Comparative study of shoot and root development in micro-propagated and sucker-derived banana and plantain (Musa spp.) plants

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Introduction

Plantains and bananas are perennial monocotyledonous tropical herbs that belong to the Eumusa series of the genus Musa. Different types of propagules, including sword and maiden suckers, are used by farmers to establish banana and plantain fields. Preparation of conventional suckers consists of detaching the sucker from the mother plant, removing the upper part of the pseudostem and pruning the crown. This conventional planting material however is usually contaminated with soil-borne pests and is bulky with a low multiplication rate. Commercial production of banana and plantain and horticultural crop experiments use in vitro-propagated planting material. Though the past field studies highlight advantages of in vitro-propagated planting materials over conventional suckers, the studies were restricted to the above ground parts. As the crown and roots are key components for the development of the pseudostem and leaves as well as the next cycle, a detailed comparative study between in vitro plants and sucker-derived plants was necessary as more and more in vitro plants are being used to establish banana fields.

Materials and Methods

This study was carried out at the IITA High Rainfall station at Onne (4°42'N, 7°10'E, 5 m asl) in south-eastern Nigeria. The average annual rainfall is 2,400 mm distributed monomodally from February until November. In vitro and sucker-derived plants of eight genotypes, consisting of 5 landraces and 3 hybrids, were assessed (Table 1). Plantlets were established in the field at a spacing of 2 m x 2 m, except for plants evaluated at flower emergence, which were spaced 4 m x 4 m to avoid overlapping of the roots of neighbouring plants. Data was collected on the following shoot and root traits during the vegetative and the early reproductive phase: leaf area (LA, cm²), number of leaves (NL), plant height (PH, cm), pseudostem circumference (PC, cm), corm weight (CW, g), corm height (CH, cm), widest width of the corm (WW, cm), corm dry weight half way between widest and the apical meristem (CNW, cm²), corm dry weight half way between the widest and the basal point of the corm (CBW, cm²), number of suckers on the corm (NS), height of the tallest sucker (HS, cm), root dry weight (DR, g), the number of roots (NR), root diameter (RD, mm). Total root dry weight of the mat (TD, g) and total corm root length (TL, cm) of the mat. In addition, days to flower (DFTL), days after emergence were recorded. Data analysis was carried out using the SAS statistical package.

Results

No significant differences were observed at flower emergence between the propagule types for leaf area, corm fresh weight, root traits, height of the tallest sucker and days to flower emergence (Table 2). Hence the larger amount of roots at planting of in vitro-propagated plants seems not to have a particular advantage during the first cycle.

Few significant correlations between the same plant growth traits of in vitro and sucker-derived plants were observed during the vegetative phase. Significant negative correlations between both types of propogules were observed at flower emergence, for leaf area, plant height, pseudostem circumference, corm weight and corm size, and root dry weight. This indicates that plants originating from different propagules tend to behave similarly at flower emergence.

During the mid vegetative phase, sucker-derived plants produced a larger root system, possibly due to the larger corm, which bears the root initiation zone. However, leaf area or pseudostem size were similar at this stage for both types of propagules (Table 2).

Discussion

This research suggests that the major advantage to grow in vitro-propagated plants would be their more homogenous growth, which is particularly important for research and timing of field practices. Despite their higher phytosanitary status, would be their more homogenous growth, which is particularly important for commercial production of banana and plantain and horticultural crop experiments use in vitro-propagated planting material. Though the past field studies highlight advantages of in vitro-propagated planting materials over conventional suckers, the studies were restricted to the above ground parts. As the crown and roots are key components for the development of the pseudostem and leaves as well as the next cycle, a detailed comparative study between in vitro plants and sucker-derived plants was necessary as more and more in vitro plants are being used to establish banana fields.

Reference


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