

PLANT & PEST ADVISORY

CRANBERRY EDITION \$1.50

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Essential Elements for Cranberry Growth and Development

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The study of mineral nutrition of plants asks the question what elements must a plant absorb in order to thrive and complete its life cycle. Soils are composed largely of aluminum, oxygen, silicon, and iron, however the composition of the cranberry plant does not resemble the composition of the soil (Table 1). Cranberries, like other plants, are selective in the manner in which they absorb minerals.

Higher plants are found to contain up to 60 different elements, however, only 16 have been identified as essential, although this number is growing. The three most important components of plant tissue are carbon, oxygen and hydrogen (Table 1); these elements are derived from the atmosphere and from water. All other nutrients must be obtained directly from the soil, through interactions with soil organisms (e.g. mycorrhizae), through fertilizers, or minimally through atmospheric deposition. There are small levels of nutrients that are delivered by atmospheric deposition (see related article, page 2). This is a minor source of nutrient supply and is variable year to year (Table 2).

Plant nutritionists have grouped the essential nutrient elements based on concentrations necessary for healthy plant production. Macronutrients are needed in concentrations of 1000 mg/kg (commonly expressed in terms of 10,000 mg/kg or parts per hundred = %) of dry tissue while micronutrients are needed in concentration of mg/kg (or parts per million = ppm) of dry tissue or less. The concentration indicated in Table 1 is representative of a "normal" concentration in the vegetative portion of the cranberry upright tissue sampled between August 15 and September 15. These concentration values may vary based on the plant tissue sampled and the age of the plant. If a nutrient requirement has not been met, plant productivity would increase until its optimum concentration is reached. Higher plants are capable of luxury consumption (absorption of more than sufficient quantities of a nutrient). Nutrient concentration at super-optimal levels can be toxic to the plant. The range of concentrations tolerated in plant tissue prior to reaching toxic levels is wider for macronutrients than micronutrients. Tissue concentrations in the toxic levels will obviously lower plant productivity.

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In gauging adequate nutrient supply, it has been found that the period between August 15 and September 15 provides a relatively stable indicator of plant nutrient status in cranberry. Tissue samples may be taken at other periods during the growing season if nutrient stress is suspected. However, these stressed tissues should be compared with non-stressed tissue samples taken at the same time in order to evaluate deficiencies or toxicities.

The importance of micronutrients to plant productivity is little understood. Increasingly more elements are being added to the essential micronutrient list, including nickel. Although they are only present in small quantities, micronutrients can play critical roles in plant growth and development. Some of the key roles of micronutrients include functions in flower formation, enzyme activity, and in the formation of chlorophyll. Reports have also been made for the role of micronutrients in accelerated rooting and enhancing fruit coloration.

Table 1 Cranberry tissue nutrient concentration guidelines for producing beds[†]

Nutrient	Normal Concentration (%)
Macronutrients	
Carbon*	~ 45
Oxygen*	~ 45
Hydrogen*	~ 6
Nitrogen	0.90 - 1.10
Phosphorus	0.10 - 0.20
Potassium	0.40 - 0.75
Calcium	0.30 - 0.80
Magnesium	0.15 - 0.25
Sulfur	0.08 - 0.25
Micronutrients ppm	
Boron	15 - 60
Iron ^a	> 20
Manganese ^a	> 10
Zinc	15 - 30
Copper	4 -10
Molybdenum [§]	30-40
Chlorine ^a	N/A

[†] Modified from Davenport et al. 1995 unless otherwise stated. Levels based on vegetative portion of upright tissue taken between Aug. 15 and Sept. 15.

* Modified from Stout, 1961

^a Normal range for these three elements has not been established

[§] Modified from Chaplin and Martin, 1979.

Table 2. 1998 Annual summary of atmospheric deposition for Atlantic County, NJ [¶]

	lbs/acre
Nitrate (NO ₃)	1.21
Ammonium (NH ₄)	0.19
Calcium	0.05
Magnesium	0.09
Potassium	0.03
Chlorine	1.36
Sulfur dioxide	1.57

[¶] Data modified from the National atmospheric deposition program for Ocean County, 1998-1999.

What Does the Atmosphere Feed Your Crops?

Reprinted from *Agri-Briefs Agronomic News Items, Summer 2000, No. 1, Potash & Phosphate Institute.*

Our atmosphere is changing. Industrialized society has produced rising levels of carbon dioxide, ozone, and nitrogen oxides. Sulfur dioxide emissions may have stabilized, but considerable amounts are still transferred in the air, particularly in the northeast states.

What do these substances do to your crops? Do they help, or do they harm?

Carbon dioxide, worrisome for its role as a greenhouse gas, is the biggest source of nutrients for all plants. More than 90 percent of plant dry matter is made up of the carbon and oxygen it supplies. Numerous studies indicate that the elevated levels expected in the future are likely to stimulate plant productivity.

Ground level ozone, on the other hand, can hurt your crop. Near urban areas, crops frequently show symptoms of ozone injury. Increasing levels of carbon dioxide may not do much more than counterbalance the increasing levels of ozone.

Across the eastern Corn Belt, sulfur dioxide in the air can supply substantial amounts of the plant nutrient sulfur. Plant leaves can absorb it through their stomates as a gas or through their roots after rain washes it into the soil as sulfate. The soil does not hold sulfur well, though, and crops like alfalfa, which remove a lot of it, can still show deficiencies.

In some areas, sulfur dioxide may be concentrated enough to cause stress to plants. Recent research in India showed that nutrient-deficient soybeans were particularly susceptible, while those grown with balanced levels of nitrogen, phosphorous and potassium tolerated stress better. Potassium protects against ozone as well by increasing leaf levels of antioxidants such as ascorbic acid.

Nitrogen can be delivered through the air just like sulfur. Across most of the Corn Belt, 5 to 8 pounds per acre fall with the rain each year. Ammonia that volatilizes from livestock operations, manure storages, and fields can be absorbed as a gas by plant leaves. Leaves also rapidly take up oxides of nitrogen that are emitted from the soil. In fact, a recent study in Ontario found that turf fertilized with nitrogen took up nitrogen oxides faster than unfertilized turf.

In some areas near the ocean coasts, the rain delivers as much as 28 pounds of chloride per acre each year. Away from those areas, however, chloride deposition is negligible. Rainfall delivers only very small amounts of calcium, magnesium, potassium,

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Insect Update

Sridhar Polavarapu, Ph.D., Entomology and IPM

✓ **Spotted fireworm:** Egg masses are hatching over the past few days. If you were planning on using Confirm 2F for managing spotted fireworm during bloom, you should apply this insecticide around June 27-30. Confirm 2F is somewhat slower in bringing larval death than the organophosphates we have been using. Often two applications are required, especially to suppress moderate to heavy infestations. If a second application is required, it should be applied 7-10 days after the first application.

✓ **Blackheaded fireworm:** Pheromone trap catches have significantly decreased this week and we are almost at the end of the adult activity period. In our research bog, more than 75% of the eggs have hatched. Most larvae are in second and third instar stages at this time. If you have not seen larval infestations by now, it is more than likely that you are not going to see an infestation this season. If an insecticide treatment is required, Confirm 2F should be applied at this time.

✓ **Sparganothis fruitworm:** Pheromone trap

catches have increased this week over last week. Trap catches have been higher this year in the majority of our monitored locations. Trap catches are expected to peak in the following 4-7 days. We anticipate Sparganothis fruitworm larval populations to be higher this year than in previous years. These higher populations may be in part because of fewer insecticide applications made this year during the pre-bloom period. Confirm 2F applied for spotted fireworm or blackheaded fireworm in the following 4-7 days will also suppress the Sparganothis fruitworm larvae that are hatching at this time. □

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and phosphorus – not enough to be significant to the nutrition of most crops.

Deposition varies greatly from one place to another and from year to year. The National Atmospheric Deposition Program, through its nationwide network of precipitation monitoring sites, provides useful maps showing the distribution of nutrients delivered by rain each year. Their website, <http://nadp.sws.uiuc.edu/>, gives full public access to the data.

Your nutrient management plan is not complete if it doesn't consider what comes from the air.

Submitted by Joseph Heckman, Ph.D., Soil Fertility. □

Weekly Weather Summary

Keith Arnesen, Ph.D., Agricultural Meteorologist

Temperatures averaged above normal south and below normal north. Extremes were 93 at Pemberton and Hammonton on the 13th and 18th and 45 degrees at Charlotteburg on the 14th. Weekly rainfall averaged 1.02 inches north, 1.40 inches central, and 1.32 inches south. The heaviest 24 hour total was 1.41 inches at Atlantic City Marina on the 18th to the 19th. Estimated soil moisture, in percent of field capacity, this past week averaged 95 percent north, 82 percent central and 58 percent south. Four inch soil temperatures averaged 67 degrees north, 71 degrees central and 72 degrees south.

Weather Summary for the Week Ending 8 am Monday 6/19/00

WEATHER STATIONS	RAINFALL			TEMPERATURE				GDD BASE50		MON %FC
	WEEK	TOTAL	DEP	MX	MN	AVG	DEP	TOT	DEP	
BELVIDERE BRIDGE	1.44	17.98	4.15	87	53	65.	-3	727	71	91
CANOE BROOK	.69	13.09	-1.89	90	53	67.	-2	822	200	88
CHARLOTTEBURG	.96	16.43	1.39	87	45	62.	-4	543	70	92
FLEMINGTON	1.02	14.97	.70	89	53	66.	-3	852	205	91
LONG VALLEY	.99	15.73	.42	84	52	64.	-3	628	102	92
FREEHOLD	.72	10.99	-3.09	90	54	68.	-2	900	169	75
LONG BRANCH	1.54	14.19	-.05	91	54	67.	-2	742	75	89
NEW BRUNSWICK	1.31	14.55	.78	90	54	68.	-3	868	93	94
PEMBERTON	1.57	13.19	-.36	93	57	74.	4	1268	506	82
TOMS RIVER	2.55	14.03	.03	92	57	70.	1	860	197	100
TRENTON	.72	12.32	-.46	89	55	69.	-3	933	110	61
CAPE MAY COURT HOUSE	.96	13.95	1.55	90	58	72.	2	894	157	61
DOWNSTOWN	1.17	13.01	.35	91	57	73.	1	973	129	72
GLASSBORO	.93	13.64	-.01	91	58	73.	2	1050	227	67
HAMMONTON	1.68	11.92	-1.37	93	56	73.	1	927	112	80
POMONA	1.69	11.51	-.65	92	57	73.	3	884	141	93
SEABROOK	.91	14.31	2.30	91	57	73.	1	1048	198	61
ATLANTIC CITY MARINA	1.90	12.94	1.38	88	59	71.	2	883	199	100
WOODSTOWN	data will no longer be available due to unexpected passing of Ed Flitcraft the observer.									
WES KLINE — GDD BASE 40 PINEY HOLLOW	Last Week 209 (Ending 6/12/00) This Week 233 (Ending 6/19/00)									

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