CORIANDER—A SPICE SENSITIVE TO DEFICIENCIES OF N, P, K, Ca AND Mg

Visible symptoms, characteristic of the deficiency of an element aided by chemical analysis of plant tissues form a suitable method for identifying mineral deficiencies under field conditions (Bould, Hewitt & Needham, 1985; Wallace, 1951; Bergmann & Neubert, 1976; Robinson, 1974; Agarwala & Sharma, 1979). Since mineral nutrient deficiencies are an important constraint in crop production (Agarwala & Sharma, 1981), the plant nutrition group at the University of Lucknow has, over three decades, been engaged in mineral nutrient element deficiency survey trials for producing information useful in diagnosing mineral nutrient disorders on the basis of visible symptoms and plant analysis (Agarwala & Sharma, 1979). One of these trials revealed that coriander (*Coriandrum sativum* L.) is sensitive to the deficiencies of N, P, K, Ca and Mg which are described here.

Coriander was grown in sand culture using the Long Ashton technique (Hewitt, 1952) adapted by the authors for Indian conditions (Agarwala & Sharma, 1976) at normal and low (deficient) levels of each of the macro-nutrients (Table 1). Along with the macronutients, supplied at the levels indicated in Table 1, the micronutrients were supplied at normal levels—5.6 ppm Fe, 0.55 ppm Mn, 0.064 ppm Cu, 0.065 ppm Zn, 0.19 ppm Mo, 0.37 ppm B, 0.06 ppm Co and 0.06 ppm Ni.

Table 1—Normal and deficient levels of the macronutrients used for growing Coriander in sand culture

Treatment	Level of nutrient supply meq/l					
	N	P	K	Ca	Mg	S
Normal	15.0	4.0	3.0	12.0	3.0	3.0
Deficient	0.75	0.2	0.15	0.6	0.15	0.15

Plants were harvested at 112 days and separated into different plant parts which were thoroughly washed with distilled water, blotted and dried for 48 hr in a forced drought oven at 70°C to determine the dry matter. The oven dried leaf material was digested in nitric and perchloric acids (Piper, 1942) and estimated for tissue concentration of the macro-nutrients according to the methods described by Nicholas (Wallace, 1951).

Deficiencies of the different macronutrients reduced the concentration of the deficient nutrient (Table 3), induced visible symptoms of the deficiency (Table 2) and decreased the dry matter of plants (Table 4) to varying extents.

Table 2—Visible effects of macronutrient deficiencies in Coriander

Nutrient	Deficiency effects
Nitrogen	Growth markedly stunted; plants thin, upright, and spindly with very few laterals; leaf area restricted, foliage became pale green, and later deep purple-red. Fruits also appeared tinted. Symptoms initiated from the old leaves and spread to the next upper leaves.
Phosphorus	Growth severely depressed; main shoot thin and upright; laterals poorly developed; foliage turned dull and green and developed deep purple tints. Symptoms spread from old to young leaves. Stem and leaf petiole also developed bright purple tint. As pigmentation became severe, the pigmented lamina became scorched and papery. Plants showed premature and severe defoliation. Flowering was markedly restricted; fruits few, lacked lustre and exhibited reddish purple tints; ripening of fruits considerably delayed.
Potassium	Growth of tops and roots severely restricted; internodes short; foliage sparse and lamina restricted; symptoms initiated from old leaves, margins of the lobes become chlorotic; chlorosis later spread to the entire lamina. Chlorotic areas turned necrotic, dark brown and papery and curled upward (Fig. 3). Flowering and fruiting restricted. Ripening of fruits was delayed.
Calcium	Growth severely stunted; stem and branches thin and foliage restricted; symptoms began on the young leaves; the margins of the lobes became pale, scorched and ragged in appearance and curled upward. Severely affected plants showed death of the growing point and *die-back*' of the main shoot (Fig. 4). This was followed by the development of several poorly developed laterals. Foliage was sparse. Middle and old leaves developed brown pigmentation along the margins of the lobes; pigmentation was followed by scorching and drying; flowering was delayed and severely restricted; inflorescence on the laterals collapsed. Number and development of fruits was restricted. Fruits were shed prematurely. Root system poorly developed, rootlets gelatinous.
Magnesium	Old leaves became pale green and developed yellow areas which eventually turned brown and papery. Under severe deficiency, lobes showed withering of margins.
Sulphur	Margins and anterior part of the lobes of old leaves appeared reddish purple; colouration progressively spread towards mid-vein. Severely pigmented lamina turned brown and scorched. The scorched margins tended to curl inward or outward.

Visible symptoms in Coriander plants due to the deficiency of—1, nitrogen; 2, phosphorus; 3, potassium; and calcium.

Table 3—Tissue concentration of N, P, K, Ca, Mg and S in Coriander plants grown at normal and deficient supply of each

Treatment	N	P	K	Ca	Mg	S
	per cent dry matter					
Normal	2.33	0.66	1.20	2.50	0.50	0.70
Deficient	0.88	0.18	0.10	0.44	0.08	0.50

Table 4—Dry matter of Coriander plants grown at normal and deficient supply of N, P, K, Ca, Mg and S in sand culture

Normal	-N	-P	-K	-Ca	-Mg	-S
g dry matter per plant						
25.3	3.5	2.6	6.7	10.7	16.1	11.9

Induction of characteristic visible symptoms of deficiency of each of nitrogen, phosphorus, potassium, calcium and magnesium at 1/20 the normal supply of these nutrients along with marked decrease in the concentration in leaves of the deficient element and the dry matter suggest that coriander, the most commonly grown spice in India, can serve as an *indicator plant* for rapid diagnosis of these deficiencies.

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