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NUTRITIONAL STUDIES OF MANGO SEEDLINGS GROWN IN SAND CULTURE

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ABSTRACT

Sand culture studies conducted in the main campus of Kerala Agricultural University, Vellanikkara, for inducing the symptoms of deficiency of various nutrient elements in mango indicated that deletion of various nutrient elements from complete Hoagland's nutrient solution resulted in differential growth behaviour of seedlings. The visual symptoms of deficiency was concurred with marked reduction in foliar level of concerned elements. The visual symptoms of deficiency depicted in plates and illustrated in this paper may provide guidance to understand nutrient deficiencies under field conditions.

KEY WORDS : Deficiency, Deformation, Hoaglands, Bronzing

Absence or scarcity of mineral elements in soil causes deficiencies in tree which may affect various vital processes in the plant systems. Deficiencies are often manifested as leaf discoloration, growth retardation and leaf and stem deformation. Abnormality in root production can also be noticed in some species. In recent times, there has been an awareness of the need for proper nutrition of mango owing to wide spread nutritional disorders resulting in low production and decline of mango trees. Severe nutritional deficiencies resulting ultimately in the death of plant, particularly in the nursery, is a major problem in the commercial cultivation of this fruit crop in most of the tropical and subtropical regions of the world. Early recognition of the symptoms is of practical importance to prevent further losses by application of appropriate amounts of mineral nutrients. Mineral nutrients however, are not the same for the crops and hence, deficiency symptoms may also vary in different crops. The sand culture studies were conducted with an objective to induce the symptoms of various nutrient elements in mango seedlings to learn the nutrient deficiencies of this crop under field conditions also.

MATERIALS AND METHODS

Detailed sand culture studies were conducted during 1990-91 in the main campus of the Kerala Agricultural University, Vellanikkara with a view to induce the symptoms of deficiency of various nutrient element in seedlings of mango. Pure, quartz, acid washed sand was used for the study. Polythene containers of elongated bucket type (30 x 10 cm size) were used for raising seedlings for sand culture studies (Plate 1). Washed sand was carefully filled in the containers leaving a depth of 3 cm from top. Uniform seedlings of mango were carefully transplanted in the containers with seeds intact ten days after germination. Due precautions were taken to rinse the roots in very dilute hydrochloric acid and quickly bathed in distilled water before transplanting in order to avoid contamination. For the present study Hoagland's No.2 solution was used (Table 1) (Hoagland, 1948).

Each treatment was replicated four times in completely randomised design. The treatment includes complete nutrient solution (control), solutions lacking N, P, K, Ca, Mg, S and Zn. The treatment solution from Hoagland's No.2 required for each treatment was prepared in bulk by eliminating the desired nutrient. Two ml of 0.01% ferric iron solution was also supplied daily in each pot. About 50ml of treatment solution was added to each pot twice a day for five days. Distilled water was used for the remaining two days for watering. The leachate was carefully drained out. The pots were placed in a closed area protected from rain and wind (Plate 1). Biometric observations were recorded for each replication and the plants were sampled separately after a period of six months. They were dried and processed for chemical analysis (Jackson, 1958).

Plate 1. Seedlings arranged for sand culture studies

RESULTS AND DISCUSSION

After a lapse of six months, differential behaviour in respect of growth of seedlings was observed in some treatments. The seedlings grown in complete Hoagland's nutrient solution were vigorous in vegetative growth with dark green foliage through out the period of investigation (Table 2) and were tall and healthy. The concentrations of all nutrients were found to be normal in these plants supplied with complete nutrient solution. (Table 2). Representative leaf samples showing the symptoms of deficiencies of various nutrient elements are depicted in Plate 2.

Lack of nitrogen was visible as leaf discolouration. The nitrogen deficiency was manifested as pale green colour of the leaves which later changed to uniform yellow colour. Symptoms spread from lower leaves to upwards. Development of leaf symptoms coincided with growth stagnation. The mean height of the plants were only 16.55 cm compared to 26.48 cm in control. The chlorotic symptoms for nitrogen deficiency are natural since 70 per cent of leaf nitrogen is present in chloroplast. The reduction in vegetative growth is due to the fact that N is involved in all the process associated with protoplasm, enzymatic reactions and photosynthesis (Chapman, 1975). The visual symptoms of nitrogen deficiency was found to correlate with leaf content of this element. The N content in these seedlings was found to be only 1.19 per cent compared to control where it was 3.20 per cent. A slight increase in magnesium content was observed in these seedlings compared to control.

Phosphorus deficiency resulted a slow change in leaf colour from normal green to dark green.

1. Control
2. N deficiency
3. P deficiency
4. K deficiency
5. Ca deficiency
6. Mg deficiency
7. S deficiency
8. Zn deficiency

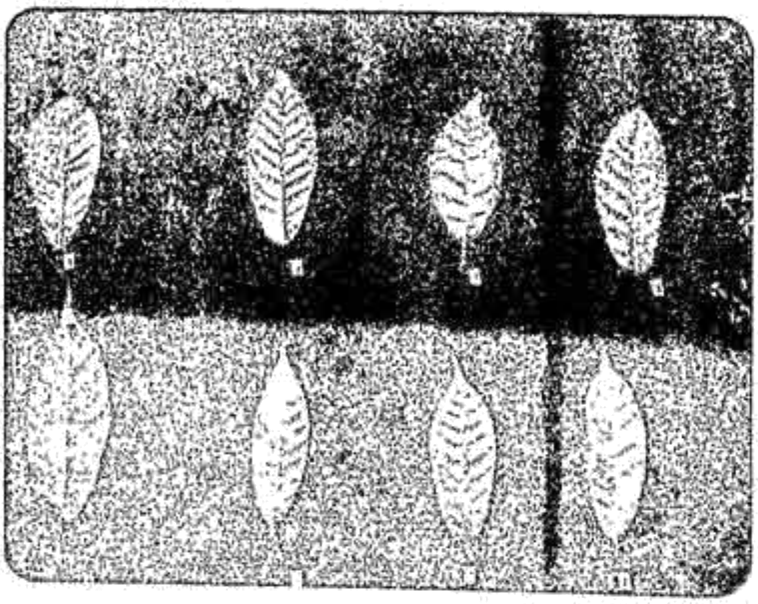

Plate 2 Leaves showing deficiency sysmptoms of various nutrient elements

Table 1. Composition of Hoagland's No.2 solution

Stock solution	Working solution (ml/l)
1M $NH_4H_2PO_4$	1
1M KNO_3	6
1M $Ca(NO_3)_2$	4
1M $MgSO_4 7H_2O$	2
Boric acid (2.86 g/l)	1
$MnCl_2.4H_2O$ (1.86 g/l)	1
$ZnSO_4 7H_2O$ (0.28 g/l)	1
$CuSO_4 5H_2O$ (0.08 g/l)	1
Molybdic acid (0.02 g/l)	1

There was a gradual transition from green to bronze colour. The purple bronze colouration can be attributed to the formation of anthocyanin pigments due to P deficiency (Gauch, 1972, Gopikumar and Aravindakshan, 1988). Lower leaves gradually withered. Deficiency also resulted a significant reduction in height, girth and leaf production. Deletion of P also resulted a drastic reduction in foliar P content (0.09%). Zinc content was also relatively low (50 ppm) in these seedlings compared to control (63 ppm).

No visual symptoms were observed for potassium and calcium deficiency. However, their deficiencies resulted in reduced growth. Absence of K adversely affected the growth parameters of seedlings particularly the girth. Girth of seedlings in K deficient plants was 1.35 cm while in control it was 1.89 cm. Significant reduction in foliar content of this elements was also noticed. Interestingly in these seedlings, the Zn content was found to be relatively high (79 ppm) compared to healthy seedlings. Results indicated that in the case of calcium deficiency also, there was an appreciable reduction in foliar content of this element. A slight increase in Mg content (1.89%) was noticed in these seedlings. This may be because of the antagonistic effect of Ca and Mg as reported by Emert (1961).

Deficiency of magnesium was visible 3 to 4 months after planting. There was severe interveinal chlorosis and yellowing of young leaves (Plate 2). Leaf development was extremely poor. Since Mg constitutes 2.7 per cent of weight of chlorophyll, chlorotic symptoms are generally observed in Mg deficient plants. Gopikumar and Aravindakshan (1988) also observed similar symptoms of Mg deficiency in seedlings of cashew grown in sand culture. The leaf production was considerably reduced by Mg deficiency. The concentration of Mg in the leaves was found to be 0.12 per cent compared to healthy seedlings. However, the antagonistic effect of Ca and Mg was not very clear from this treatment.

The early symptoms of sulphur deficiency were similar to that of N deficiency except that here, the younger leaves were more chlorotic than older ones. This is because of the fact that unlike N, sulphur is immobile with in the plant. Gauch (1972) also observed yellowing of younger leaves due to S deficiency. Some leaves showed a reddish colouration of the petioles. The growth was also stunted considerably. Here the height and girth of

Table 2. Growth parameter and nutrient content of mango seedlings grown in sand culture

Treatment	Height (cm)	Girth (cm)	Leaf (No.)	N (----	P	K ---- per cent	Ca	Mg	S ----)	Zn (ppm)
Complete Hoaglands nutrient solution (control)	26.48	1.89	16.05	3.20	0.30	3.18	2.49	1.71	0.20	63
N deleted	16.55	1.54	13.55	1.19	0.32	3.19	2.50	1.81	0.21	54
P deleted	19.68	1.56	11.6	3.11	0.09	3.18	2.11	1.09	0.21	50
K deleted	20.48	1.35	14.43	2.11	0.29	0.91	2.31	1.11	0.28	79
Ca deleted	19.78	1.78	15.48	3.10	0.31	3.18	0.61	1.89	0.29	81
Mg deleted	20.45	1.86	13.88	2.18	0.31	3.12	2.16	0.12	0.26	79
S deleted	18.83	1.59	12.93	3.10	0.29	2.91	2.30	1.17	0.09	69
Zn deleted	22.38	1.81	13.50	2.19	0.27	3.10	2.19	1.19	0.29	21
F test	*	*	*							
CD (5%)	1.31	0.09	0.78							

* Significant at 5 per cent level

seedlings was 18.83 cm and 1.59 cm respectively while in control it was 26.48 cm and 1.89 cm. Sulphur being a constituent of amino acids like methionine and cystein, its deficiency will definitely inhibit photosynthesis which in turn will affect the growth and development of plant. Due to deficiency there was a reduction in the content of S in plants (0.09%).

The initial symptoms of zinc deficiency was interveinal chlorosis of young leaves. Gradually chlorosis spread to young leaves also. Leaves produced were small in size. The internodal length was also shortend. Abscission of leaves was also noticed. Youngest leaves remained small and clustered resulting a rosetted condition. Tusi (1948) stressed the importance of Zn for the synthesis of tryptophan, a precursor for IAA, the important hormone responsible for cell elongation. When Zn is deficient with in the plant, RNA concentration gets reduced by the activation of oxidative enzyme resulting in decreased protein synthesis which may also contribute to reduction in vegetative growth. The foliar content of Zn was found to be 21 ppm while in control it was 63 ppm.

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Effect of different levels of white backed planthopper, (WBPH) *Sogatella furcifera* populations on different rice cultivars

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ABSTRACT

A field experiment was conducted during the *kharif* 1986-87 to study the effect of different population levels of white backed planthopper (WBPH) *Sogatella furcifera* (Horvath) on five rice varieties *viz.*, ARC 10550 (resistant), Co 22, Co 13, Triveni (moderately resistant) and ACM 9 (locas check). The seedling screening bulk test indicated similar reaction to *S. furcifera* in the resistant and moderately resistant varieties. However, field screening showed that Triveni was more tolerant than other varieties, as evidenced from the low reduction in the mean plant height and plant weight. This clearly indicates the ability of Triveni to survive and produce more number of productive tillers even at higher population levels of WBPH. On the other hand, a minimum population of 25 WBPH/plant was sufficient to cause a significant reduction in the plant vigour, height and weight in all the varieties.

KEY WORDS : WBPH, Population Levels, Rice Varieties, Tolerance.

The white backed planthopper (WBPH), *Sogatella furcifera* (Horvath) has become one of the most serious pests of rice in the last decade in India (Vaidya and Kalode, 1981). Under favourable conditions, WBPH can multiply faster and cause hopper burn (Gunathilagaraj *et al.*, 1983). More emphasis is now placed on breeding or growing resistant varieties in the field to check the population growth of WBPH. However, these resistant varieties are also being subject to the attack by the different populations of WBPH on account of their narrow genetic make-up. Breeding a variety which is resistant to all the populations of WBPH is rather a very difficult and time