

Nutrient Levels in Tissue of Greenhouse Crops

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The information needed for proper evaluation of plant analysis results is being gathered by several

researchers. One of the methods used to learn deficient and excess levels of individual ions is that of growing the test plant in complete nutrient solutions minus one nutrient. If all nutrient ions are studied in one experiment in excess, normal and deficient ranges, the experiment becomes too complicated. Another problem arises in that one deficient ion affects the uptake of other ions.

One of the better approaches to defining high and low ranges for the various nutrients has been used by John White of Penn State University (1). Tables 1 and 2 show the results from testing 360 tissue samples taken from 5 growers of roses (Table 1) and 5 carnation growers (Table 2). These do not define deficient or excess levels in all cases. They could be biased by being taken from growers who use similar practices, similar irrigation water, or in some other way are similar to each other or differ from grower practices in another area. These are possibly a best estimate of one who has as much experience with foliar analysis as anyone working with flower crops.

J. W. Boodley has also had wide experience with developing standards and sampling techniques as well as diagnosing the results of foliar tests. Boodley lists on a recent leaf analysis report sheet desirable

levels as indicated in Table 3. D. C. Kiplinger at Ohio State University is another experienced in diagnosing results from tissue tests of flower crops. Unfortunately, we do not have on hand the maximum-minimum levels that he uses as a guide for the various nutrients.

At Colorado State University, we started tissue testing seriously with Jim Green's work of the past three years. We are testing for some ions not being tested at other labs and are not testing the complete range of trace minerals. We are still learning as are all others in this field. Our maximum-minimum range is listed in Table 3. This information has been developed from Green's work on ion uptake (CFGA Bulletins 210, 211, 212) and is being refined further by Hartman. We also test for total cations, total inorganic anions and organic acids (C-A). Our present knowledge indicates that levels below those listed in Table 3 are deficient and will reduce growth. Further, levels above those listed may reduce growth also.

Note that while there is some variation in recommended levels from one lab to another, the recommended range for the several nutrients agrees remarkably well. Some of the differences are no doubt due to climate and growing conditions.

Table 1. Results of leaf analysis survey of commercial rose growers in Pennsylvania, 1965.

Nutrient element	N	P	K	Ca	Mg	Mn	Fe	Cu	B	Al	Zn
Units of measure	percent of dry weight					micrograms per gram (ppm)					
*Mean concentration	3.56	.277	2.22	1.04	.321	93	73	7	37	16	37
Range - High	3.75	.347	2.81	1.27	.410	186	87	11	53	19	48
Range - Low	3.27	.229	1.76	0.90	.279	52	54	5	28	14	22

Table 2. Results of leaf analysis of commercial carnation growers in Pennsylvania, 1965.

Nutrient element	N	P	K	Ca	Mg	Mn	Fe	Cu	B	Al	Zn
Units of measure	percent of dry weight					micrograms per gram (ppm)					
*Mean Concentration	3.71	.362	3.09	1.38	.421	163	70	8	36	18	51
Range - High	3.93	.405	3.32	1.50	.613	444	93	12	47	29	68
Range - Low	3.41	.338	2.84	1.32	.189	61	60	7	21	9	34

*Each mean value represents an average of 360 samples from 5 growers.

Table 3. Nutrient levels in carnation tissue that are within the acceptable range.

	Percent								ppm					
	N	P	Ca	K	Mg	Na	Cl	S	Zn	Mn	Fe	Cu	B	Al
PS	3.4	.34	1.3	2.8	.19	---	---	---	34	61	60	7	21	9
	3.9	.41	1.5	3.3	.61	---	---	---	68	444	93	12	47	29
CU	3.0	.20	1.0	2.0	.20	Max	---	---	25	100	50	10	25	?
	5.0	.30	2.0	6.0	.35	.60	---	---	75	300	150	30	400	?
CS	3.2	.20	1.5	2.9	.20	.12	.50	.10	---	---	---	---	---	---
	3.6	.35	2.0	3.3	.40	.20	1.0	.20	---	---	---	---	---	---

PS - Pennsylvania State University. Not all acceptable but the range from low to high found in 360 samples from 5 growers.

CU - Cornell University. Desirable levels.

CS - Colorado State University. Determined by Green.

Literature Cited

1. White, J. W. 1966. Plant analysis for flower crops. Pennsylvania Flower Growers Bulletin 187.