Plantain (Musa AAB. cv Agbagba) setts growth in response to growth media and organic fertilizer in south western Nigeria

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ABSTRACT

Micro propagation of plantain or banana is posited as a means to produce great number of healthy plants but the technicality and expertise involved is not what an average farmer or grower can handle. The ability to transfer plantlets from *in vitro* conditions to greenhouse or field environment at low cost and with high survival rates is germane to its success. The increasing demand for plantain fruit in the recent times had led to tremendous increase in demand for vigorous plantain plantlets or suckers to establish new plantations expand the existing ones or rehabilitate the moribund ones. A study was conducted between November 2012 and April 2013 at the Organic skill demonstration plot, Federal University of Agriculture Abeokuta (7° 15ˈN, 3° 25ˈE) to examine the effects growth media and organic fertilizer on the setts of Plantain cv Agbagba as a rapid local and adaptive alternate means of suckers multiplication. The 3 x 2 factorial experiment was laid out in a CRD with four replicates. The growth media were top soil (TS), Sawdust (SD) and a mixture of TS and SD (TSSD). The organic fertilizers were fortified Gateway organic fertilizer (GOMF) and Cured poultry manure (CPM) applied at 10 t/ha and no fertilizer as control (C). Application of organic fertilizers was as described by Baiyeri and Tenkouano, 2007. Setts from plantain corms from freshly harvested stands were pared cut into bits of 300 g, dusted with wood ash and air dried for a week prior to planting. Data were collected from 5 weeks after planting (WAP) on number of leaves, plant height, stem diameter, leaf area, canopy diameter, root length and number of root. The result indicated a superior performance of setts planted in TSSD with CPM (26.7cm, 4.0, 62.4 cm, 24.7 cm) for plant height, number of leaves, canopy and stem circumference compared to plantlets in TS only with or without organic fertilizer with lowest values (0.7 cm. 2.3, 62.2cm, 9.0 cm) respectively.

Keywords: *plantain corms, setts, bits, organic, growth media, plantlets*

Introduction

Plantain of family Musaeae is an important staple food for more than 50 million people ranking third among starchy staples after cassava and yam in Nigeria and other tropical regions where banana plays an important role family diet (Venkatachalam *et al*., 2007). The fruit remains starchy at maturity and needs some minimal processing before consumption (Robinson, 1996). Nigeria is one of the leading producers of plantain globally (FAO, 2006) but there is currently under supply due to increasing demand for the fruits by processors who are involved in small and medium scale industries (SME) producing value-added products (easy and convenient foods and snacks) in the urban centres (Akinyemi *et al.,* 2010). Plantain can occupy a strategic position in rapid food production because it is a perennial ratoon crop with a short gestation period. All stages of the fruit are used as a source of food in one form or the other. The immature fruits are processed into powder and consumed as ‘plantain fufu’ The mature fruits (ripe or unripe) are consumed boiled, roasted, steamed, baked, pounded or sliced and fried into chips. Industrially plantain fruits serve as composite in the making of baby food such as (Babena and Soyamusa), bread, biscuit and others (Ogazi, 1996). Despite the huge potential of this crop, the far below supply with demand has hampered its status as a foreign exchange earner and under supply at home due to the shortage or inadequate supply of vigorous suckers for increasing large scale production. The study was therefore carried out to examine response of plantlets from setts from corms to growth media and organic amendments. The objectives of the study were to assess the effects of growth media on growth of setts and determine the influence of organic fertilizers on growth of the plantlets.

Materials and Methods

16 L perforated plastic buckets were filled with 12 kg of Topsoil (TS), Sawdust (SD) and mixture of Topsoil and Sawdust (TSSD). Gateway Organo-mineral fertilizer (GOMF) and Cured Poultry manure (CPM) were added at 2kg/pot (10t/ha) as described by Baiyeri & Tenkouano, 2007, watered and allowed to stand for 14 days. Corms from recently harvested plantain stands were pared and cut into 300g setts, dusted with wood ash and air dried for 7days and planted in the growth media.

Data collection and analysis

Data collection on growth parameters started 5 weeks after planting (WAP) and continued at weekly intervals. Plant height (cm) was taken using measuring rule, number of leaves by count, stem circumference was determined by multiplying the value of the diameter measured using digital vernier calipers by formula πD (i.e 3.14 multiplied by the obtained diameter (D) value), leaf breadth and leaf length, canopy diameter using measuring rule. Leaf area was calculated using the formula (Y = 0.65X – 0.22 (r = 0.97) Aiyelaagbe, 1991. Y = Leaf area (m2/plant), X = leaf length (m/plant). Number of root and chord root length (cm) were assessed 21 WAP. Data were analyzed using ANOVA and significant treatment means separated with DMRT at 5 % probability level.

Results

Effects of media and amendments on height of plantlets

At 5WAP corm bits planted with TSSD and SD with addition of CPM produced tallest plantlets (11.9cm) and were not significantly different from those planted TSSD but with GOMF with (9.4cm). Setts planted in TS and SD only were not different from TSSD mixture. Application of GOMF in TS or SD had the shortest plantlets (0.7cm). SD amended with CPM had comparable value (7.7 cm) to the taller plantlets. Similar trends were observed up to 11 WAP for TSSD mixture with CPM application (16.2 - 18.7 cm) and TSSD mixture amended with GOMF (14.9 - 18.0 cm. Between 13 and 19 WAP SD treated with CPM produced plantlets with values of 21.0 and 26.6 cm, followed by TSSD mixture with GOMF with 21.6- 26.3 cm while TSSD mixture treated with CPM had values 21.2- 26.3cm. At 21 WAP, TSSD mixture with GOMF had the tallest plantain plantlet (31.0 cm) while SD with CPM had 30.0 cm. Other treatments had lower values 29.0 cm, for SD plus GOMF, 26.7 cm for TSSD mixture plus CPM, TS only 22.8 cm. TS only plus GOMF produced the shortest plantlets throughout (Table 1)

Effects of media and amendments on number of leaves of plantlets

The media and applied fertilizers had significant effects on number of leaves. SD and TSSD amended with CPM between 7 and 15 WAP produced higher number of leaves per plant (4.0 -7.0 and 3.7-5.2). Highest number of leaves (8.3) was obtained from TSSD mixture amended with GOMF at 15 WAP although it was not significantly different from values obtained between 9 and 15 WAP for SD amended with GOMF (4.0 - 7.5) while other treatments had significantly lower values (Table 2).

Effects of Growth media and fertilizer on leaf area stem circumference, canopy and root development of plantlets

Media mixture amended with CPM or GOMF had the largest canopy diameter 21 WAP with 62.0 cm/plant each. Media mixtures with fertilizer application had remarkable effects on stem circumference of plantlets. Circumferences of plantlets from non-amended media mixtures were not different from those of TS only and SD only. The plantlets from SD amended with CPM had significantly largest stem circumference (77.6 cm) 21 WAP compared to other treatments which had comparable values that ranged between 39.6 and 62.2 cm. At 21 WAP it was determined that the SD with CPM, TSSD mixture with CPM or GOMF amendments had significant (*p =* 0.05) effects on leaf area with 13.9 cm, 13.1 cm, 16,0 cm) respectively. This same pattern was found in number of root and but not in chord root length. The plantlets in SD only or in TSSD without amendments produced longest chord roots (Table 3).

Discussion

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Treatment | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 |
| TS | 3.1bc | 9.7abc | 11.9ab | 13.4ab | 15.5abc | 16.8abc | 16.8abc | 18.1abc | 22.8abc |
| SD | 2.4bc | 6.4abc | 8.2abc | 8.8abc | 9.5bcd | 10.0bcd | 10.9bcd | 12.0bcd | 15.5bc |
| TSSD | 1.6bc | 3.7bc | 5.1bc | 6.0bc | 6.5cd | 7.5cd | 7.5cd | 8.8cd | 13.3cd |
| TS +CPM | 2.8bc | 8.0abc | 9.9abc | 10.8abc | 12.7abc | 13.9abc | 13.9abc | 14.9abc | 17.7abc |
| SD+CPM | 7.7abc | 13.6ab | 15.8ab | 16.9ab | 21.0ab | 25.0a | 25.3a | 26.6a | 30.0a |
| TSSD+CPM | 11.9a | 16.2a | 17.9a | 18.7a | 21.2ab | 22.2ab | 22.2ab | 23.2ab | 26.7abc |
| TS+ GOMF | 0.7c | 0.7c | 0.7c | 0.7c | 0.7c | 0.7c | 0.7c | 0.7c | 0.7c |
| SD +GOMF | 0.7c | 7.0abc | 10.5abc | 11.5ab | 18.0ab | 22.0ab | 22.0ab | 23.3ab | 29.0ab |
| TSSD+GOMF | 9.4a | 14.9a | 16.8a | 18.0a | 21.6a | 24.6a | 25.1a | 26.3a | 31.0a |

The superior performance of plantlets from TSSD with CPM with reference to the plant height, number of leaves, canopy and stem circumference compared to plantlets in TS only with or without amendments suggested that they provided a better environment for growth. SD or TSSD amended or not amended seemed to support the growth of plantlets more than TS only. It is possible that the roots of the plantlets penetrated more easily through them due to the inherent high porosity. Baiyeri and Aba, 2005 found similar trend in their work in which sawdust and rice hull enhanced plantlets growth. Their opinion that the media served for anchorage, moisture supply and root aeration is in line the with the finding of the present study. Table1: Effects of Growth media and fertilizer on plantain plantlet height (cm)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Treat | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 |
| TS | 2.4ab | 3.2a | 3.3ab | 4.0cd | 4.3c | 3.5c | 2.8bc | 1.5cd |
| SD | 3.4a | 3.7a | 3.7a | 3.5d | 3.3c | 3.0c | 2.3cd | 2.3cd |
| TSSD | 2.9a | 3.8a | 3.6a | 3.5d | 3.5c | 3.5c | 2.8bc | 2.5bcd |
| TS +CPM | 2.1ab | 3.2a | 3.4ab | 3.7d | 4.2c | 3.7c | 2.7bc | 2.2bcd |
| SD+CPM | 4.0a | 4.5a | 4.5a | 6.0abc | 7.0ab | 4.8abc | 3.5abc | 2.5abc |
| TSSD+CPM | 3.7a | 4.7a | 4.7a | 4.7bcd | 5.2abc | 4.2bc | 2.9bc | 2.4abc |
| TS+ GOMF | na | na | na | na | na | na | na | na |
| SD +GOMF | 2.0ab | 4.0a | 4.0a | 6.3ab | 7.5a | 6.0ab | 4.3ab | 3.8ab |
| TSSD+GOMF | 3.8a | 5.5a | 6.0a | 7.0a | 8.3a | 6.8a | 5.0a | 4.0a |

Table 2: Effects of Growth media and fertilizer on number of leaves

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Treatment | Canopy (cm/plant) |  | Leaf area  (cm 2) | Stem  Circumf. (cm) | Leaf area  (cm 2) | Number of roots | Chord root length (cm) |
| TS | 46.3a |  | 12.6ab | 45.8b | 12.6ab | 9.9ab | 58.0bcd |
| SD | 46.8a |  | 12.1ab | 46.5b | 12.1ab | 12.0ab | 118.0a |
| TSSD | 38.0a |  | 12.1ab | 39.6b | 12.1ab | 10.8ab | 101.0a |
| TS +CPM | 34.2a |  | 9.2ab | 39.3b | 9.2ab | 6.4bc | 20.8de |
| SD+CPM | 57.3a |  | 13.9ab | 77.6a | 13.9ab | 15.5a | 97.2abc |
| TSSD+CPM | 62.4a |  | 13.1ab | 62.2ab | 13.1ab | 17.4a | 52.6cd |
| TS+ GOMF | - |  | 0.2c | 2.2c | 0.2c | 0.7c | 0.7e |
| SD +GOMF | 53.3a |  | 12.1ab | 59.7ab | 12.1ab | 14.3ab | 77.5abc |
| TSSD+GOMF | 62.8a |  | 16.0a | 59.7ab | 16.0a | 16.8a | 81.0abc |

Table 3: Effects of Growth media and fertilizer on leaf area, stem circumference, canopy and

root development

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