Nutrient Disorders of 'Evolution' Mealy-cup Sage

Essential elements taken up by plants serve a specific physiological role and reduced (nutrient deficiency) or excess (nutrient toxicity) of these elements can result in unique visual symptoms. In producing different floriculture crops growers must be able to recognize symptoms of nutrient deficiency and toxicity.

'Evolution' mealy-cup sage (*Salvia farinacea*), was grown in silica-sand culture and received complete modified Hoagland's all-nitrate solution of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (B), and molybdenum (Mo).

Induced deficiencies were obtained by the eliminating the respective element and induced toxicity obtained by increasing the element 10-fold higher than recommended. Of all 13 treatments, 12 showed symptoms of deficiency; Mo was asymptomatic. Symptoms of N, P, K, S, Ca, and Fe deficiencies and B toxicity were detected early in plant growth and are more likely also encountered by growers (Figures 1 and 2; Table 1). Plants grown in N, Cu and Zn deficient conditions showed distinctive symptoms of coloration on different parts of the plant and necrosis (dead plant tissue) was commonly observed across all treatments. These results can be used as a guide for growers diagnosing mealy-cup sage and other sage species deficiencies.

Table 1. 'Evolution' mealy-cup sage plant tissue dry weight and nutrient concentrations as affected by deficient or toxic nutrient treatments.

	Dry wt (g)[z]												
Element	−N	−P	−K	−Ca	−Mg	−S	−B	++B	−Cu	−Fe	−Mn	−Mo[y]	−Zn
Complete control	0.53	1.03	2.33	2.33	2.39	1.04	3.94	2.33	9.91	2.02	6.45	13.99	2.39
Treatment	0.33	0.63	1.45	1.47	2.05	0.58	2.57	2.16	10.45	2.04	5.71	18.44	1.43

	Tissue nutrient concn (%)[z]						Tissue nutrient concn (mg·kg^{-1})[y]						
Element	−N	−P	−K	−Ca	−Mg	−S	−B	++B	−Cu	−Fe	−Mn	−Mo[x]	−Zn
Complete control	5.06	0.67	6.07	1.66	0.66	0.45	56.0	46.8	5.5	72.0	114.4	0.6[w]	21.4
Treatment	2.57	0.12	0.47	0.40	0.08	0.24	13.0	242.1	1.1	55.5	7.6	—[v]	12.1

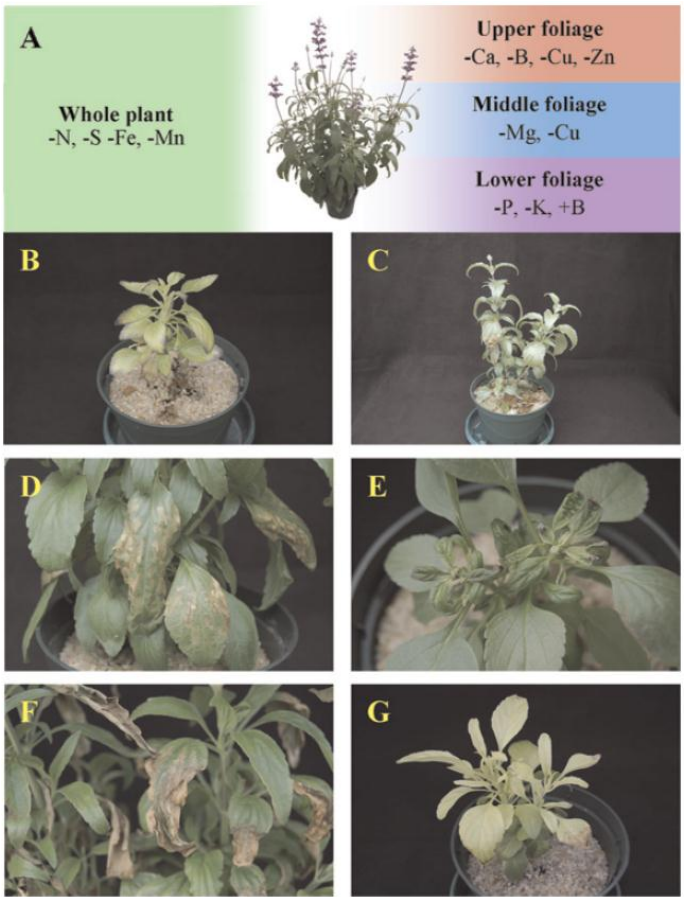

Figure 1. (A) The location where initial symptoms were first observed on plants for N, P, K, Ca, Mg, S , Cu, Fe, Mg, Mo, Zn, B deficiency and B toxicity (B) Plants grown under N deficiency. (C) Plants grown in P deficient conditions. (D) K deficient plants. (E) Plants grown in Ca deficient conditions. (F) Plants grown with Mg deficiency. (G) S deficient plants.

Figure 2. (A) Upper leaves on plants growing in B deficient conditions. (B) Lower leaves of plants grown under B toxicity. (C) Plants grown in Cu deficient conditions. (D) Plants grown under Fe deficiency. (E) Plants grown under the Mg deficient regime. (F) Plants grown under Zn deficiency.

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