HortScience 15(6):822–823. 1980.

Magnesium Nutrition of Poinsettia[1]

D.A. Cox and J.G. Seeley[2]
Department of Floriculture and Ornamental Horticulture, Cornell University, Ithaca, NY 14853

Additional index words. Euphorbia pulcherrima, tissue analysis, magnesium deficiency, nutrient culture

Abstract. **Poinsettia (*Euphorbia pulcherrima* Willd. ex Klotz) in nutrient culture developed Mg deficiency symptoms at 0, 1 and 2 ppm Mg in the solution. A high K level caused a depression of leaf Mg concentration and the appearance of deficiency symptoms with 5 ppm Mg in the solution. The Mg concentration of leaves from 3 stem positions reflected changes in Mg supply. The results emphasize the importance of recognizing the K–Mg relationship when interpreting results of soil and foliar nutrient analyses.**

During commercial poinsettia production an interveinal chlorosis often is observed on the lower leaves of potted plants producing an unsightly appearance. Pflantz and Rogers (7) linked this chlorosis to a deficiency of Mg and found it to be most common on plants grown in soilless media. The objective of our project was to study the Mg requirement of poinsettia grown in nutrient culture and to associate the Mg content of leaves from 3 stem positions with the production of Mg deficiency symptoms.

Single stemmed, vegetative plants of 'Eckespoint C-1 Red' were grown for 17 weeks between April 6 and August 5 in a semi-automatic nutrient culture system previously described by Poole and Seeley (8). Rooted, terminal cuttings were planted in 7.5 liter glazed, ceramic crocks, painted on the inside with horticultural asphalt and filled with glass marbles (1.5 cm, diam). Each crock with 2 plants was connected to an 18 liter glass carboy containing Hoagland and Arnon's solution 1 (3), with micronutrients, and modified to supply different concentrations of the Mg and N/ or K as given in Tables 1 and 3. Crocks were irrigated 3 or 4 times daily using compressed air to raise the nutrient solutions. Fresh solutions were introduced biweekly.

Crocks were completely randomized with 3 crocks receiving the same nutrient solution. At the conclusion of the experiment, dry weight of the aerial portions and plant height of 6 replicate plants were obtained as measures of growth. Leaves from replicated plants of each treatment were combined in 1 sample and analyzed for their Mg concentration using an emission spectrograph. Leaves from 3 stem positions were sampled: 1) upper, recently matured leaves from the terminal portion, 2) lower leaves, of intermediate age, and which expanded and matured after planting, and 3) basal leaves, present on the original cutting.

With moderate levels of N and K, 210 ppm N and 235 ppm K, some leaves displayed Mg deficiency symptoms at solution Mg concentrations of 0, 1 and 2 ppm but not at 5, 12 or 24 ppm. Symptoms were characterized by an interveinal chlorosis beginning at the leaf margins and extending toward the midrib followed by, in severe cases, a downward curling of the leaf margins and the development of marginal necrosis (Fig. 1). Similar symptoms have been described in detail for poinsettia by other workers (5, 10, 11).

Relatively small increments in dry weight occurred as solution Mg increased; however, the differences in dry weight between 0 ppm and the high levels of 12 and 24 ppm were large (Table 1). At 5, 12 and 24 ppm, when Mg deficiency was not observed, the greatest dry weights were obtained.

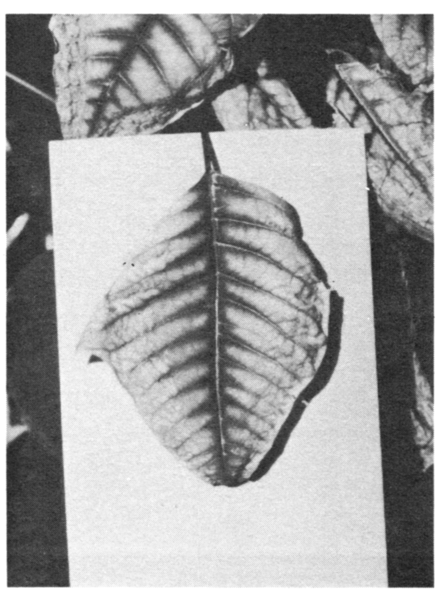

Fig. 1. Severe Mg deficiency symptoms on poinsettia.

Table 1. Dry weight and height of 'Eckespoint C-1 Red' poinsettia plants as influenced by Mg concentration in solutions containing 210 ppm N and 235 ppm K.

Mg (ppm)	Dry weight[z] (g)	Height[z] (cm)
0	17.3a[y]	50.7a
1	19.1ab	54.5a
2	21.9abc	49.2a
5	24.6abc	55.5ab
12	28.6c	50.8a
24	26.9bc	62.5b

[z]Avg of 6 measurements.

[y]Mean separation, within a column, by Duncan's multiple range test, 5% level.

Plant height was about the same with all levels of Mg, though plants grown at the highest Mg level, 24 ppm. were significantly taller than all others except those grown at 5 ppm.

Analyses of leaves from each of the 3 positions revealed that the Mg concentration at each position increased with increasing solution Mg (Table 2). At all Mg levels, Mg was in the greatest concentration in the basal leaves. At 0, 1, and 2 ppm, where Mg was low enough to produce visible deficiency symptoms, the upper leaves contained more Mg than the lower leaves. But at 5, 12, and 24 ppm where no symptoms appeared, the Mg concentration of the lower leaves was equal to or greater than that of the upper leaves.

Mg deficiency symptoms appeared on the lower leaves in the 0, 1 and 2 ppm Mg treatments in the basal leaves at 0 and 1 ppm, but occurred in the upper leaves only at 0 ppm. It appears, under these experimental conditions, that enough Mg was available to prevent the occurrence of symptoms when the upper, lower and basal leaves contained at least 0.09, 0.23 and 0.22% Mg, respectively (Table 2).

The amount of K present in the solution had a very important effect on the expression of Mg deficiency symptoms at low Mg concentrations (Fig. 2). With 235 ppm K, where either 210 or 420 ppm N was supplied, no Mg deficiency symptoms appeared with 5 ppm Mg in the solution. But with 420 ppm K, 420 ppm N and 5 ppm Mg, symptoms appeared on the lower leaves, indicating a possible decrease in Mg absorption caused by the higher level of K.

The upper, lower and basal leaves

Table 2. Mg concentration of leaves of 'Eckespoint C-1 Red' poinsettia plants grown in solutions containing 210 ppm N and 235 ppm K.

	Dry weight (%)		
Mg (ppm)	Upper leaves	Lower leaves	Basal leaves
0	0.06	0.05	0.14
1	0.09	0.06	0.12
2	0.19	0.11	0.22
5	0.23	0.23	0.30
12	0.34	0.35	0.41
24	0.39	0.51	0.58

[1]Received for publication May 17, 1980. The cost of publishing this paper defrayed in part by the payment of page charges. Under postal regulations, this paper must therefore be hereby marked *advertisement* solely to indicate this fact.

[2]Graduate Research Assistant and Professor, respectively. Appreciation is expressed to the Fred C. Gloeckner Foundation, Inc. of New York, NY for financial support of this research. We thank David Reniff and Robert Whipple for technical assistance.

Fig. 2. Development of Mg deficiency symptoms on the lower leaves at 5 ppm Mg as influenced by K supply. Solution concentration (left to right): 210 ppm N and 235 ppm K, 420 ppm N and 235 ppm K, and 420 ppm N and 420 ppm K (height in cm).

from plants grown at 235 ppm K and 5 ppm Mg, regardless of N supply, contained enough Mg to prevent the appearance of symptoms (Table 3). When 420 ppm K was supplied, the Mg concentration at each leaf position was reduced, with the lower leaves containing about half as much Mg as previously found in leaves not having symptoms. Other studies (7, 9) have shown that high K levels can reduce the Mg content of poinsettia leaves. The appearance of K-induced Mg deficiency symptoms has been reported in orchard and greenhouse studies with apple (2), but no reports of the phenomenon are available for poinsettia.

In this sutdy the basal leaves displayed Mg deficiency symptoms when the leaves contained less than 0.22% Mg. Often the basal leaves of commercially-produced plants exhibit a chlorosis when the Mg concentration is as high as 1.00% and when the medium contains dolomitic limestone at rates presumably great enough to provide adequate quantities of Mg. These observations, in light of the results of this study, suggest that the chlorosis may not have been caused by a deficiency of Mg. Deficiencies of Mn (6) and Mo (4), and an excess of NH_4–N (1) can cause interveinal chlorosis of poinsettia. However, in our study adequate amounts of Mn and Mo were supplied in the solution. $Ca(NO_3)_2 \cdot 4H_2O$) was the only source of N in the 210 ppm N treatment, and provided one-half of the N in the 420 ppm N treatment, with the remaining N from NH_4NO_3. An NH_4–induced chlorosis may be ruled out at the higher N level as no chlorosis appeared with Mg levels higher than 5 ppm, and at this level, the chlorosis of the lower leaves appeared only on plants receiving very high levels of K.

Our results indicate that good growth and the absence of Mg deficiency symptoms can be expected at a quite low (5 ppm) solution concentration of Mg where plants have a large volume of solution, renewed frequently, from which to absorb nutrients. However, high levels of K must be avoided at such a low concentration of Mg in order to prevent large decreases in leaf Mg concentration and the appearance of Mg deficiency symptoms.

The occurrence of Mg deficiency symptoms with the higher K level (420 ppm) as contrasted to no symptoms with the lower K level (210 ppm) illustrates an antagonism in cation absorption and emphasizes the importance of considering the K–Mg relationship when interpreting the results of soil and foliar nutrient analyses.

Table 3. Mg deficiency in 'Eckespoint C-1 Red' poinsettia plants as influenced by Mg and K.

Solution concn (ppm)				Mg concn (% of dry wt)		
N	K	Mg	Deficiency symptoms (lower leaves)	Upper leaves	Lower leaves	Basal leaves
210	235	5	no	0.23	0.23	0.30
420	235	5	no	0.19	0.22	0.26
420	420	5	yes	0.16	0.12	0.21

Literature Cited

1. Boodley, J.W. 1970. Nitrogen fertilizers and their influence on the growth of poinsettias. *Flor. Rev.* 147(3800):26-27, 69-73.
2. Boynton, D. and A.B. Burrell. 1944. Potassium induced magnesium deficiency in the McIntosh apple tree. *Soil Sci.* 58: 441-454.
3. Hoagland, D.R. and D.I. Arnon. 1950. The water-culture method of growing plants without soil. *Calif. Agr. Expt. Sta. Cir.* 347 (Rev. ed.).
4. Jungk, A., B. Malaheb, and J. Wehrmann. 1970. Molybdenum deficiency on poinsettias, a cause of leaf injury. *Gartenwelt* 70:31-33, 35.
5. Laurie, A. and A. Wagner. 1937. Nutritional deficiencies in greenhouse flowering plants. *Proc. Amer. Soc. Hort. Sci.* 35: 759-761.
6. Lenanton, J.H. 1969. Interveinal chlorosis of poinsettia. MS Thesis, Univ. Calif., Davis.
7. Pflantz, V. and M.N. Rogers. 1973. Magnesium deficiency of poinsettias. *HortScience* 8:254. (Abstr.)
8. Poole, H.A. and J.G. Seeley. 1978. Nitrogen, potassium and magnesium nutrition of three orchid genera. *J. Amer. Soc. Hort. Sci.* 103:485-488.
9. Shanks, J.B. and C.B. Link. 1957. The mineral nutrition of poinsettias for greenhouse forcing. *Proc. Amer. Soc. Hort. Sci.* 69:513-522.
10. Struckmeyer, B.E. 1960. The effect of inadequate supplies of some nutrient elements on foliar symptoms and leaf anatomy of poinsettia (*Euphorbia pulcherimma* Willd.). *Proc. Amer. Soc. Hort. Sci.* 75:739-747.
11. Widmer, R.E. 1953. Nutrient studies with poinsettia. *Proc. Amer. Soc. Hort. Sci.* 61:508-514.