International Journal of Agricultural Research

ISSN 1816-4897

Academic Journals Inc.

www.academicjournals.com

International Journal of Agricultural Research 2 (3): 307-311, 2007
ISSN 1816-4897

Agronomic and Sensory Evaluation of Some IITA Hybrids in Ghana

B.M. Dzomeku, M.D. Quain, J.N.L. Lamptey, F.O. Anno-Nyako,
A. Aubyn and S.K. Darkey
Council for Scientific and Industrial Research-Crops Research Institute,
P.O. Box 3785, Kumasi, Ghana, West Africa

Abstract: The agronomic evaluation of some IITA hybrids (BITA-3, PITA-1, PITA-4, and BITA-2) was conducted alongside some local land races and FHIA-21 at two locations in the semi-deciduous forest region of Ghana. Some farmers also evaluated the hybrids for their agronomic performance and the sensory qualities. A survey was conducted to sample the views of farmers on the hybrids. Results indicated that the hybrids were very tolerant to the black Sigatoka disease with high number of functional leaves at flowering and at harvest. The crop cycle was comparable to the False Horn plantains. BITA-3 however was early maturing (12 months) compared to 15 to 18 months crop cycles. Majority of farmers (94%) declared that the hybrids were superior to the landraces in terms of agronomic characters. They added that the hybrids remained green throughout with about 10 green leaves at harvest as against 0 to 4 for the landraces. This characteristic of the hybrids was an important feature because it provided shade for their young cocoa plants. 63.9% of respondents ranked FHIA 21 as the best in terms of yield, taste and commercial potential. BITA-3 was rated second but to be used for processing. 65% of the farmers declared that PITA hybrids were tasty and good for fufu. BITA-2 was outright rejected for its finger size and length though it was very roubust and disease-free. Some women indicated that the hybrids cooked faster and so required less time for cooking and also saved them fuel wood.

Key words: Musa hybrids, agronomic performance, sensory qualities, black sigatoka,

Introduction

Plantain cultivation has become a feature of great socioeconomic importance in Ghana from the point of view of food security and job creation. Plantain belongs to the non-traditional sector of the rural economy, where it is used mainly to shade cocoa and is an essential component of the diet. More than 90% of the cultivated area in Ghana belongs to small holder farmers. In the agricultural sector, plantain is ranked fourth in Ghana (FAO, 2005) and contributes about 13.1% to the Agricultural Gross Domestic Product (AGDP). Its per capita consumption of 96.4 kg (Lescot, 2000) is higher than all other starchy staples. Plantain and banana are also very important sources of rural income (Ortiz, and Vuylsteke, 1996). Plantain is grown mainly in the forest, semi-deciduous to forest-savanna transition zones of Ghana. A total of 8,348,865 ha of land area in Ghana is used to cultivate plantain producing an annual average of 2.0 million tonnes of fruits, of which more than 95% is sold on the domestic market and the rest exported (SRID-MOFA, 2006). This is about 35% of the total land area (23,853,900 ha) of Ghana. Plantain production is concentrated in the three agro-ecological zones namely Rain forest, moist semi-deciduous forest and forest-savanna transition. The rainfall pattern is bi-modal from March to July as the major rainy season and August to November as the minor season. The rainfall amounts ranging from 1300 mm to 2200 mm per year.

Corresponding Author: B.M. Dzomeku, Council for Scientific and Industrial Research-Crops Research Institute, P.O. Box 3785, Kumasi, Ghana, West Africa

Plantain and banana (*Musa* spp.) are very important starchy staples in Ghana as well as in entire West African sub-region (Stover and Simmonds, 1987). They are consumed both as energy yielding food and as dessert. Plantain contributes about 13.1% of the Agricultural Gross Domestic product and its per capita annual consumption of 96.4 kg per head (Lescot, 2000) is higher than maize and yam except for cassava. Plantain and banana are also very important sources of rural income (Ortiz, and Vuylsteke, 1996).

Nearly 90% of the total plantain and banana produced worldwide (63 million tones) are consumed locally in the producing countries leaving only 10% for export (CGIAR, 1992, 1993). In Ghana for example, annual production of plantain (AAB subgroup) is about 1.8 million metric tonnes and only 500 tonnes is exported (Lescot, 1999; 2000). In the case of banana (ABB and AAA subgroups) annual production is about 7.9 metric tonnes; only 3.4 metric tonnes is exported (Lescot, 2000).

Despite the high value of plantain and banana, growing pest and disease pressures have affected production, the most notable being the fungal disease Black Sigatoka *(Mycosphaerella fijiensis)* (IITA, 1992; Stover and Simmonds, 1987; Swennen, 1990). Yield losses due to the disease are highly significant ranging from 20 to 50%. Under very severe conditions yield losses may be as high as 80% (Hemeng and Banful, 1994). Also banana streak viral disease cause by banana Badna virus has been observed to attack plantain and banana

The Black Sigatoka disease can be controlled with appropriate fungicides but the cost is prohibitive. Furthermore, the fungicides are not environmentally friendly and thus threaten the fragile ecosystem. Consequently, the best viable alternative for the control of Black Sigatoka is through the use of high yielding resistant hybrids. International research centres have succeeded in their breeding programmes. New hybrids, resistant/tolerant to the black Sigatoka disease have been developed. International Institute for Tropical Agriculture (IITA), Nigeria is one of such centres that have developed new hybrids against these diseases and were being tested in the sub-region.

Materials and Methods

In vitro plantlets were raised from two laboratories- Crops Research Institute and Botany Department, University of Ghana. The hybrids used for the trial included BITA-3, BITA-2, PITA-4, PITA-1 and Apem hemaa (FHIA-21). The local cultivars used included Brodeyuo, Oniaba, Asamienu and Osoboaso.

The trials were established in 1999 at two locations namely Fumesua (1°37'W, 5° 43'N,) in the Ashanti region, Assin-Fosu (1°25'W, 5° 40' N) in the Central region all in the semi-deciduous forest region of Ghana. The locations were selected on the basis of the variation in the soil types and the severity of black Sigatoka incidence. Fumesua is characterized by sandy-loam (Arenosols) soils. The Assin-Fosu soils are red-brown and clay-rich (Nitrosols). The design was randomized complete block with three replications. Plant spacing of 3×2 m was used giving a plant population of 1667 plants ha^{-1} and 42 plants/plot. Field management was slashing alternated with glyphosate application. Data was collected on the inner 20 plants. Data was collected on plant height at flowering and at harvest, pseudostem girth at one metre above ground, number of leaves at flowering and at harvest, number of months to flowering and to harvest, bunch weight number of hands per bunch, number of fingers, and finger lengths. The disease evaluation was done using the Stover scale of 1 (less severe) to 10 (very severe) (Stover and Simmonds, 1987) as observed on the 3rd leaf.

Twenty farmers from four communities in the Assin district were asked to evaluate the agronomic and yield performance of the hybrids, their cooking qualities, taste and the potential for their acceptance and adoption. A focus group discussion was used in the appraisal. In all 50 farmers who were the participating farmers and those who observe the plants in the field and have tasted the fruits were interviewed. Farmers boiled the fruits for slices (ampesi) and fufu (plantain and cassava paste).

Results and Discussion

The BITA accessions were observed to be cooking bananas. BITA-3 compared favourably with false Horn in terms of agronomic characteristics. However, it was early maturing (12 months). It was also sigatoka-free compared to the False Horns. PITA-1 produced very short plants at Assin Foso (175 cm) (Table 2). PITA-4 and PITA-1 produced the smallest pseudostems (43 cm) at the two locations (Table 1 and 2). Asamienu produced the thickest pseudostem (60 cm) (Table 1). BITA 2 on the other hand produced the thickest pseudostem at Assin Foso (Table 2). All the hybrids retained sufficient functional leaves (7) at harvest at the two locations (Table 1 and 2) compared to the local cultivars. There was no difference in the crop cycle between the hybrids and the locals at the two locations (Table 1 and 2).

The yields of the IITA hybrids were higher at the Fumesua location than at Assin Foso. This could be attributed to the poor rainfall pattern experience during the period. Similar trend was observed among the land races. The number of hands was also higher at Fumesua than at Assin Foso (Table 1 and 2). The hybrids also produce higher numbers of fingers. The hybrids were also resistant to the black Sigatoka disease at the two locations. The land races were all susceptible to the sigatoka disease. Apem hemaa (FHIA-21 was superior to the other hybrids as well as to the land races both in agronomic character and yield.

Fruit morphological characteristics of BITA-3 resemble that of False Horn plantain. The yield values were high (25 kg) compare to the landraces (15 kg). It was observed that BITA-3 produced large fingers at harvest resembling fingers of false horn plantain. The fruit peel of BITA-3 was observed to be very thick and could protect the fruit against mechanical injury. The fruit of PITA-1 and PITA-4 were very short unlike normal plantains.

Table 1: Yield and selected agronomic parameters of accessions at harvest at fumesua

	Accessions								
Parameters	BITA-3	BITA-2	PITA-4	PITA-1	Brodeyuo	Oniaba	Asamienu	Apem hemaa	Osoboaso
Plant height at harvest (cm)	275.0±5.2	295±7.1	214.0±5.4	217.0±8.1	265.0±5.1	241.0±5.8	270.0±8.1	250.0±6.1	248.0±9.1
No. of leaves at flowering	13±1.2	13±2.1	13±2.1	13±3.1	12±1.3	11±1.1	11±2.0	13±1.6	12±2.4
No. of leaves at harvest	7	8	7	7	4	4	4	6	3
Yield (kg)	25.3±6.8	20.5±7.1	24.5±11.1	21.0±9.1	17.5±7.5	16.0±5.1	16.0±6.2	23.1±8.1	15.0±9.8
Pseudostem (cm)	45±2.1	51±3.1	43±4.1	52±3.1	53±4.1	50±3.2	60±4.6	56±3.1	58±5.7
No. of mths to flowering	9±1.1	12±2.1	12±1.5	11±3.1	12±2.1	9±3.1	12±2.1	12±5.1	12±3.6
No. of mths to harvest	12.5±1.3	15.6±2.1	15.5±2.3	14.5±1.5	15.5±2.1	12±3.1	16.5±2.2	15±3.4	15.5±3.4
No. of hands/bunch	5	7	7	7	5	6	3	7	5
No. of fingers	76±6.6	46±13.1	52±10.5	56±11.8	30±13.2	64±11.2	16±10.3	76±8.4	32±9.3
Finger length (cm)	30±3.1	7±4.1	13±5.2	15 ±2.3	26±4.3	23±7.1	34±2.3	26±4.2	25±3.3
BSD (%)	0	0	0	0	6	6.0	6.0	1.3	6.0

Table 2: Yield and selected agronomic parameters of Accessions at harvest at Assin-Fosu

	Accessions								
Parameters	PITA- 4	Brodeyuo	PITA-1	BITA-2	BITA-3	Oniaba	Asamienu	Apem hemaa	Osoboaso
Plant height at harvest (cm)	265±5.1	295±6.3	175±3.1	300±7.2	300±4.1	270±3.4	350±8.4	250±6.3	248±4.5
No. of leaves at flowering	13±1.2	11±1.0	12±2.0	13±1.0	12±1.0	10±1.2	10±1.4	13±1.1	12±1.0
No. of leaves at harvest	7±1.0	5±1.0	7±1.0	7±1.0	7±1.0	4±1.0	4±1.0	6±1.0	3±1.0
Yield (kg)	11.3±9.3	8.5±11.1	14.5±9.0	12.5±7.1	25.0±10.1	9.2±6.1	13±6.1	15.0±6.1	16.6±7.1
Pseudostem (cm)	45±3.3	51±4.1	43±2.5	65±5.1	53±3.2	50±4.1	60±2.1	56±2.6	58±4.1
No. of mths to flowering	12±1.2	12±1.1	12±2.0	11±2.2	12±2.1	9±2.3	12±3.1	12±2.4	12±2.1
No. of mths to harvest	15.5±1.1	15.6±2.1	15.5±1.1	14.5±2.0	15.5±1.1	12±1.3	16.5±2.1	15±1.1	15.5±2.1
No. of hands/bunch	5	6	5	5	3	6	3	7	5
No. of fingers	74±8.9	26±9.1	97±11.2	56±11.4	73±12.3	64±9.2	21±10.1	76±12.4	42±11.3
Finger length (cm)	14±5.1	27±6.1	13±5.2	6±3.1	31±4.3	25±7.1	33±2.3	26±4.4	26±4.3
Black Sigatoka Incidence (%)	0	6	0	0	0	7	6	2	6

The finger numbers, lengths and sizes compared with the False Horns. However, the fingers of PITA 1 and 4 were not as long as known for local plantain. The fingers of BITA-2 were very short and were not appealing to the eye. Asamienu (True Horn) had the longest fingers than any of the cultivars. The hybrids had shorter fingers except BITA-3 (a cooking banana). The shape of the fingers of the hybrid plantains (the PITAs) may disqualify them as good materials for release; especially when the consuming public is used to finger lengths ranging from 21- 34 cm. The yield values of the hybrids were not significantly different from those of the land races. Apart from their resistant to Black Sigatoka disease, the hybrids were not showing extra-ordinary agronomic characters that could characterize them to be superior to the land races.

Majority of farmers (94%) declared that the hybrids were superior to the landraces agronomically. They added that the hybrids remained green throughout with about 10 green leaves at harvest as against 0 to 4 for the landraces. This characteristic of the hybrids was an important feature because it provided shade for their young cocoa plants. Hundred percentage of the farmers interviewed had tasted most of the new hybrids. 22.5% of respondents gave the fruits to friends, relations and visitors as gift.

About 65% of the farmers described the PITA hybrids as tasty while 20.1% said they were too soft and sometimes watery when boiled green as ampesi. They described a tasty plantain as one which is sticky and firm when boiled green. Majority of the women learnt that boiling the hybrids for only 7-10 min prevented them from being too soft or watery. The relatively shorter time for boiling was an added advantage because fuel was conserved and it was quick to cook. FHIA 21 was ranked as best for ampesi followed by CRBP 39. Some farmers indicated that BITA 3 was tasty when allowed to cool after boiling. They had earlier mistaken BITA-3 for Apantu (False horn plantain) and used it as such. However the consumers detected the difference in taste. 63.9% of respondents ranked FHIA 21 as the best in terms of yield, taste and commercial potential. The market women were also ready to purchase

FHIA-21 for sale in the urban areas. BITA-3 was rated second but to be used for processing. PITA 1 and 4 were rated for use for fufu. BITA-2 was outright rejected for its finger size and length though it was very roubust and disease-free.

Acknowledgment

The authors are grateful to Gatsby Charitable Foundation, U.K. and International Institute for Tropical Agriculture (IITA), Nigeria for their financial support for the study.

References

CGIAR, 1992. Future priorities and Strategies. CGIAR Technical Advisory Committee. TAC Secretariat FAO, Rome, Italy.

CGIAR, 1993. Progress Report by the CGIAR Task Force on Banana and Plantain Research. CGIAR Secretariat, World Bank, Washington, D.C., USA.

FAO (Food and Agriculture Organization), 2005. Food and Agriculture Indicators ESSA October 2005. http://www.fao.org/es/ess/top/country.html (Accessed on August 25, 2006)

Hemeng, O.B. and B. Banful, 1994. Plantain Development Project. Government of Ghana and International Development Research Centre, Canada. Final Technical Report, 1991-1993.

IITA, (International Institute of Tropical Agriculture), 1992. Sustainable food production in Sub-Saharan Africa, 1. IITA, Ibadan, Nigeria, pp: 208.

Lescot, T., 1999. Banana: Production, Trade and Varieties. FruiTrop., 63: 13-61.

Lescot, T., 2000. The importance of plantains and cooking bananas in Africa: Outlets for the subtropical zones. INFOMUSA., 9 : 25-28

Ortiz, R. and D. Vuylsteke, 1996. Improving plantain and banana-based system.

SRID-MOFA., 2006. Statistics, Research and Information Directorate -Ministry of Food, pp: 12.

Stover, R.H. and N.W. Simmonds, 1987. Banana, 3rd Edn., John Wiley and Sons, Inc. New York. pp: 468.

Swennen, R., 1990. Plantain Cultivation under West African Conditions: A Reference Manual. International Institute for Tropical Agriculture, Ibadan, Nigeria, Amarin Printing Group Co. Ltd. Thailand, pp: 24.