Table 1. Some characteristics of diploids (AA) banana genotypes resistant to Moko disease. Embrapa Occidental Amazon, Manaus, Amazonas, Brazil, 1998.

Genotype[1]	Height	Fruits /bunch	Length of fingers (cm)	Reaction to diseases[2]		
				Fusarium wilt	Yellow Sigatoka	Black Sigatoka
Babi Yadefana	Low	60	12	_	S	-
F_2P_2	Medium	96	12	-	-	-
1319-01	Medium	200	13	R	R	
1741-01	Medium	112	14	-	R	-
SH3362	High	192	15	-	-	S

[1] Babi Yadefana: cultivar from New Guinea; F_2P_2: hybrid from Ecuador; 1319-01: cross between Malaccensis x Tjau Lagada, selection 01; 1741-01: cross between Jary Buaya x hybrid (Calcutta x Madang); SH3362: hybrid from Honduras.
[2] R: resistant; S: susceptible.

opens up a real possibility of creating resistant commercial varieties, through conventional breeding techniques. Considering that only a small number of genotypes was evaluated, it is expected that new sources of resistance to *R. solanacearum*, race 2 would be detected as evaluations continue. ■

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Multilocational evaluation of FHIA hybrids in Ghana

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Plantain and banana (*Musa* spp.) are very important starchy staples in Ghana. 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 85 kg per head is higher than other staples such as maize and yam. Plantain and banana are also very important sources of rural income (Ortiz and Vuylsteke 1996).

Despite their high value, production has been affected by growing pest and disease pressures, the most notable being the fungal disease black Sigatoka *(Mycosphaerella fijiensis*). The disease was first observed at Assin-Fosu in the Central region of Ghana in the early 1980s and has since spread to all the plantain-growing regions of the country. 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).

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.

The Crops Research Institute introduced in 1994 some black Sigatoka-resistant/tolerant tetraploid hybrids of *Musa* from *Fundación Hondureña de Investigación Agrícola* (FHIA) in Honduras. The introduction was against the background that all the local landraces are susceptible to black Sigatoka disease. The hybrids included one dessert banana (FHIA-01), one cooking banana (FHIA-03) and one French plantain (FHIA-21).

Materials and methods

Tissue culture plantlets of FHIA-21 and FHIA-01 were received from the *Fundación Hondureña de Investigación Agrícola* (FHIA) in Honduras for evaluation. The plantlets were hardened under a hardening shed for six weeks before field planting.

The trials were established at three locations, namely Fumesua in the Ashanti region, Assin-Fosu in the Central region and Bunso in the eastern region. The locations were selected on the basis of the variation in the soil types and the severity of black Sigatoka incidence. The design was a randomized complete block with three replications. Three kilograms of poultry manure were applied as soil amendment at planting. The planting spacing was 3 m x 2 m (1667 plants/ha).

The disease evaluation was carried out using the Stover scale of 1 to 10 as observed on the third leaf.

Table 1. Yield and selected agronomic parameters of FHIA–21 at harvest (Fumesua, Bunso and Assin-Fosu)

	Fumesua				Bunso				Assin Fosu			
	1997	1998	1999	Mean SE	1997	1998	1999	Mean SE	1997	1998	1999	Mean SE
Plant height at harvest (cm)	270.0	268.2	269.0	**269.1 (0.2)**	247.0	258.0	256.4	**253.8 (7.8)**	238.8	244.0	239.0	**240.6 (1.9)**
Height of tallest daughter sucker (cm)	195.0	156.0	148.0	**166.3 (140.5)**	135.0	125.0	115.5	**121.5 (21.1)**	145.0	134.0	136.2	**138.4 (7.5)**
Number of daughter suckers	4.0	4.0	6.0	**4.7 (0.3)**	4.0	5.0	4.0	**4.5 (0.1)**	2.8	5.0	4.0	**3.9 (0.3)**
Number of leaves at flowering	14.0	13.0	12.0	**13.7 (0.2)**	12.0	13.0	14.0	**13.0 (0.2)**	11.3	13.0	14.0	**12.8 (0.4)**
Number of leaves at harvest	6.0	7.0	6.0	**6.3 (0.1)**	8.0	8.0	7.0	**7.8 (0.1)**	8.0	7.0	7.0	**7.3 (0.1)**
Yield (t/ha)	41.7	38.4	39.2	**39.8 (0.7)**	30.3	32.4	35.7	**33.7 (1.6)**	35.3	37.4	38.5	**37.1 (0.6)**
Pseudostem (cm)	55.0	56.0	55.2	**55.4 (0.1)**	57.0	55.0	44.0	**49.8 (10.9)**	53.8	51.6	47.3	**50.9 (2.4)**
Number of months to flowering	11.4	11.6	11.3	**11.4 (0.0)**	11.5	11.3	11.8	**11.5 (0.0)**	11.1	11.4	11.3	**11.3 (0.0)**
Number of months to harvest	14.9	15.3	15.1	**15.1 (0.0)**	15.2	14.9	15.2	**15.1 (0.0)**	14.5	14.8	14.7	**14.7 (0.0)**
Number of hands/bunch	8.0	7.0	8.0	**7.7 (0.1)**	8.0	7.0	8.0	**7.7 (0.1)**	7.0	8.0	7.0	**7.3 (0.1)**
Number of fingers	108.0	98.0	115.0	**107.0 (16.2)**	99.0	100.0	101.0	**100.0 (0.2)**	98.0	99.0	97.0	**98.0 (0.2)**

Table 2. Yield and selected agronomic parameters of FHIA –01 at harvest between 1997-1999 at Fumesua, Bunso and Assin-Fosu.

	Fumesua				Bunso				Assin Fosu			
	1997	1998	1999	Mean SE	1997	1998	1999	Mean SE	1997	1998	1999	Mean SE
Plant height at harvest (cm)	237.0	241.0	240.0	**239.3 (1.0)**	265.0	250.0	248.2	**254.4 (18.9)**	245.0	240.0	250.1	**245.0 (5.7)**
Height of tallest daughter sucker (cm)	180.0	170.0	168.0	**172.7 (9.2)**	180.0	172.3	167.4	**173.2 (9.0)**	120.0	128.0	118.0	**122.2 (5.7)**
Number of daughter suckers	3.2	5.0	6.3	**4.8 (0.5)**	5.2	6.1	4.0	**5.1 (0.2)**	3.0	6.0	4.0	**4.3 (0.5)**
Number of leaves at flowering	13.0	14.0	14.0	**13.7 (0.1)**	14.2	13.0	13.0	**13.4 (0.1)**	14.0	13.0	13.0	**13.3 (0.1)**
Number of leaves at harvest	7.0	8.0	7.0	**7.3 (0.1)**	5.6	7.0	8.0	**6.9 (0.3)**	6.0	8.0	7.0	**7.0 (0.2)**
Yield (t/ha)	38.3	40.8	41.1	**40.1 (0.5)**	42.7	39.4	38.5	**40.2 (1.0)**	30.7	34.2	55.6	**33.1 (1.4)**
Pseudostem (cm)	50.3	49.3	50.2	**49.9 (0.1)**	50.6	47.3	49.0	**49.0 (0.6)**	45.0	48.5	46.2	**46.6 (0.7)**
Number of months to flowering	11.3	11.4	11.3	**11.3 (0.0)**	11.3	11.3	11.4	**11.3 (0.0)**	11.9	11.4	11.6	**11.6 (0.0)**
Number of months to harvest	14.7	14.5	14.7	**14.6 (0.0)**	15.0	15.2	15.0	**15.1 (0.0)**	15.4	15.2	15.3	**15.3 (0.0)**
Number of hands/bunch	8.0	8.0	8.0	**8.0 (0.0)**	8.0	9.0	8.0	**3.0 (0.1)**	7.0	8.0	7.0	**7.3 (0.2)**
Number of fingers	109.0	103.0	112	**108.0 (4.7)**	110.0	102.0	104.0	**105.3 (3.9)**	101.0	98.0	99.0	**99.3 (0.5)**

Table 3. Yield and selected agronomic parameters of FHIA–03 at harvest between 1997-1999 at Fumesua, Bunso and Assin-Fosu.

	Fumesua				Bunso				Assin Fosu			
	1997	1998	1999	Mean SE	1997	1998	1999	Mean SE	1997	1998	1999	Mean SE
Plant height at harvest (cm)	225.0	221.0	220.0	**222.0 (1.5)**	226.0	230.0	228.2	**228.1 (1.9)**	235.0	233.0	230.1	**232.7 (1.4)**
Height of tallest daughter sucker (cm)	100.0	98.0	102.0	**100.0 (0.8)**	100.0	107.3	115.4	**107.6 (4.4)**	90.0	99.0	101.0	**96.7 (7.6)**
Number of daughter suckers	3.0	3.2	4.0	**3.4 (0.1)**	1.0	1.0	1.0	**1.0 (0.0)**	2.0	2.0	3.0	**2.3 (0.1)**
Number of leaves at flowering	12.4	12.0	11.0	**11.8 (0.1)**	14.0	14.0	13.0	**13.7 (0.0)**	10.0	11.0	11.0	**10.7 (0.1)**
Number of leaves at harvest	8.0	7.0	6.0	**7.0 (0.2)**	6.3	6.0	6.0	**6.1 (0.0)**	5.0	4.0	6.0	**5.0 (0.2)**
Yield (t/ha)	38.3	36.8	36.1	**37.1 (0.3)**	34.3	34.0	34.5	**34.2 (0.0)**	25.3	26.4	27.8	**26.5 (0.3)**
Pseudostem (cm)	58.0	56.0	58.0	**57.3 (0.3)**	60.0	58.0	60.0	**59.3 (0.3)**	53.0	52.0	53.0	**52.7 (0.1)**
Number of months to flowering	8.0	7.8	7.9	**7.9 (0.0)**	8.6	8.7	8.5	**8.6 (0.0)**	8.6	8.3	8.0	**8.3 (0.6)**
Number of months to harvest	11.0	10.7	11.0	**10.9 (0.0)**	11.6	11.7	11.5	**11.6 (0.0)**	11.6	11.2	11.0	**11.4 (0.0)**
Number of hands/bunch	8.0	7.0	8.0	**8.0 (0.0)**	8.0	7.0	8.0	**7.7 (0.1)**	7.0	8.0	7.0	**7.3 (0.2)**
Number of fingers	92.0	90.0	94.0	**92.0 (1.3)**	91.0	90.0	93.0	**91.3 (0.9)**	93.0	90.0	92.0	**91.7 (0.9)**

Table 4. Comparison of yield and selected agronomic parameters of FHIA-21 with two French plantain landraces at Assin Fosu and Bunso.

	1997				1998			
	FHIA-21	Apem Pa	Apem oniaba	SE	FHIA-21	Apem pa	Apem oniaba	SE
Plant height at harvest (cm)	252.3	352.0	273.0	30.4	256.0	353.0	272.0	30.0
Pseudostem girth (cm)	54.7	59.2	47.1	3.3	49.7	57.5	50.3	2.5
Number of daughter suckers	5.3	4.5	7.0	0.7	4.7	4.0	6.0	0.6
Number of leaves at flowering	12.1	10.0	8.0	1.2	13.3	11.0	9.0	1.2
Number of leaves at harvest	7.3	4.0	1.0	1.8	7.0	4.0	2.0	1.5
Number of months to harvest	14.8	18.0	16.2	0.9	15.0	18.5	17.0	1.0
Number of hands/bunch	7.3	8.0	6.0	0.5	8.0	8.0	6.0	0.6
Number of fingers/bunch	101.0	109.0	98.0	0.5	100.0	111.0	100.0	0.7
Yield (t/ha)	35.7	24.0	15.8	5.7	36.5	25.3	16.3	5.8

Results and discussion

At each of the three locations, FHIA–21 exhibited stable performance in yield and growth characteristics over the three years of study (Table 1). The performance of FHIA-21 in yield and growth characteristics over the years in all three locations was consistent and suggested its stability. Similar trends were observed in FHIA-01 (Table 2). These results suggested that performance of FHIA–21 and FHIA-01 was not influenced by seasons or locations. It implies that under good management practices, farmers would be assured of good yields irrespective of time or season of planting so long as there is adequate supply of moisture.

FHIA-03 (cooking banana) showed consistency in yield and growth performance over the years (Table 3). The agronomic characteristics of the hybrid were not affected by location. The hybrid was however not well accepted by consumers.

Comparing the performance of FHIA-21 with the land races Apem pa and Apem oniaba, FHIA-21 exhibited superiority in growth and yield for all the locations tested (Table 4). FHIA-21 was 21% shorter in height and 8% thicker in pseudostem girth than the mean of the landraces, which suggested that plants of FHIA-21 were sturdier than the landraces. It is therefore more likely that FHIA-21 would escape stem lodging. Earlier work (Hemeng *et al.* 1994) indicated that plants with thicker pseudostem girth experienced less stem lodging. FHIA-21 also retained more functional leaves at flowering than the landraces, which possibly contributed to its higher yield (Table 4): FHIA–21 produced 43% more than the landraces. ■

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Socioeconomics | **Survey of banana producers**

Results of a survey on bananas conducted among farmers in the Democratic Republic of Congo

Bakelana-ba-Kufimfutu, Vangu Phaka and Mputu Kena Kudia

Bananas are a staple food for the Congolese and also a very important source of income for the farmers who grow them.

An exploratory survey was performed among banana growers to increase the body of production statistics. It was conducted in the various production zones in the Congo.

The survey was started in the Cataractes District in the Mbanza-Ngungu area and the Bas-Fleuve (Lower Congo) District in the Sehebanza area. Thirty-six farmers were questioned about various aspects of the cultivation and marketing of bananas. The results of the first part of this survey are provided below.

Methodology

An inventory of banana production zones was performed in the Lower Congo region. On the basis of the financial and material resources available, several farmers selected at random were interviewed by the personnel of the INERA M'vuazi Banana Programme. The number of farmers questioned was proportional to the size of the village.

Results

The use of farmers' banana production

Bananas are both a foodstuff and a source of income for most of the farmers questioned. Growers hardly ever use banana in the production of local beverages; these are generally based on pineapple, sugar cane and orange (Table 1). They do not usually know the precise quantity of bananas produced, eaten or sold on the market each year.

Area and ownership of cultivated land

Although the area cultivated by each farmer is not known precisely, the farmers in the Lower Congo district farm larger holdings than those in the Cataractes district (Table 2). This is explained by the on-farm consumption of bananas in each district (Table 1) and also by the more or less favourable nature of the production environment (savannah in the Cataractes district and forest in the Lower Congo). As farmers cultivate with hoes, the areas do not exceed 1 hectare.

Land belongs mainly to the extended family. Some husbands living in their in-laws' villages cultivate the latter's land. Nevertheless, 27% of the farmers rent their land in the Sehebanza area in the Lower Congo district where there are large banana plantations in the forest area (Table 3).

Types of bananas grown

All the farmers questioned grow both sweet bananas and plantains. Cooking and beer bananas are not grown in the districts surveyed. In certain circumstances, some families use sweet bananas as cooking bananas and extremely ripe plantains for the manufacture of local beverages.

Cropping systems

Banana monoculture is more important in the Lower Congo district than in the Cataractes district (Table 4). Home gardens are also more frequent in the Lower Congo district because of the importance of banana as a staple food for the population of this district.

Sucker planting system

Most farmers replant suckers directly in the field after desuckering (81% in the Cataractes district and 93% in the Lower Congo district). Only 19% (Cataractes) and 7% (Lower Congo) of