation water.

At fruit set and sizing time, terminal leaves on flowering uprights should turn from a healthy green color to a pale yellowish green. Terminal leaf margins turn red, while leaf bases and midribs remain green. These natural signals of stress indicate normal nutrient flow from current season growth to developing fruit. Recent research supports these observations.

Rate of N fertilizer application will vary depending on crop potential, weather, and stress conditions such as herbicide use, frost injury, and drainage. Warm soils may stimulate release of N from duff in established beds and uptake of recently applied N fertilizer. Depending on local conditions, apply a total of 10 to 60 lb N/a in increments of 5 to 20 lb N/a throughout the growing season as described below.

Nitrogen applied between bud break and early bloom often produces excessive growth, especially during cloudy or rainy periods. For most beds, optimum timing of N for fruit set, berry size, and bud initiation seems to be from the time berries are pea-sized until the last flower falls, a period of 3 to 4 weeks. Use bee activity during bloom to help determine N timing. Make final N applications 1 to 3 weeks after bee activity stops. Reduce nitrogen fertilization after fruit is sized, since research has shown that little N is taken up at that time.

If vines are weak or stressed, however, a postharvest application of 5 lb N/a may be helpful. Heavy applications of N late in the season encourage berry rot, delay ripening and color development, and stimulate bud growth, increasing the risk of winter injury.

For established plantings of 'Crowley' and 'McFarlin,' if the bed is not overly vegetative, apply 5 to 10 lb N/a at late hook/early bloom stage. Withhold further N until berries are pea or marble size throughout the field, then apply 10 to 20 lb N/a. A final application of 5 to 10 lb N/a may be applied in late July or early August to maintain plant vigor and to further encourage bud development.

For 'Stevens,' wait until pea-sized berry stage occurs before beginning N fertilization. Apply 10 to 20 lb N/a every 7 to 14 days until berry sizing seems complete. An alternative is to apply 20 lb N/a twice at 2-week intervals during the same period. A final application of 5 to 10 lb N/a may be applied in late July or early August to maintain plant vigor and to further encourage bud development.

### New beds

For new plantings (first year), apply 5 to 10 lb N/a when ¼ inch of growth is observed. Then apply 10 lb N/a no more than every other week until September or until appropriate vigor and runner growth is achieved. Fertilization of new beds encourages rapid soil coverage and root growth for early establishment and decreased weed competition.

Irrigate to maintain a moist but not wet soil environment. If water puddles consistently, adjust sprinklers,

reduce irrigation amounts, or improve drainage. Cranberries may die or lose vigor if standing water is chronic. Establishment is achieved when runners generate new uprights and terminal buds. When sufficient uprights and buds have been formed, apply N according to the scheme outlined for bearing beds.

## Phosphorus (P)

Determination of need for P fertilizer is best made by tissue testing. Soil test P below 15 ppm most likely will produce cranberries with tissue P below 0.10 percent, a below-normal concentration. However, soil test P above 15 ppm does not ensure the production of cranberries with tissue P above 0.10 percent; therefore, tissue testing better predicts cranberry P status.

Recent work in Massachusetts showed that applications of 40 to 120 lb P<sub>2</sub>O<sub>5</sub>/a performed equally well in providing P to established P-deficient cranberries. No definitive data exist to indicate whether single or multiple applications of P are superior. Single applications of P should be made at or before the roughneck development stage.

In established beds, apply P according to Table 9. Where vines are weak, a postharvest application of 10 to 20 lb P<sub>2</sub>O<sub>5</sub>/a may be helpful.

## New plantings

Efficient use of P fertilizer depends on fertilizer placement as P is not mobile in soil. The fibrous root system of cranberry develops in the top 1 to 3 inches of soil. Therefore, on new plantings, apply 1/2 to 2/3 of the P fertilizer just before vines are scattered and disked. Apply the remaining P at midseason.

If the vines already have been planted, split the P applications in the first year, applying half as growth starts and half at midseason.

Table 2.—Cranberry phosphorus sufficiency and fertilizer recommendations based on soil and tissue tests.

If the Bray soil test for P is (ppm)	If plant P in Aug–Sept is (%)	Status
0–15	<0.10	Below normal
15–30	0.10–0.20	Normal
>30	>0.20	Above normal

  

If cranberry status is	Broadcast this amount of P <sub>2</sub> O <sub>5</sub> (lb/a)
Below normal	40–80
Normal	0–40
Above normal	0

## Potassium (K)

An adequate supply of K is needed for the high K requirement of young leaves and berries. Multiple applications of K fertilizer are recommended. If dry K fertilizers are applied, rinse material from foliage with irrigation to prevent fertilizer burn.

Table 3.—Cranberry potassium sufficiency and fertilizer recommendations based on soil and tissue analysis.

If soil test for K is (ppm)	If plant K in Aug–Sept is (%)	Status
0–50	<0.40	Below normal
50–100	0.40–0.75	Normal
>100	>0.75	Above normal

  

If cranberry status is	Broadcast this amount of K <sub>2</sub> O (lb/a)
Below normal	60–100
Normal	0–60
Above normal	0

When K is required, apply 25 percent of the total at cabbagehead/bud break stage in late March or early April, 25 percent at hook stage in May, 25 percent at fruit set stage in June to early July, and 25 percent after fruit set in late July to early August. Where vines are weak, a postharvest application of 10 to 20 lb K<sub>2</sub>O/a may be helpful. Use Table 3 to determine how much to apply.

## Sulfur (S)

Plant analysis is used for prediction of cranberry S needs.

Table 4.—Cranberry sulfur sufficiency based on tissue analysis.

If plant S in Aug–Sep is (%)	Status
<0.08	Below normal
0.08–0.25	Normal
>0.25	Above normal

Fertilizer materials used to supply the other nutrients normally contain more than adequate S. Therefore, separate applications of S are not recommended.

## pH

Cranberries grow best in south coastal Oregon between pH 4.5 and 5.5. Treatments to change pH status of cranberry beds usually are not advised since native soils are in this pH range.

## Calcium (Ca)

Apply Ca as gypsum (calcium sulfate) between cabbagehead/bud break and roughneck stages according to Table 5. Caution: Excess soil calcium can enhance invasion of unwanted legumes in cranberry beds. Gypsum will not improve soil drainage in western Oregon. Sufficient Ca may be supplied by 0-45-0 (12 to 14 percent Ca) fertilizer and bordeaux fungicide.

Table 5.—Cranberry calcium sufficiency and fertilizer recommendations based on soil and tissue analysis.

If the Ca soil test is (meq/100 g)	If plant Ca in Aug-Sept is (%)	Apply this amount of gypsum (lb/a)
<0.50	<0.30	100
	0.30–0.80	0–100
	>0.80	0

## Magnesium (Mg)

Little is known about Mg nutrition of cranberries, and, according to Eck in *The American Cranberry*, no reports of yield or growth increases to Mg applications have been published. Eck also reports that blueberries grown on the same soil as cranberries sometimes exhibit Mg deficiency symptoms. The limited growth of cranberries compared to blueberries may be one factor in the lower Mg requirement of cranberries. In addition, the evergreen growth habit of cranberries may allow Mg to be translocated from old to new growth.

Though little information on cranberry Mg nutrition exists, the choice of 0.15 percent tissue Mg from a late summer sampling is supported by tissue analysis summaries and is consistent throughout North American growing regions. Analyses of Oregon cranberry tissue from 1974 to 1988 show most samples were between 0.17 and 0.24 percent Mg. Only 2 percent of the samples were below 0.17 percent.

South coastal Oregon cranberries are routinely fertilized with Mg. If Mg is deficient, a greater distribution of tissue Mg concentration would be expected. Low tissue Mg can be caused by Ca and K fertilization, which is reflected by high tissue Ca and K concentration. In this situation, reduce Ca and K applications. If needed, apply Mg at cabbagehead/bud break stage according to Table 6.

Table 6.—Cranberry magnesium sufficiency and fertilizer recommendations based on soil and tissue analysis.

If the Mg soil test is (meq/100g)	If plant Mg in Aug-Sept is (%)	Broadcast this amount of Mg (lb/a)
<0.30	<0.15	20
	0.15–0.25	0–20
	>0.25	0

## Boron (B)

Boron can be toxic to cranberries if applied in excess. Apply B only when the need is indicated by soil or plant analysis. Use a soluble form of B broadcast by sprayer or sprinkler. Do not mix it with copper materials. Apply between roughneck and early bloom.

Table 7.—Cranberry boron sufficiency and fertilizer recommendations based on soil and tissue analysis.

If the B soil test is (ppm)	If plant B in Aug-Sept is (ppm)	Apply this amount of B (lb/a)
<0.50	<15	1
	15–60	0–1
	>60	0

## Iron (Fe), Manganese (Mn), and Zinc (Zn)

Soil and tissue tests for iron are difficult to interpret, so analysis for Fe is not recommended. High levels of manganese (Mn) are common in cranberry tissue. If Mn-containing fungicides have not been used and tissue concentration of Mn exceeds 300 ppm, soil drainage may be inadequate.

Soluble forms of zinc, such as zinc sulfate or chelate, can be applied by sprayer or sprinkler. Apply only when needed between roughneck and early bloom.

Table 8.—Cranberry zinc sufficiency and fertilizer recommendations based on soil and tissue analysis.

If the DTPA soil test for Zn is (ppm)	If plant Zn in Aug-Sept is (ppm)	Apply this amount of Zn (lb/a)
<0.80	<15	1–2
	15–30	0–1
	>30	0

Table 9.—Guide to timing of cranberry fertilization in bearing beds.

Nutrient	Cabbagehead/ bud break	Roughneck	Late hook/ early bloom	Fruit set	Late fruit set to early bud development	Post- harvest
	-----lb/a-----					
Nitrogen (N)	a		5–10	10–20	10–20	0–5 <sup>b</sup>
Phosphorus (P <sub>2</sub> O <sub>5</sub> )	0–80 <sup>c</sup>					0–20 <sup>b</sup>
Potassium (K <sub>2</sub> O)	0–25		0–25	0–25	0–25	0–20 <sup>b</sup>
Calcium (Ca)	[ _____ 0–100 <sup>d</sup> _____ ] <sup>e</sup> (as gypsum)					
Magnesium (Mg)	0–20					
Boron (B)		[ _____ 0–1 _____ ] <sup>e</sup>				
Zinc (Zn)		[ _____ 0–2 _____ ] <sup>e</sup>				

<sup>a</sup>Apply 5 to 10 lb N/a if vines are weak. Excess growth can occur in warm and wet weather for beds with duff buildup. Avoid early N treatments in second-year beds if first-year growth was abundant. Also, avoid early N use on ‘Stevens.’

<sup>b</sup>Postharvest fertilization usually is not needed. However, apply immediately after harvest if the vines are weak.

<sup>c</sup>No definite data exist to indicate whether single or multiple applications of P are superior. Single applications should be made at or before roughneck development stage.

<sup>d</sup>Apply 100 lb calcium sulfate/a (gypsum) if needed. Gypsum contains 19 to 23 percent calcium.

<sup>e</sup>Apply during the period marked between brackets or according to the product label. Post-bloom applications are not recommended.

## For More Information

### OSU Extension publications

Hart, J. *Analytical Laboratories Serving Oregon*, FG 74 (Oregon State University, Corvallis, revised 1996). No charge.

Davenport, J., C. DeMoranville, J. Hart, K. Patten, L. Peterson, T. Planer, A. Poole, T. Roper, and J. Smith. 1995. *Cranberry Tissue Testing for producing beds in North America*, EM 8610 (Oregon State University, Corvallis). 75¢

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### Other publications

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Wood, J.H., L. Warner, and W.L. Powers. 1950. Preliminary Report, *Water and Nutrient Relations for Cranberries*. Oregon State College Extension Service, Experiment Station Soils Department (now Oregon State University, Corvallis, OR).

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Tissue and soil analyses are based on procedures used by OSU. Soil Mg, Ca, and K are determined from an ammonium acetate extraction. Boron is extracted with hot water and Zn from a DTPA extraction. N recommendations are based on tissue analysis groupings from Plant Analysis Laboratory data and field research. Other recommendations are based on Extension experience and grower observation.

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