STUDIES OF PHYSIOLOGICAL DISORDERS IN SOME LOCAL BANANA CULTIVARS

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Introduction

Agronomic practices such as fertiliser requirements and planting density of local commercial banana clones are mostly adapted from the Cavendish banana of the subtropical regions. However, information on the physiological factors affecting banana growth and development of local banana cultivars is very limited. A water culture technique was developed to study growth and development of local banana cultivars raised from *in vitro* propagation. Plant growth and development was monitored from early growth until fruit bearing stage. Leaf and peel surface morphology also differ among the local banana cultivars. These differences affect leaf susceptibility to leaf diseases as well as choice of fungicides to control leaf diseases. Ultrastructural changes in the banana peel have been correlated with the development of pre-harvest disorder. The results are discussed in terms of plant growth and development, post-harvest handling of local bananas and the effectiveness of fungicide sprays to control leaf diseases.

Materials and Methods

In vitro propagated banana plantlets of Berangan, Novaria, Jari Buaya and Rastali obtained from United Plantations Bhd. (UPB), Tissue Culture Lab. Were suspended in 3.5L jar containing full strength nutrient solution. Another set of banana plantlets and sword suckers of Raja Udang Merah were planted in black polyethylene bag containing soil mixture. The jars were continuously aerated and the polybags were watered daily with the nutrient solution. After ten weeks in the jars or polybags, six plants each of Novaria, Berangan and Jari Buaya were transferred to 450 L containing nutrient solution or soil mixture. The plants in the water culture were suspended above the solution and the pseudostem supported by wooden frames. All the containers were placed in the open. The solution was monitored weekly for changes to pH and EC and renewed monthly. Plants in soil were fertilised monthly as recommended by UPB. At flowering stage, the third leaf from the top were sampled for scanning electron microscopy (SEM) and leaf nutrient analysis. Banana bunches were harvested at 11 weeks after the top (first) hand was visible on the hanging bunch. The second and third hands from each bunch were sampled for SEM and water loss characteristics. SEM of leaf and peel was viewed in a JOEL 6400 SEM at an acceleration voltage of 15 kV.

Results and Discussion

During the first 10 weeks of growth, banana plant in the water culture system were taller with larger leaf area, longer total primary root length, heavier total dry weight and higher root to shoot ratio than plants grown in soil. Relative growth and net assimilation rate, however, decreased after the 8th week to values comparable to soil-grown plants. In the larger containers, plants grown in water culture flowered four weeks earlier but bunch weight at harvest was approximately 40% lower than soil-grown plants. Plants grown in soil also had higher total dry matter accumulation even though plants in water culture had more than two fold the root dry weight. The higher proportion of root growth is a strong indication of nutrient deprivation due to low solution pH. Fruits from the water culture system were firmer while total soluble solids and Vit. C contents were of comparable values (Zakaria et al. 1997). The rate of water loss from the banana fruits could not be correlated with the amount of wax deposit on their peel (Mahmud et al. 1998). Berangan retained approximately 93% of its initial weight after eight days of storage, the lowest rate of water loss compared to Novaria and Jari Buaya. Stomatal density in the fruit peel was higher at the mid region than at the fruit tip (Zakaria and Abd Rahman, 1997, 1998). Jari Buaya had the highest stomatal density (576 $\pm$ 43 per cm^2) while Berangan had the lowest (244 $\pm$ 22 per cm^2). Novaria and Berangan had epidermal cells that appear to be radiating from a common point, which is the stomatal complex. This arrangement was not clearly defined for Jari Buaya. Jari Buaya had shorter stomatal aperture (13.8 µm) compared to Berangan (17.8 µm) or Novaria (16.4 µm). The apparent smaller aperture size of Jari Buaya was compensated by having higher stomatal frequency. Stomatal density on the abaxial and adaxial leaf surfaces differed among the banana cultivars. The abaxial surface had 2-3 fold more stomata per mm^2 than the adaxial surface (Zakaria and Abd. Rahman-unpublished). Surface of Jari Buaya lacking is wax layer showed clear fungal colonisation. There is a possibility of the wax layer acting as a protectant against germination of fungal spores on the leaf surface. The stomatal complex of both leaf surfaces is located in a slight depression among the epidermal cells. This is in contrast to the peel where the stomatal complex is situated on a mound (Zakaria and Abd. Rahman, 1997). The apparent presence of two stomata openings were common to both leaf and peel stomata.

Conclusions

Growing banana plantlets in water culture is practical and advantageous for short-term study. The system can be adapted for multi purpose use such as water relations, nutrient, root, acid and salt tolerance studies The presence of wax layer on the leaf surfaces restrict the selection of fungicides to hypophilic based chemicals. Water loss from fruit peel would be related to amount of wax deposit, stomatal architecture and peel thickness.

References

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