ROLE OF BORON IN COCONUT NUTRITION

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onsidered to be one of the essential micro-ents for plant growth though it does not required by animals. The essentiality of gher plants was first recognised by Agul-910, but it was widely accepted only after works of K. Warrington on beans were 1923.

rs in rocks and soils in the form of tour-ry insoluble fluorine-containing borosili-um and magnesium borates and as iron m complexes. In arid soils sodium and es may accumulate in the surface soils in plants. Irrigation waters containing more f boron are considered to be undesirable. on content of surface soils ranges from 5 Soils derived from marine sediments in good supplies of boron in the avail-Boron is also held in organic combinations t is readily released in forms available to content of boron in the surface soils is r than that in the subsoils. The water solu-considered to be the form immediately plants. The content of water soluble boron l soils of the humid regions ranges from ppm. Higher amounts of water soluble und in organic soils and soils in arid and ions.

lity of boron is increased under acid con-it is also readily leached from the soil. acid soils of the humid regions are likely nt in available boron. The availability of reased at high soil pH and by dry soil xcessive liming has been found both to ron deficiency and decrease boron toxicity ns of boron deficiency show up more y than in wet seasons.

iency is not common in cereals under field the boron requirement of cereals is low. 4 to 10 ppm boron is found to be an l for cereals while the boron content of es from 20 to 50 ppm. It is also reported cyledonous species have relatively lower ment compared to dicotyledonous species.

The biochemical role of boron is not yet well understood, and unlike other micronutrients, boron has not been shown to form a part of any enzyme system. Yet numerous roles have been assigned to this element. Boron is concerned in the water relations in cells and in the translocation of sugars within the plant, it enhances tissue respiration, it is concerned in the germination of pollen, it controls the action of calcium in the plant and tends to keep calcium in a soluble form, and it is concerned with nitrogen metabolism and the oxidation-reduction equilibria in cells.

Plate 1. A 4-year old palm affected by 'Crown Rot' disease

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It is generally observed that deficiency of boron affects the cells of the growing regions and most observers agree that the effects are on the differentiating cells leading to the death of the apical growing point preceded by abnormal deformed growth of young leaves. A large number of physiological diseases of economic importance like the 'heart rot' of sugar beet, mangolds and other root crops; 'cracked stem' of celery; 'top sickness' of tobacco; 'browning' of cauliflower; 'internal cork' of apples; 'yellows' of alfalfa; 'hard fruit' of citrus; 'crown rot' of coconut etc., are associated with a deficiency of boron. Boron deficient plants respond well to the application of boron in the soil, usually given in the form of borates which move freely in soils, and there is rapid recovery of the visual symptoms. Borax (sodium tetraborate) is the common fertilizer chemical used for correcting boron deficiencies under field conditions. Boron is generally regarded as an immobile element in plants and there is little translocation of this element within the plant. Foliar application of boron salts usually have little effect in correcting deficiencies particularly in perennial plants. In contrast, boron toxicity symptoms appear in the older leaves of many plants and is associated with an accumulation of boron in the affected leaves. The toxicity symptoms generally included chlorosis and marginal scorch.

The effect of boron on certain physiological and pathological problems in coconut was studied at different parts of the world. For example, the 'leaf scorch' symptoms of coconut in Sri Lanka was suspected to be due to boron deficiency, since the affected palms had a slightly lower boron content (9 ppm) than the normal range found in healthy palms (16 to 20 ppm). Application of borax, either in the soil or as foliar spray, was not effective against the 'leaf scorch' symptoms. In Jamaica, palms attacked by Lethal Yellowing disease were sprayed with borax, but there was no beneficial effect. Effect of boron on yield responses was studied in West Africa as well as in Sri Lanka using borax upto a level of 907 g. per tree per year, but no positive response on yield was recorded. Fremond (1965) reported that a form of bud rot of coconut palms in the New Hebride might be due to boron deficiency.

The 'crown rot' disease of coconut at the Regional Coconut Research Station campus, Kahikuchi and *from other parts* of Assam was reported to be due to boron deficiency and was cured by the application of borax (Chakrabarty *et al*, 1970). Symptoms of 'crown rot' disease had developed in 39 palms at varying degrees of intensity during 1973-75 out of 800 West Coast Tall seedlings (one year old) planted in Central Plantation Crops Research Institute, Regional Station campus, Kayangulam in 1970 and has been under a regular N, P, K, Ca & Mg fertilizer trial. The symptoms of the disease were the emergence of shorter leaves with deformed, crinkled and rudimentary leaflets associated with severe tip necrosis, giving a choked appearance of the frond. Laminal expansion of the leaflets of the distal ends of innermost leaves was inhibited in *the earlier stages* and the leaflets were corrugated by transverse constriction and they became thicker than normal, brittle and distorted in some cases. When the disease progressed necrotic black stick like leaf stalk devoid of any leaflet emerged leading ultimately to the death of the palm. The outer whorls of leaves remained normal throughout (Plate 1).

Analysis of leaf samples from the affected palms showed a lower status of boron (5.7 ppm) compared to healthy palms (9.2 ppm B). Out of the 39 affected palms, 23 palms deteriorated fastly while the other 16 palms showed slight deformation of leaflets. All the 39 affected palms were divided into three groups; and one group of palms was supplied with 250 g. each of borax through the soil, the second group with 500 g. of borax each, and the third group was kept as control without borax treatment during Aug./Sept., 1975. All the treated palms showed improvement of visual symptoms and the recovery was faster in palms treated with 500 g. of borax and the newly emerged leaves were normal in appearance (Plates 2 & 3). Among the untreated palms, seven palms in the advanced stage died while the others remained affected till August, 1976 when they were also treated with 250 g. of borax and brought into normal condition.

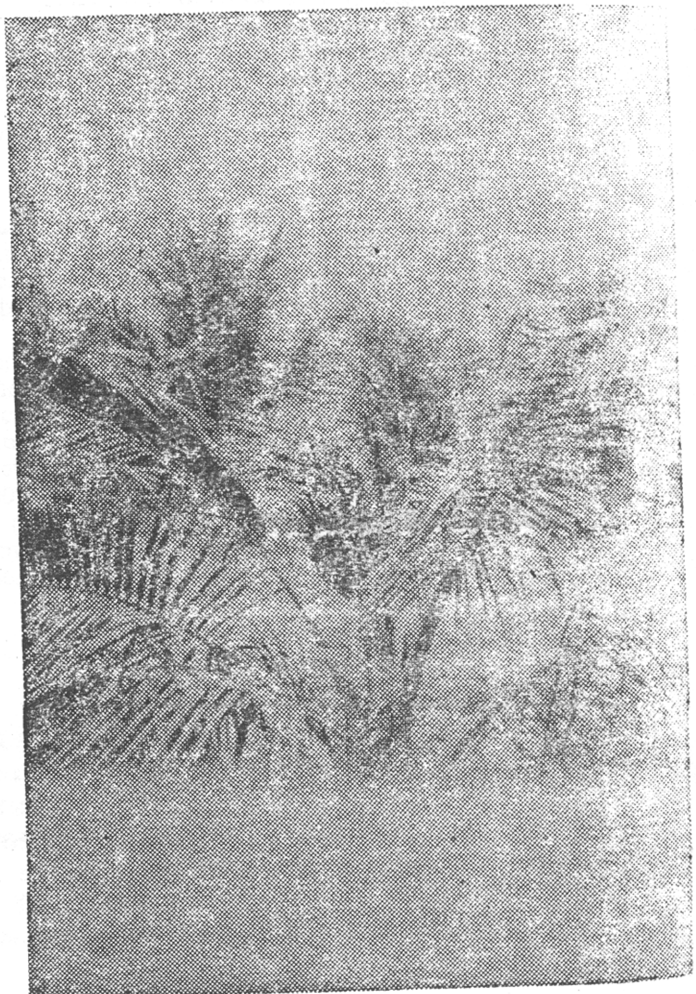

Plate 2. A palm in the advanced stage of 'Crown Rot' disease before treatment with Borax

Palm in Plate 2. 4 months after treatment with (500 g.). The newly emerged leaves look normal

seen from the above observation that, palms by the 'crown rot' symptoms responded well ation of borax and the malady may be due to boron deficiency. It was also noted that fresh incidence of 'crown rot' symptoms was not observed in the plantation since 1976 supplementing the observation made by Chakrabarty *et al* (1970) that 'crown rot' disease was usually prevalent in palms in the age group of 3 to 6 years.

It may be mentioned in this connection that normally the elements N, P and K are of major concern to the coconut growers because years of experimental work and practical experience have proved that the available supplies of these elements in soils are more likely to be insufficient for maximum growth and yield than the supplies of other essential elements. Deficiencies of one or more of secondary/micronutrient elements are coming to attention now than at earlier times. This may be due to the continued cultivation of the palm in the same land over longer periods, the increased use of high analysis fertilizers, the limited use of bulky organic manures and the intensive intercropping practices followed in coconut gardens without taking adequate care of the micronutrient problems of the soil. It may also be a fact that in certain instances the micronutrient deficiencies were left unrecognised in the past due to lack of knowledge on the symptoms of such deficiencies. But the application of micronutrient salts on a regular basis without regard to the crop or the soil is unwarranted and sometimes may prove injurious.

An all Kerala surveys and study of Kerala soils and coconut palm tissues made by Pillai *et al* (1975) had revealed that nearly 12 per cent of the soils were deficient in boron based on a threshold value of 0.1 ppm boron while in the leaf the levels were marginal in most cases based on a critical level of 10 ppm boron. This suggests the necessity for a vigilant watch on the occurrence of 'crown rot' symptoms on young palms in coconut plantations and timely application of borax to save the affected palms. The dose of borax may be varied from 100 to 250 g per palm depending upon the age of the palm, and if the application is made during dry months irrigation should be followed for quicker response.

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