The Role of Calcium and Boron in Rose Development and Petal Blackening:

Nutrient Distribution along Flower Shoot Organs

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In this report we report some data from a short hydroponic study where we intended to monitor the uptake of calcium and other ions in rose plants, as well as determine the partitioning (distribution) of mineral elements along the various organs in flowering shoots, including the petals. Unfortunately we lost most of our nutrient solution samples due to a regrettable storage accident, and thus we will be reporting only on the nutrient analyses done in the tissues. Given this unfortunate accident we were forced to request a no-cost, six-month extension period to our project (until December 2007), to run another hydroponic study that hopefully will yield good calcium uptake data.

Calcium uptake studies

On our last report we mentioned that for the first time in seven years, this past winter we observed rose petal blackening symptoms in our research greenhouses in Dallas. These observations were made during December of 2006, and specifically in the cultivars 'Freedom' (growing in 5-gallon containers with peat-based substrate) and 'Happy Hour' (growing in the recirculating hydroponic units; shown below).

Figure 1. 'Happy Hour' roses grafted on *R. manetti* and *R*. x 'Natal Briar' growing in a re-circulating hydroponic system in a experimental greenhouse at Texas A&M University at Dallas.

The 'Happy Hour' plants, grafted on both *R*. x *manetti* and 'Natal Briar' rootstocks, were grown over one flowering cycle with a complete modified 0.5X Hoagland solution that received additional supplements (4 meq/L) of either calcium or potassium (added as chloride salts).

Flower shoots were harvested were dissected into petals, sepals plus ovaries/reproductive structures, peduncles, leaves and stems, then dried and ground, and finally analyzed for mineral nutrient concentrations. While the tissues were analyzed for all essential mineral nutrients, data is shown only for nitrogen (N), potassium (K), calcium (Ca) and boron (B). We also calculated the Ca/B ratio (Ca was first converted to ppm). As in our last report about the tissue nutrient status of 'Freedom' cut flowers affected by petal blackening, the concentration of most nutrients varied significantly among organs, with leaves showing the highest values for N, Ca and B. The rootstock had a differential effect on the accumulation of some nutrients in flower shoot tissues, particularly higher Ca (Table 1), P, S and Mn (data not shown) in *R*. x *manetti* plants. The supplemental salt treatments only had a significant effect on tissue Ca concentrations (higher in plants receiving a supplemental 4 meq/L of Ca application).

Table 1. Effect of rootstock and supplemental Ca and K nutrition on the concentration of selected mineral elements in tissues of 'Happy Hour' flower shoots. Flowers were harvested from hydroponically-grown plants supplied with a modified Hoagland solution supplemented with additional calcium (Ca) or potassium (K).

Rootstock ➔		Man	NB	Man	NB	Man	NB	Man	NB	Man	NB
ORGAN	**Treatment**	**N - %**		**K - %**		**Ca - %**		**B - ppm**		**Ca/B ratio**	
Petals	Ca	2.80	3.00	1.92	1.88	0.16	0.17	27	18	61	95
	K	2.95	2.90	1.94	1.93	0.17	0.16	20	18	84	91
Sepals & Ovaries	Ca	3.11	3.11	2.66	2.48	0.64	0.57	19	18	333	323
	K	3.12	3.09	2.58	2.54	0.57	0.55	18	19	314	295
Peduncle	Ca	2.19	2.10	4.37	4.44	1.05	0.93	21	20	505	454
	K	2.18	2.02	4.37	4.21	0.94	0.87	25	18	373	479
Leaves	Ca	3.85	3.95	2.72	2.68	1.46	1.46	68	69	216	211
	K	4.00	3.96	2.89	2.76	1.18	1.20	60	62	198	194
Stems	Ca	1.31	1.30	1.72	1.71	0.50	0.45	20	21	246	215
	K	1.33	1.38	1.89	1.71	0.42	0.38	19	21	217	185
Grand Average		***2.68***	***2.68***	***2.71***	***2.63***	***0.71***	***0.67***	***30***	***28***	***255***	***254***

Interestingly, and regardless of supplemental nutrient additions, the highest K concentrations were observed in the peduncles (average of 4.35%), about 60% higher than those observed in the leaves (average of 2.76%). The K concentrations in sepals and reproductive structures were similar to those recorded for the leaves. The observation of relatively high K levels in the peduncles, at least in this cultivar, poses the question of what is its role in the water relations in this transitional organ, commonly associated with the postharvest disorder known as bent neck. It may be interesting to find out whether K levels in the peduncles vary differentially among cultivars, particularly contrasting those that are more prone to develop bent neck and those who are not. As a precedent for this observation, the data we presented for 'Freedom' flower shoot tissues in our last report had peduncle K concentrations that did not exceed 2%, being less than ½ of the ones shown here for 'Happy Hour'.

As previously reported, we found out that most, if not all, of the harvested flowers shoots from this experiment, regardless of rootstock and supplemental Ca and K treatments, were afflicted by mild petal blackening symptoms. With all the experimental data and information we have collected so far from US and Colombian growers we are contending that both genetic predisposition (or cultivar sensitivity) and minimum greenhouse temperatures below 55-60 ºF are among the most influential factors on the development of petal blackening. We nevertheless intend to provide as much information as possible about the involvement of plant nutrition on the development and/or severity of this disorder.

REFERENCES

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