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EFFECTS OF MICRONUTRIENTS (B, CU , FE, MN, MO, ZN) ON PLANT PERFORMANCE AND YIELD OF PINEAPPLE CVS MAURITIUS AND MASMERAH PLANTED ON MALAYSIAN VIRGIN PEAT SOILS

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by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES AND ILLUSTRATIONS

PLATES

DIAGRAMS

RINGKASAN

Tujuan utama kajian ini ialah untuk mengenalpasti kepentingan zat makanan mikro B, Fe, Mn, Mo dan terutama sekali Cu and Zn, bagi tanaman nenas kultivar Mauritius dan Masmerah di atas tanah gambut dara di Semenanjung Malaysia. Satu percubaan pasu dan tiga percubaan ladang telah dijalankan untuk menentukan kesan-kesan makanan mikro ke atas ciri-ciri seperti ketinggian pokok, bilangan daun, berat basah dan kering daun 'D', kandungan zat makanan Cu dan Zn di dalam daun 'D', dan berat buah. Tanda-tanda kekurangan zat makanan itu juga dititik beratkan. Kajian ke atas arahan zat-P ke atas kekurangan zat Cu dan Zn juga telah dijalankan.

Hanya zat Cu sahaja telah menunjukkan tanda-tanda kekurangan yang nyata pada pokok nenas kultivar Mauritius,manakala zat B, Fe, Mn, Mo dan Zn tidak kelihatan memberi tanda kekurangan yang jelas. Bagi kultivar Masmerah pula ke enam zat makanan mikro yang dikaji tidak menunjukkan tanda kekurangan yang nyata.

Zat Cu juga telah memberi kesan yang bererti ke atas ketinggian pokok, berat basah dan kering daun 'D', juga kandungan zat Cu dalam daun 'D' pada kultivar Mauritius. Walubagaimana pun, kesan ke atas bilangan daun dan berat buah adalah tidak bererti. Berlakunya tanda-tanda kekurangan zat Cu pada pokok yang ditanam di ladang adalah berkelumpok-kelumpok (sporadic). Kekurangan ini mula kelihatan pada bulan yang keempat atau kelima selepas ditanam. Oleh kerana tidak ada perbezaan yang bererti kelihatan ke atas ciri-ciri pokok yang dikaji apabila berlainan kadar Cu diberi (5, 10, 15 kg Cu/ha), dengan itu kadar 5 kg Cu/ha adalah mencukupi untuk

mengatasi tanda-tanda kekurangan yang terdapat di ladang. Kesan zat Zn ke atas tanaman kultivar Mauritius didapati tidak memberi kesan yang bererti.

Bagi kultivar Masmerah pula, zat makanan mikro khasnya Cu dan Zn tidak memberi kesan yang bererti dari segi ketinggian pokok, bilangan daun, berat basah dan kering daun 'D', kandungan zat Cu dan Zn dalam daun 'D' dan juga berat buah.

Dari kajian yang telah dijalankan, didapati tidak ada aruhan zat P ke atas kekurangan Cu dan Zn berlaku bagi kedua-dua kultivar. Dengan itu, kesimpulan yang boleh diperolehi daripada penyelidikan yang telah dijalankan ialah bahawa hanya zat Cu sahaja memainkan peranan yang penting untuk tanaman nenas kultivar Mauritius di - tanah gambut dara di Semenanjung Malaysia.

ABSTRACT

The objective of this study is to establish the importance of micronutrients B, Fe, Mn, Mo and especially Cu and Zn for the cultivation of pineapple cvs Mauritius and Masmerah on virgin peat coils in Peninsular Malaysia. A pot and three field trials were set up to determine the effects of these micronutrients on the plant height, leaf number, fresh and dry weights of D-leaf, Cu and Zn content of D-leaf and the fruit weight of these two cultivars. The deficiency symptoms were also observed. A study on P-induced Cu and Zn deficiencies was also carried out on the two cultivars.

Only Cu showed distinct deficiency symptoms in both the pot and field trials in pineapple cv Mauritius while none was observed for B, Fe, Mn, Mo,and Zn. No distinct deficiency symptoms of B, Cu, Fe, Mn, Mo and Zn were observed on pineapple cv Masmerah.

Only Cu was observed to give significant effect to the plant height, fresh and dry weight of D-leaf and Cu-content of D-leaf on cv Mauritius. However, the leaf number and fruit weight were not significantly affected. The Cu-deficient plants in the field were observed to be sporadic or pocket-like in distribution. The deficiency was observed to occur as early as the fourth of fifth month of planting. No significant difference was observed with the different levels of Cu (5,10,15 kg/ha) applied on the above-mentioned factors investigated. Thus, Cu at 5 kg/ha would be sufficient to overcome the deficiency symptoms in the field. The effect of Zn was observed to be non-significant for the cultivation of peneapple cv Mauritius.

There was no significant effect of the micronutrients, especially for Cu and Zn on the plant height, leaf number, fresh and dry weights of D-leaf, Cu and Zn-content of D-leaf and fruit yield of cv Masmerah. There was no P-induced Cu and Zn deficiencies occurring in the field with these two cultivars.

Thus, only Cu was shown to be essential for the cultivation of pineapple cv Mauritius on virgin peat soils of Peninsular Malaysia.

1. INTRODUCTION

In Malaysia, pineapple (Ananas comosus (L) Merr.) is mainly grown on peat soils. It is an economically viable crop because it can tolerate low soil acidity, which is characteristic of Malaysian peat (pH 3.5-3.8) and it is also relatively resistant to pests and diseases as compared to other annual crops which are also commonly cultivated on peat.

Peat soils have been considered to be poor in nutrient contents but due to its outstanding advantage of possessing high nutrient holding potential or cation exchange capacity, it has been extensively cultivated with annual crops.

Micronutrient deficiencies in peat soils have been reported widely both abroad and locally. Davis and Lucas (1959) reported Mn, B, Cu, Fe, Zn and Mo deficiencies for plants grown on peat soils. Report on Cu deficiency on peat and muck soils had been made by Caldwell (1966) while William (1971) reported Mo deficiency on a wide range of acid soils. Batey (1971) stated that Mo and B deficiencies occur most commonly on peaty soils or mineral soils with a high organic matter content. Andriesse (1974) reported Cu, Fe, Mn and often Zn deficiencies on peat soils in West Kalimantan.

Locally, Tay (1969) reported micronutrient deficiencies especially for Fe, Cu and Zn on pineapple grown on peat soils. Observations have been recorded on B deficiency on tomato (Joseph, Hussein and William, 1970) and oil palm (Kanapathy, Tan and Cheah, 1974; 1975); Cu deficiency on maize and cassava (Kanapathy, 1972; 1976);

Cu, Zn and Mn deficiencies on oil palm (Ng and Tan, 1974) and Cu and other micronutrients on groundnuts and sorghum (Chew, Joseph and Ramli, 1979).

Though probable symptoms of Cu and Zn deficiencies on pineapple have been reported earlier (Tay, 1969), to-date no detailed studies have been carried out on the effect of these micronutrients on plant performance, and fruit yield of pineapple when planted on virgin peat soils.

The objectives of this study are as follows:

1) To observe the importance of micronutrients B, Cu, Fe, Mn, Mo, Zn (main and two-factor interaction effects) for pineapple cultivation on virgin peat soils.

2) To identify the important micronutrient requirement for pineapple cvs Mauritius, which is mainly for fresh fruit production, and Masmerah, a canning cultivar.

3) To determine the optimum level of application of Cu and Zn (the two commonly deficient micronutrients for pineapple grown on Malaysian peat soils) for pineapple cvs Mauritius and Masmerah.

4) To observe the difference in the response of plant performance, and fruit yield to either broadcast or foliar treated Cu and Zn in pineapple cvs Mauritius and Masmerah.

5) To study the effect of P-induced Cu and Zn deficiency in pineapple cvs Mauritius and Masmerah.

2. LITERATURE REVIEW

2.1. The Pineapple, Ananas comosus (L.) Merr.

Pineapple is a terrestrial herb, native of South America, and is a member of Bromeliaceae. Its characteristic features are short stem with rosette of long, narrow leaves, either with or without spines. The inflorescence is terminal coalescing into fruit which is a syncarpous and with the main axis growing beyond to form a tuft or crown of leaves. Pineapple fruits with seeds are rarely in existence nowadays, and this is due to selection made for seedlessness through mutation.

Its other related species include Ananas bracteatus (Lindl.) Schultes, A. erectifolius L.B. Smith and A. ananassoides (Bak.) Smith, which are found wild and distributed throughout the tropics.

2.1.1. Cultivar Mauritius

This cultivar is grown extensively for fresh fruit pineapple. It is classified under the Queen Group and the plant is the smallest of the Malaysian cultivars (Wee, 1972). The leaves are dark green in colour with broad, central red stripe, and the edges are lined with red spines. The fruit is small (1.0 kg) with prominent and bulging eyes. The flesh is yellow in colour with high sugar content ($15^{o}B$ - $19^{o}B$) and high citric acid content (0.6% - 0.8%).

Ground and aerial suckers are very common with this cultivar and they are generally used as planting materials. Slips are absent.

2.1.2. Cultivar Masmerah

This cultivar is a canning cultivar and is selected from the Singapore Spanish population. It has more vigorous growth than the Singapore Spanish. The leaves are erect and spineless. The fruits are bigger in size (1.4 kg), cylindrical in shape with flesh of golden colour and translucent. Fruitlets are flat and broad.

Slips are produced just below the fruit arising from the peduncle, and they are commonly used as planting materials. The sugar content is very low ($10^{o}B$ - $12^{o}B$) with low acid content (0.3% - 0.5%).

2.2. Malaysian Peat

2.2.1. Distribution

Peat soils occur widely in Malaysia. In West Malaysia, 6% of the land area or approximately 800,000 hectares are peat soils. These occur mainly in the States of Perak, Selangor and Western Johore on the west coast, and Kelantan, Trengganu and Eastern Johore on the east coast. In Sarawak the area under peat is about 1.4 million hectares or 13% of the land area.

Peat soils of West Malaysia are made up of semi-decomposed woody materials. The condition that leads to their

formation is mainly due to the permanent water-logging in basin-shaped depression. Generally, they are found along the poorly drained coastal areas or as small, localized patches in the inland areas. They vary in depth from 3 meters to more than 10 meters.

Coulter (1957) classified Malaysian peat under the group 'oligotrophic'. This group includes moss peats and woody peats, low in mineral content, especially Ca and are acid in reaction due to the low base content of the in-flowing water.

2.2.2. Morphological characteristics

The forest peats of West Malaysia are usually blackish-brown or reddish-brown in colour. They consist of woody materials in different stages of decomposition. The size of the woody materials increases with depth. They have good texture and permeability as they are mainly made up of organic matter (89% organic matter). The water holding capacity is very high and equals 15 to 30 times its own dry weight (Tay, 1969). When undrained, peat soils are always water-logged and the water-table can be as high as the soil surface. Consequently, aeration is poor. Thus, before peat soils can be used for cultivation, drainage is very essential. However, with excessive drainage, peat soils can undergo 'irreversible drainage' (Coulter, 1950; 1957). This will lead to considerable consolidation and oxidation of the peat soils (Coulter, 1957).