Ceylon Cocon. Q. (1977) **28**, 89—93
Printed in Sri Lanka

Micronutrients in the Nutrition of Coconut III Effect of a Supplementary Source of Micronutrients on Germination and Growth of Coconut Seedlings

M. A. T. De Silva* and P. P. Atputharajah
Coconut Research Institute, Lunuwila, Sri Lanka

(*Received 14, September 1979: Accepted 6 December, 1979*)

ABSTRACT

De Silva, M.A.T. and Atputharajah, P.P., (1977). Micronutrients in the nutrition of coconut III effect of a supplementary source of micronutrients on germination and growth of coconut seedlings. *Ceylon Cocon. Q.*, **28**, 89—93.

Solutions of Fe, Mn, Cu, Zn, B and Mo were injected into the husks of seasoned coconut seednuts of uniform size and maturity. The quantity of each nutrient injected was equivalent to about 10 times the total quantity normally present in the kernel and coconut water. A "plus-all" treatment and a "minus all" treatment served as controls.

Zinc and Cu treatments not only appeared to shorten the period of sprouting, but also increased the percentage of successful germinations. Boron on the other hand progressively reduced the rate of sprouting.

These treatments also had a significant effect on growth of seedlings. With respect to height of seedlings six months after planting, the treatment effects were in the order of Cu > Mo > Mn > Fe > Zn > B > "plus all" $\gtrless$ "minus all". The adverse effects of B on both germination and subsequent growth of seedlings may possibly be due to toxic effects.

This study has shown that a supplementary source of micronutrients to seednuts may not only help to hasten the process of sprouting but also promote better initial growth of seedlings.

INTRODUCTION

Several factors are known to influence the rate of germination and subsequent growth of coconut seedlings. The work of Pandithasekera (1914), Pieris (1937), Liyanage and Abeywardena (1957), Foale (1968) and De Silva and George (1971) have shown that morphological and physical factors such as size, weight, volume and maturity of seednuts play a vital role in influencing the rate of germination and initial growth of seedlings. Such information is of particular significance since the characters of early germination and vigorous initial growth have been found to be related to the characters of early flowering and high productivity (Liyanage, 1955).

Although much work has been done to study the relationship between physical factors and germination, very little information is available on the effect of nutritional factors on germination.

Nathanael (1963) examined the movement of macronutrients from the fruit components to the shoot and root during germination and early growth, and concluded that except for Ca and Mg, the reserves of other macronutrients were adequate to meet the early requirements.

* Present address: National Science Council, Colombo 7, Sri Lanka.

Thomas (1974) found that the period of germination could be reduced when seednuts were soaked for 48 hours in 0.1 and 0.2 molar solutions of KNO_3 and Na_2CO_3. However, soaking seednuts in water for 48 hours alone was also found to produce the same effect.

In relation to micronutrients, Sumathykutty Amma (1964) found that injection of solutions of Mg, Fe, Mn, Cu, Zn, Mo and B independently into the fibrous husk of coconut seednuts helped to shorten the period of germination in each case. In this study applications were done at two concentration levels, and it had been observed that the higher dosage in every case produced better results. However, the concentration levels used in these experiments appear to be extremely high, and could under normal conditions prove toxic to plants. This paper unfortunately does not discuss the performance of seedlings immediately after sprouting.

The object of the present investigation was to determine whether a supplementary source of micronutrients would be effective in (1) shortening the period of germination in coconut seednuts, and (2) promoting vigorous initial growth of seedlings.

EXPERIMENTAL

Two hundred and forty coconut seednuts measuring approximately 17.5 cm in diameter of short axis were collected from a uniform stand at Bandirippuwa Estate, Lunuwila. The drupes were from the second bunch rather than from the most mature bunch, since these have been shown to be physiologically uniform with respect to sprouting (De Silva and George, 1971). The seednuts were separated into six classes according to weights, and from each such weight class seednuts were drawn randomly into eight treatment groups. The resulting groups, consisting of 30 seednuts each were thus uniform with respect to the mean and range of seednut weight.

Ten weeks after the pick each group of seednuts was treated with one of the following nutrient solutions.

Treatment A :— A solution of ferrous ammonium sulphate containing 1.0 g of Fe per litre.
Treatment B :— A solution of manganese sulphate containing 0.45 g of Mn per litre.
Treatment C :— A solution of copper sulphate containing 0.25 g of Cu per litre.
Treatment D :— A solution of zinc sulphate containing 0.45 g of Zn per litre.
Treatment E :— A solution of sodium tetraborate containing 0.005 g of B per litre.
Treatment F :— A solution of ammonium molybdate containing 0.001 g of Mo per litre.
Treatment G :— A solution containing all the above nutrients at the same concentration (plus all).
Treatment H :— De-ionised water only (minus all).

Each treatment consisted of injecting into the husk with a large hypodermic syringe 100 ml of solution per seednut. This volume of solution contained approximately ten times the total amount of nutrient normally present in the kernel plus liquid endosperm. The solutions were injected at the proximal end in order to moisten thoroughly the area near the soft "eye" of the shell. The seednuts were later laid out in nursery beds and watered regularly according to requirements.

Dates of sprouting were recorded for each seednut, and at the end of a six-month period in nursery beds, the experiment was terminated after growth measurements were taken.

RESULTS AND DISCUSSION

The data presented in Fig. 1 depicts the effects of treatments on the rate of sprouting. It is evident that Zn and Cu treatments had been effective in reducing the period of sprouting. These two treatments had also been responsible for higher percentage of sprouting. Although B treatments apparently helped a few seednuts to sprout rapidly the rate of sprouting steadily declined with time. The "plus all" treatment appeared to occupy an intermediate position possibly reflecting the net result of the good effects of Zn and Cu and the adverse effects of B.

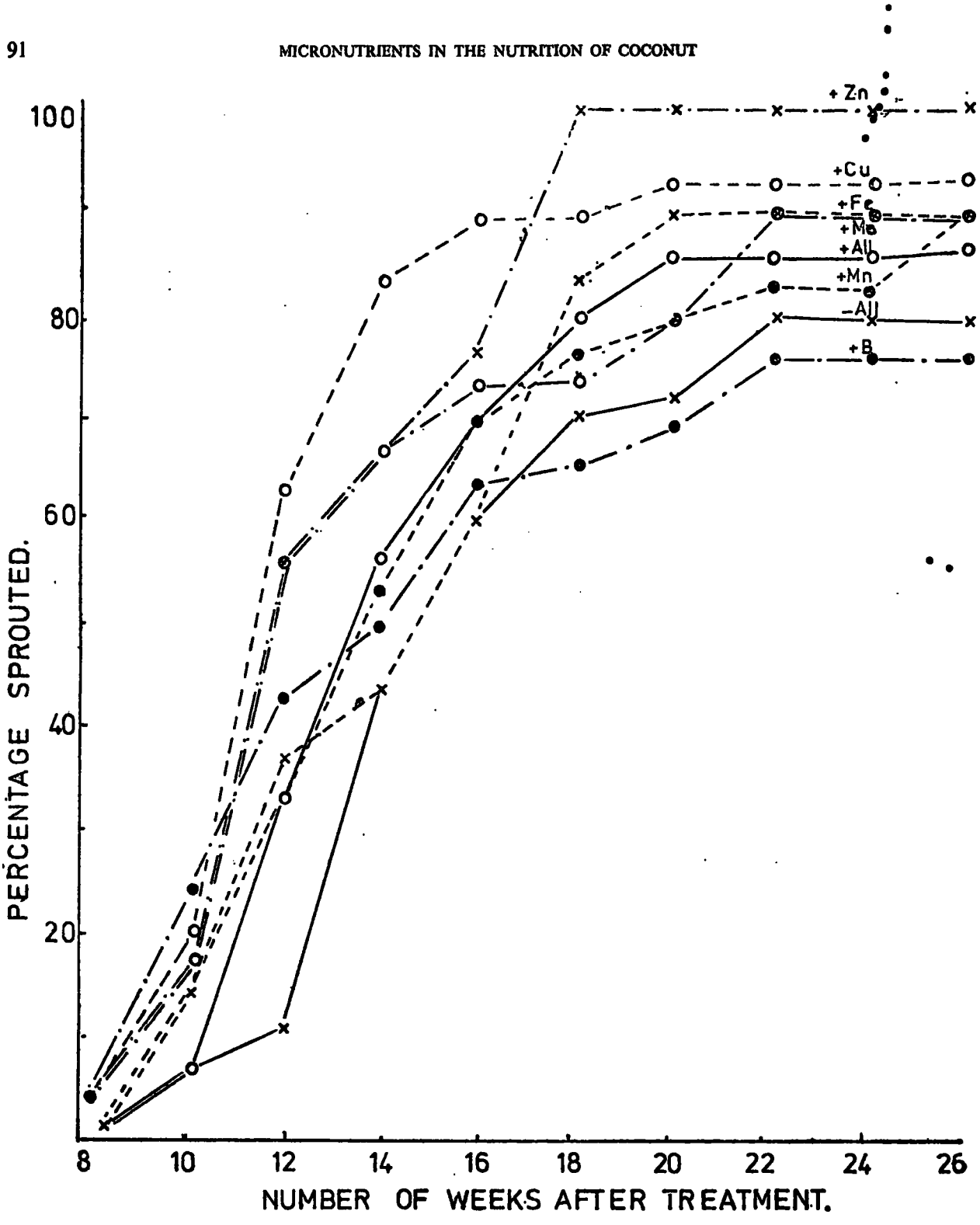

Fig 1. — Effect of a supplementary source of Fe, Mn, Cu, Zn, B and Mo on the rate and percentage of sprouting in coconut seednuts.

The data presented in Table 1 shows the effect of treatments on the total number of leaves and height of seedlings. Analysis of variance showed that treatment effects with respect to height of seedlings was significant at the one percent level with the Cu treatment showing highest mean value. The effect of treatments on the production of leaves however, was not significant. The data given in Table 2 summarise the differences in responses between the various treatments

Table 1

Treatment means for total number of leaves and heights of coconut seedlings.

Treatments	*+Fe*	*+Mn*	*+Cu*	*+Zn*	*+B*	*+Mo*	*+All*	*—All*
Means for No. of leaves ...	3.5	3.7	3.6	3.2	3.4	3.4	3.3	3.2
Means for height (cm)	73.06	75.50	85.24	68.49	67.75	76.54	66.43	66.50

Table 2

Differences between means for the measurements of seedling height

Treatment effects	*Differences between means (cm)*	
Fe, — All	6.56	N.S.
Mn, — All	9.00	N.S.
Cu, — All	18.74	***
Zn, — All	1.99	N.S.
B, — All	1.25	N.S.
Mo, — All	10.04	*
+All,—All	0.07	N.S.
Fe, + All	6.63	N.S.
Mn, + All	9.07	N.S.
Cu, + All	18.81	***
Zn, + All	2.06	N.S.
B, + All	1.32	N.S.
Mo, + All	10.11	*
Fe, Mo	3.48	N.S.
Mn, Mo	1·04	N.S.
Cu, Mo	8.70	N.S.
Zn, Mo	8.05	N.S.
B, Mo	8·79	N.S.
Fe, B	5.31	N.S.
Mn, B	7.75	N.S.
Cu, B	17.49	***
Zn, B	0.74	N.S.
Fe, Zn	4.57	N.S.
Mn, Zn	7.01	N.S.
Cu, Zn	16.79	***
Fe, Cu	12.18	*
Mn, Cu	9.74	N.S.
Fe, Mn	2.44	N.S.

N.S.—Not significant.

* — Difference significant at 5%
** — Difference significant at 1%
*** — Difference significant at 0.1%

with respect to height of seedlings. It is evident that a supplementary source of Cu and Mo had helped young seedlings to produce taller shoots than those receiving the "plus all" and "minus all" treatments. Seedlings receiving the Cu treatments had also grown significantly taller than those receiving Zn and Fe. Boron treatment has produced adverse effects not only in the rate of germination, but also in the subsequent growth of seedlings. Apparently the B concentration used had been toxic.

Iron and Mn treatments have also increased the heights of plants, though the values do not reach statistical significance.

It is also interesting to note that as in the case of germination, "plus all" treatments have had no impact on growth of seedlings when compared to the "minus all" treatment. As suggested earlier it is possible that in this treatment ("plus all") the beneficial effects of nutrients such as Cu and Mo are nullified by the adverse or toxic effects of B.

Thus with respect to height of seedlings six months after planting the treatment effects were in the order of Cu > Mo > Mn > Fe > Zn > B > "plus all" $\rightleftharpoons$ "minus all".

The beneficial effects of a supplementary source of Cu for both the rate of germination and subsequent growth of seedlings indicate that in these seednuts the reserves of Cu were probably below optimal levels for germination and growth. On the other hand Zn which hastened germination, and Mo which facilitated growth of seedlings are likely to have functioned by enhancing the activity of some factors affecting these processes.

This study basically shows that a supplementary source of micronutrients to seednuts may not only help to hasten the process of sprouting but also promote better initial growth of seedlings.

REFERENCES

DE SILVA, M. A. T. and GEORGE, G. D., (1971). Influence of size and maturity of coconut seednuts on the rate of germination and subsequent growth of seedlings. *Ceylon Cocon. Q.* **22,** 114-119.

FOALE, M. A., (1968). The growth of the young coconut palms (*Cocos nucifera*). ii The influence of nut size on seedling growth in three cultivars. *Aust. J. Agric. Res.*, **19,** 927-937.

LIYANAGE, D. V., (1955). Report of the Botanist. *Rept. cocon. Res. Inst. Ceylon for 1955,* 27.

LIYANAGE, D. V. and ABEYWARDENA, V., (1957). Correlations between seednut, seedling and adult palm characters in coconut. *Trop. Agric.*, **43,** 195-196.

NATHANAEL, W. R. N., (1963). Report of the Chemist. *Rept. cocon. Res. Inst. Ceylon for 1961,* 25-33.

PANDITHASEKERA, G., (1914). Coconut nurseries. *Trop. Agric.*, **43,** 195-196.

PIERIS, W. V. D., (1937). Seed selection. *Trop. Agric.*, **88,** 216-217.

SUMATHYKUTTY AMMA, B., (1964). Preliminary studies on the effect of micronutrients on the germination of coconut seednuts *Current Sci.*, **33,** 49-50.

THOMAS, K. M., (1974). Influence of certain physical and chemical treatments on the germination and subsequent growth of coconut (*cocos nucifera*) seedlings: A preliminary study. *East Afric. Agric. J.*, **40,** 152-156.