Plantation Crops Research and Development in the New Millennium (2002): 320-324

BORON DEFICIENCY IN COCONUT (*COCOS NUCIFERA* L)

P.G.Kamalakshi amma, M.Shanavas, D.Prema

Central Plantation Crops Research Institute. Regional Station,
Kayangulam-690 533, Kerala

ABSTRACT

Boron is an essential micronutrient for plants. It helps in division and multiplication of meristematic tissues. Boron deficient palms exhibit different disorder symptoms. In coconut, the deficiency of boron causes various malformations, thereby decreasing the productivity substantially. In seedlings the deficiency symptoms are manifested by unopened and crinkled leaves, rachis with necrotic tips, bare and necrotic leaf stalk with short stubby leaves, production of hardy leaflets with asymmetrical arrangements, rachis with longitudinal /transverse cracking etc. In adult palms the deficiency resulted in the production of branched spikes, premature death of inflorescence, production of inflorescence with lesser female flowers, shedding of female flowers, cracking of nuts externally/internally with meat protruding towards the mesocarp and barren nuts with partial/ unevenly developed kernel having poor quality copra. The malformations may be exhibited either singly or by various combinations based on the intensity of the deficiency. Studies conducted at C.P.C.R.I (RS), Kayangulam showed that these symptoms of boron deficiency could be cured by application of 300g and 500g borax to the seedlings and adult palms respectively along with the recommended dose of fertilizers. This paper discusses the various symptoms of boron deficiency and its management.

Key words: *Boron, coconut, deficiency, disease.*

INTRODUCTION

Boron is an essential micronutrient for plants. In nature it is moderately rare and occurs principally as borates of calcium and sodium. It helps in division and multiplication of meristematic tissues. Boron deficient palms exhibit different disorder symptoms. In coconut, the deficiency of boron causes various malformations, thereby decreasing the productivity substantially. The first report about the deficiency disorder appeared in 1964 in India. In Kerala 12 percent of the palms were affected by boron deficiency (Pillai *et al.*, 1983), which emphasis the necessity of boron nutrition to coconut. The present study manifests the various symptoms associated with boron deficiency in coconut and its correction

MATERIALS AND METHODS

To study the role of boron in coconut nutrition, an experiment was conducted at C.P.C.R.I, Kayangulam, India with 5 treatments and 3 replications on 3-year-old seedlings and 20-year-old WCT palms showing typical boron deficiency symptoms. The various symptoms associated with these palms were recorded. The affected palms were supplied with 0,100,300,500 and 700 g borax per palm per year in 2 split doses along with the other scheduled dose of fertilizers. Irrigation was done during summer seasons. Leaf samples of the palms from the first, sixth, ninth and fourteenth leaf of palms were collected for monitoring Boron status. The samples were estimated for B as per Jackson, 1967. The growth parameters were recorded during the pre and post-treatment period. Improvements in the conditions of the affected palms were recorded by noting the emergence of healthy spindle.

RESULTS AND DISCUSSION

In seedlings, the deficiency symptoms were manifested by unopened and crinkled leaves, even the mid ribs of the leaflets were crinkled (Fig.1). The length of the rachis, number of leaflets per leaf and number of leaves per palm reduced

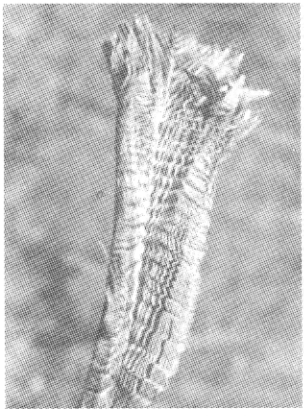

Fig1.Crinkled Leaf

Fig 2. Leaf with tubular structure

Fig 3. Double hooking

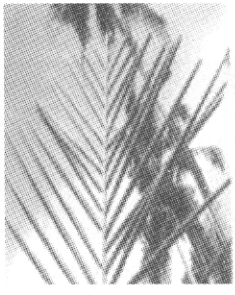

Fig 4. Leaflet with necrotic tip&

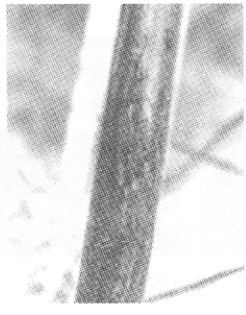

Fig 5.Cracked rachis hardened bracts

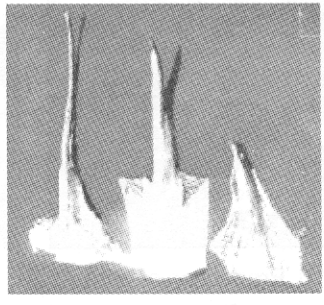

Fig 6.Rachis with wider space

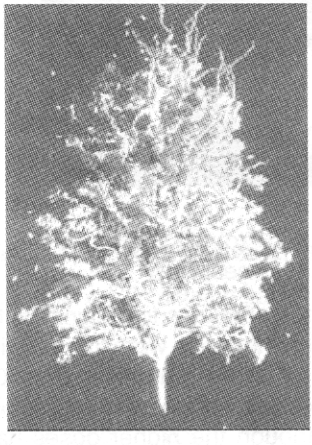

Fig 7.Branched spikes

Fig 8. Blackish & healthy inflorescence

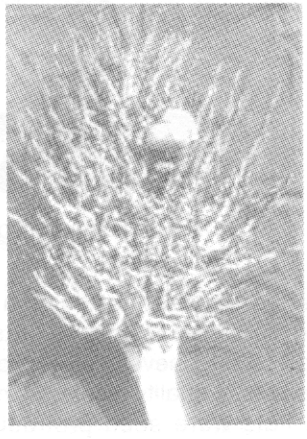

Fig 9. Abnormal Inflorescence with few female flowers

progressively with very short or long pinnae either on one side or on both sides with single or double hooking is a common phenomenon of boron deficiency (Fig. 3). Production of hardy leaves with the increase in the intensity of the disorder. In some cases the petiole of the new leaves becomes very thick and forms a tubular structure (Fig. 2). Developments of fronds with asymmetrical arrangements is also observed. The intermittent spacing between the leaflets are wider than the normal one (Fig.4). Rachis with longitudinal/transverse cracking were also noted in some of the deficient palms (Fig. 5). In such cases, oozing of a brown liquid through the stalk is usually found. Rachis with necrotic tips with hardened bracts (Fig. 6), bare and necrotic leaf stalks with short stubby leaves are some other characteristic symptoms associated with typical boron deficiency found in coconut seedlings. In adult palms the deficiency adversely affected the productivity of the palms. Production of inflorescence with branched spikes without any female flowers (Fig.7), blackish / aborted inflorescences (Fig.8), inflorescence with a few or without any female flowers are also common. (Fig. 9). The deficiency is also manifested by low

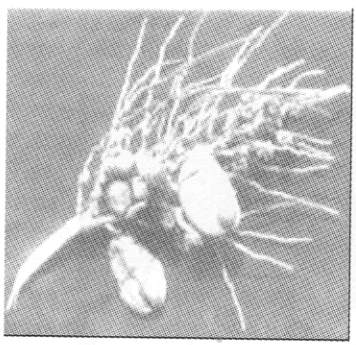

Fig. 10. Production of barren nuts

Fig.11. External crack

Fig. 12. Shell crack

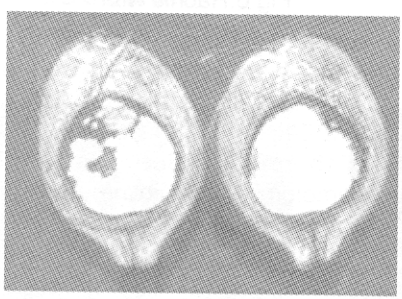

Fig. 13. Uneven kernel growth

Fig. 14. Protrusion towards mesocarp

bearing capacity production of barren nuts (Fig.10), cracks in the nuts of husk/shell (Fig.11&12), uneven kernel growth (Fig.13) and also inferior quality meat with foul smell. Meat of the nuts were seen protruding towards the mesocarp in rare cases (Fig.14

Table 1 depicts the yield and yield attributes of the palms. It was found that borax application has improved all the attributes to a significantly higher level. Though the palms were treated with different doses of borax the treatment giving 500 g borax per palm per year had shown the optimum increase. Even though the higher doses had increased the attributes to a higher level, they were not economically higher than that of the above treatment. This corroborates the finding of

Cecil and Pillai (1978) and Kamalakshi amma and Anithakumari (1999). They reported that 250-500 g borax per palm per year resulted in the recovery of boron deficiency symptoms and increase in yield of palms. The formation of new bunches had increased from 6.4 to 8.8 thereby recording a 27.27% increase in the above treatment . The number of female flowers produced per bunch had registered a 45% increase (from 21.4 to 31.0). Similarly the nut yield and weight of husked nuts have shown an improvement from 15 to 24.2 and 559.76g to 1009g respectively, i.e. a 60% and 80.25 % increase respectively. This data clearly indicate that Borax application has improved the productivity of the palms. This agrees with the findings of Davis and Pillai(1966) and Dwivedi *et al.*, 1980.

Fig 15 & 15 a. illustrates the growth parameters of the seedlings under the different treatment. The figure showed that girth had increased from 110 to 120cm whereas the height had registered an increase from 603 to 630 cm.The total number of leaves, length of the oldest leaf and number of leaflets on the oldest leaf had also significantly increased from 10 to 15, 315 to 420 and 158 to 180 respectively. Thus an overall improvement of the seedlings was noted by the boron supplementation.

Fig.16 depicts the boron status of different leaves of coconut. The data clearly indicated a significant increase in the boron content due to the application of borax. The palms treated with borax had recovered from the deficiency symptoms

Boron deficiency causes reduction in coconut productivity. The deficiency could be cured by application of 300 g and 500g borax per palm per year in two split doses for seedlings and adult palms respectively. The deficiency symptoms associated with B, described in symptamatology, were completely recovered by Borax application.

ACKNOWLEDGEMENT

The authors are thankful to Dr.K.U.K.Nampoothiri ,Director, CPCRI, Kasaragod Dr.P.K.Koshy,

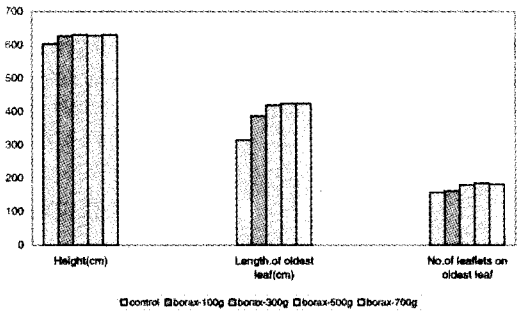

Fig. 15. Effect of borax on growth parameters

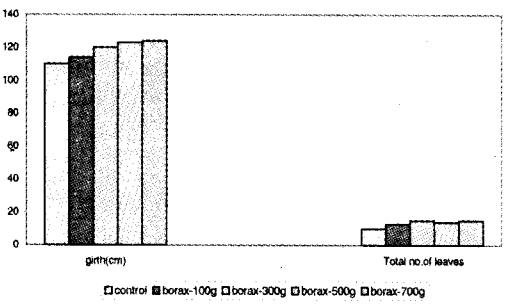

Fig.15a. Effect of borax on growth parameters

Table 1. Yield attributes of adult palms after application of Borax

Treatment	Bunch/palm	Female flower /bunch	Nuts /bunch	Nut set (%)	Yield/palm/ year	Wt.husked nuts (g)
Control	6.4	21.4	3.0	15.05	15.0	559.76
Borax-100g	6.5	21.8	4.2	16.62	16.1	568.65
Borax-300g	6.7	22.2	4.9	16.98	17.2	581.68
Borax-500g	8.8	31.0	5.5	17.97	24.2	1009.00
Borax-700g	8.9	31.0	6.2	19.68	24.5	1025.21
CD	0.37	1.13	NS	NS	2.32	31.53

Head, C.P.C.R.I, Kayangulam for providing facilities and encouragement in work. They also express their thanks to Shri. E.R Asokan for the assistance given in photography.

REFERENCES

Cecil, S.R. and Pillai, N.G. 1978. *Indian Cocon.J.*, **9**:13.

Davis,T.A. and Pillai, N.G. 1966. *Oleagineux,* 21(**11**): 669-674

Dwivedi, R.S., Sumathykuttyamma, B., Mathew, C. and Ray, P.K. 1980. *Plant Dis. Reptr.*, 64(**9**): 843-844

Jackson, M.L. 1967. In: *Soil chemical analysis.* Prentice- Hall Ltd. New Delhi

Kamalakshi amma, P.G. and Anithakumari, P. 1999. Boron deficiency in coconut. Symptoms and its management. Pamphlet. CPCRI(RS), Kayangulam

Pillai, N.G., Kamaladevi, C.B., Wahid, P.A. and Nambiar, C.K.B. 1983. In :Coconut research and development, Proceedings of the international symposium, 1st,CPCRI, Kasaragod, Dec 27-31,1976, edited by N.M. Nayar.New Delhi, Wiley Eastern. 144-151