

Mineral Nutrition of Caneberries

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How to Sample

- Collect 25 to 50 of the most recently fully expanded leaves (12” down the cane, between leaves 5 and 7)
- Sample problem leaves from same section as good leaves. Multiple samples best.
- Sample primocanes (late July raspberry, late July florican blackberry)
- Sample primocanes (bloom – red fruit in primocane blackberry).

Leaf Nutrient Sufficiency Levels (Caneberry)

Nutrient	Recommended Amount
Nitrogen	2.3 -3 %
Phosphorous	0.19-0.45%
Potassium	1.3-2.0%
Calcium	0.6-2.0%
Magnesium	0.3-0.6%
Sulfur	0.1-0.2%
Manganese	50-300 ppm
Boron	30-70 ppm
Iron	60-250 ppm
Zinc	15-50 ppm
Copper	6-20 ppm
Molybdenum	1- 2 ppm

From :

http://smallfarms.oregonstate.edu/sites/default/files/sf_nutrient_management_berrys_sept_7_2013_strik.pdf

Diagnostics



Light colored tips





Soil



Soil

- pH 7.6
- SAR 0.89

Mineral Characteristics of the Leaves

Mineral	Green Leaves	Yellow Leaves	T-test p value
Total Nitrogen (%)	2.825	2.875	0.4950
Total Phosphorous (%)	0.19	0.2025	0.2394
Potassium (%)	1.425	1.925	0.0088
Calcium (%)	1.675	1.375	0.0462
Magnesium (%)	0.4525	0.375	0.0139
Sulfur (%)	0.165	0.15	0.1817
Copper (ppm)	4.725	4.625	0.7629
Zinc (ppm)	14.25	14	0.3910
Iron (ppm)	530	380	0.0270
Manganese (ppm)	42.75	21.25	0.0016
Boron (ppm)	73.25	68.5	0.2777
Molybdenum (ppm)	1.625	1.55	0.7680
Sodium (ppm)	172.5	167.5	0.1817
Chloride (ppm)	5250	3125	0.0520
Nitrate (ppm)	1115	1800	0.3185

Yellowed leaves on lower part of cane throughout most of cultivated area.



Yellowing and Dying Leaves Restricted to Bottom Half of Cane



Unusual Mottling of Leaf



Mottling Restricted to One Side and Not the Other



Further Observations

- Yellowed leaves separate easily from cane.
- Most plants continue to be vigorous toward top.
- Fruiting for the most part normal at top of cane, not at bottom.
- All canes in question are farmed in tunnels.
- One grower claims that he has seen a mite in association with the yellowing.

In collaboration with grower company

PCA:

- Evaluate for insects - negative
- Evaluate for fungi/bacteria - negative
- Tissue samples to CDFA laboratory for viruses - negative
- Leaf and soil samples taken for analysis.

Nutrient	Sample Description								
	Healthy Green	Green 1	Yellow 1	Green A	Yellow A	Green B	Yellow B	Green 2	Yellow 2
% N	3.3	1.7	2.1	3.0	1.3	2.5	1.3	2.7	1.7
% P	0.22	0.15	0.17	0.27	0.19	0.30	0.21	0.23	0.15
% K	1.1	1.0	1.8	1.8	2.6	1.9	1.4	1.5	1.0
% Ca	2.5	2.1	1.8	1.9	2.8	2.5	3.0	1.9	2.1
% Mg	0.83	0.67	0.56	0.58	0.63	0.74	0.79	0.58	0.67
% S	0.18	0.20	0.23	0.17	0.10	0.18	0.093	0.20	0.20
ppm Cu	4.1	7.2	8.4	6.5	5.4	7.1	5.7	8.3	7.2
ppm Zn	19	12	26	21	22	22	19	14	12
ppm Fe	330	320	400	780	970	940	900	200	320
ppm Mn	560	180	150	1600	1400	2000	1400	140	180
ppm B	78	67	73	110	170	140	180	72	67
ppm Na	160	270	210	110	290	140	220	270	270
ppm Cl	390	2500	320	4100	3900	4900	6000	2900	2500
ppm NO3- N	2500	300	340	610	400	180	460	790	300

Nutritional- Leaf Blade Tissue

Nutrient (% and ppm)	Average – Green Leaf	Average – Yellow Leaf
% Nitrogen	2.6	1.7
% Phosphorous	0.23	0.16
% Potassium	1.53	1.4
% Calcium	1.8	2.2
% Magnesium	0.57	0.64
% Sulfur	0.18	0.17
Copper (ppm)	7.0	6.9
Zinc (ppm)	16	18
Iron (ppm)	460	650
Manganese (ppm)	740	675
Boron (ppm)	86	117
Sodium (ppm)	185	293
Chloride (ppm)	3667	4136
Nitrate (ppm)	446	318

Nutritional - Soil

Data	Sample Description*				
	Healthy Green	Yellow 1	Yellow A	Yellow 2	Yellow 3
NO ₃ -N (ppm)	33	4.2	16	4.7	<2
P (ppm)	120	98	130	100	130
K (ppm)	240	580	340	210	260
Ca (ppm)	3300	3000	2700	2000	2300
Mg (ppm)	840	550	400	340	400
SO ₄ -S (meq/L)	8.6	1.3	7.5	4.3	4.2
Na (ppm)	100	74	53	40	50
Cl (ppm)	110.1	22.0	23.8	22.7	34.8
CEC (meq/100 g)	24	21	19	13	16
pH	7.1	6.9	5.5	6.8	7.2

Discussion

- No bugs or diseases.
- Striking differences in concentrations of nutrients in leaves and the soils.
- All plants are grown in tunnels, and experienced a hot spell in early June – indeed PCA noted a high degree of humidity on visiting each one.

Further Discussion

- Leaf N and P are lower in yellow leaves than green.
 - *leaf senescence often preceded by the degradation and loss of chlorophyll and a net mobilization away from the leaf.*
- Leaf Ca higher in yellow leaves than green.
 - *calcium, in contrast to other plant minerals, is moved passively through the plant via evapotranspiration. So, higher deposition of calcium would occur in plants drawing up lots of water.*
- Nitrate, sodium and chloride are all low in fields with yellow.
 - *all three ions leach in excess water.*

Conclusion

- The tunnels are too hot and killing or did kill the leaves at the bottom of the plants.
- High rate of evapotranspiration – calcium in yellow leaves, low concentrations of NO_3 , Na and Cl in soil from leaching, as well as observed heat in tunnels by PCA.
- Response: pull up the plastic on the tunnels and cool field down.

