

Morphological Taxonomy of Plantain (*Musa* Cultivars AAB) in West Africa

R. Swennen and D. Vuylsteke *

PLANTAIN bananas, hereafter called 'plantains', form a special subgroup among the AAB bananas (Simmonds 1966). These perennial giant herbs are interspecific hybrids produced as a natural crossing between *Musa acuminata*, which provided genome A, and *Musa balbisiana*, which provided genome B (Simmonds and Shepherd 1955). They are characterised by the orange-yellow colour of the compound petal in the flowers and the rather orange-yellow starchy flesh when ripe (Simmonds 1966). Fruits are slender (ratio fruit length-fruit girth is high) and are usually cooked, roasted or even boiled before consumption because they are unpalatable when raw. Although the centre of origin is supposed to be in South India (Simmonds 1966), a remarkable diversity exists in Central Africa (De Langhe 1961a, 1964a). Plantain was suggested to be among the oldest cultivated bananas in Africa (De Langhe 1964b). Four bunch types are distinguished (Tezenas du Montcel and Devos 1978): (1) *French plantain*: inflorescence is complete at maturity (many hands consisting of many rather small fruits followed by inflorescence axis covered with persisting hermaphrodite flowers and male flowers; the male bud is large and persistent); (2) *French Horn plantain*: inflorescence is incomplete at maturity (hands consisting of large fingers followed by few hermaphrodite flowers); (3) *False Horn plantain*: inflorescence is incomplete at maturity (hands consisting of large fingers followed by few hermaphrodite flowers); (4) *Horn plantain*: inflorescence is incomplete (few hands consisting of few but very large fingers; no hermaphrodite flowers and no male inflorescence; inflorescence axis is terminated by a tail or a deformed glomerule).

Hence within the plantain subgroup there exists a continuous variation from inflorescences with many hands and small fingers to inflorescences with few

hands and large fingers. One extreme is represented by the Congolese cultivar 'Nazika' (with 22 fruit-bearing hands, personal observation) and the other by the Cameroonian cultivar 'nothing but green' (no fruits, Tezenas du Montcel et al. 1983). That this variation is continuous is clearly indicated by the fact that some cultivars vary between two inflorescence types. The Horn plantain cultivar 'nothing but green' which normally does not produce fruits, occasionally produces one or two hands (Tezenas du Montcel et al. 1983). Similarly the False Horn plantain cultivar 'Agbagba' occasionally becomes a French plantain (Tezenas du Montcel et al. 1983; Vuylsteke et al. 1986). The prototype plantain is believed to be a French plantain (Simmonds 1966), the other bunch types being more degenerated and more parthenocarpic (De Langhe 1964b, c).

De Langhe was the first to classify the plantain cultivars according to the size of the pseudostem (De Langhe 1964a). In Zaire at the Yangambi field genebank he distinguished 'giant,' 'medium' and 'small' plant sizes which were supposed to be of parental origin.

The plant size was positively correlated with the number of hands per bunch produced, time till harvest and number of leaves produced till flowering. Mutants of the plant size types were considered either as 'semi-dwarf' or 'dwarf.'

The previous consideration leads to the conclusion that the plantain subgroup manifests an extremely wide morphological variation despite botanical homogeneity. This is the main reason why identification of plantain cultivars is so difficult and why in many reports the cultivars are not precisely identified. This makes the meaningful exchange and interpretation of research findings and results difficult and sometimes impossible.

This paper is based on field data related to cultivars from the field genebank at the High Rainfall Substation of the International Institute of Tropical Agriculture (IITA) at Onne in southeastern Nigeria. It is hoped that the information may

* International Institute of Tropical Agriculture, High Rainfall Substation One — Port Harcourt, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.

provide a better understanding of plantain morphology.

Materials and Methods

The plantain field genebank was established in 1983 in the beginning of the rainy season (April). Sword suckers were planted in plant holes 30–40 cm deep at a spacing of 3 × 2 m. Row spacing between cultivars was 3 m, and plants of the same cultivars were separated by a 2 m distance.

Annual rainfall at Onne averages 2400 mm. The rainfall is distributed over a 10-month period extending from February through December. Temperatures are moderate, averaging 27°C in the warmest months (February, March and April) and 25°C in July, the coolest month. Relative humidity remains high throughout the year, with average values ranging from 78% in February to 89% in July and September. On the average, there are only 4 hours of sunshine each day. The range is from 2 hours/day in September to 6 hours/day in February. The soil is an Oxic Paleudult derived from the coastal plain sediments of the Niger Delta region. It is deep and well drained. The soil is acid with pH of 4.2.

The field was mulched with *Pennisetum purpureum* at a rate of 80 t/ha/year (fresh weight). Total fertiliser rate per ha was 300 kg N and 456 kg K applied in six equal applications during the annual rainy season. The Onne field genebank contains at least 46 plantain cultivars (more accessions await a final conclusion); these are part of 85 cultivars we have seen in West Africa and which are now in the process of being introduced to Onne from Cameroon, Gabon and Congo. Interpretation of the determination key of the 56 Zairean plantain cultivars (De Langhe 1961a) suggests that among these, 32 cultivars are common to our genebank. Hence the total number of plantain cultivars identified is at least 109.

Twenty-five plantain cultivars were selected for discussion as they are believed to represent the major variability of the plantain subgroup in West Africa. They were introduced from Ghana, Ivory Coast, Nigeria and Cameroon but are also present in other countries under different names (Table 1).

The following characters were observed or measured: (1) Rhizome size, sheaths, petiole margins and bases, lamina bases, peduncle, basal flowers, bunch density, pedicels, fruit skin, fruit dehiscence, male bud and male bracts. They were classified according to Simmonds' criteria (Simmonds 1962); (2) Bunch weight: fresh fruit weight at harvest including the inflorescence axis bearing the fruits (fingers); (3) Number of fruit bearing hands; (4) Total number of fruits; (5) Average fruit weight calculated as the ratio of fresh

fruit bunch weight to number of fruits; (6) Total number of flowers of each hand; (7) Height at flowering: the main pseudostem was measured from soil level to the point where the two highest petioles meet at the time of bunch emergence (shooting); (8) Circumference at flowering: measured on the main pseudostem 50 cm above soil level at the time of bunch emergence; (9) Time to flowering: number of days between date of planting and date of bunch emergence; (10) Leaf number: number of asymmetric leaves (i.e. foliage leaves) produced till flowering; (11) Leaf ratio: ratio leaf length — leaf width, the width being measured at the middle of the leaf. This was measured on the 7th youngest leaf at shooting; (12) Height of ratoon at harvest: height of the tallest sucker at the time of harvest of its mother plant. Height is measured in the same way the main pseudostem is measured; (13) Bunch orientation: either pendant (positively geotropic) or subhorizontal (ageotropic) (De Langhe 1964a; Tezenas du Montcel et al. 1983); (14) Fruit orientation: either erect (negatively geotropic), subhorizontal (ageotropic) or pendant (positively geotropic) (De Langhe 1961a; Tezenas du Montcel et al. 1983); (15) Fruit apex: either blunt, straight or salient (bottlenecked) (Tezenas du Montcel and Devos 1978; Tezenas du Montcel et al. 1983); (16) Fruit shape: either curved or S-shaped (Tezenas du Montcel et al. 1983).

The aforementioned data were recorded on just five plants of each cultivar from the plant crop only. Because of this and since the cultivars were not randomly planted, comparisons among cultivars can be made only with caution.

Results and Discussion

The corms of the different plantain cultivars are about the same size. Sheaths are slightly waxy, petiole margins are incurved and petiole bases are clasping. The lamina bases are rounded. The peduncles of the bunches of the different plantain cultivars are slightly hairy, all basal flowers are biserial and parthenocarpic (except in 'nothing but green' which has no flowers and in 'Madre del Platanar' which has only hermaphrodite flowers).

Hermaphrodite flowers of French plantain cultivars are biserial but are uniserial in the French Horn and False Horn plantains. The bunch density of French plantain cultivars are either dense or medium, while the other bunch types are rather lax. Pedicels of all plantain cultivars are of the same size. The fruit skin is glabrous. Fruits are indehiscent. The male bud of French plantain cultivars is imbricate. Their male bracts are deciduous but this happens rather slowly. In several cultivars bracts start to wither before dropping off. The male bracts have a dull surface and are not revolute.

Table 1. Local names and synonyms of 25 cultivars representing the major variability in the plantain subgroup in West Africa.

cv. No.	Ivory Coast	cv. No.	Ghana	cv. No.	Nigeria	cv. No.	Cameroon	cv. No.	Gabon	cv. No.	Congo	
				P 1	<i>Ntanga 2*</i>	P 1	Mbouroukou No. 2*					
				P 2	<i>Ntanga 5*</i>	P 2	Nyombe No. 1*	P 2	Digondi Dibala			
						P 3	<i>Ovang</i>	P 3	Baka			
						P 4	<i>Njock Kon</i>					
P 5	3	<i>Vert</i>				P 5	Batard					
						P 6	<i>Big Ebanga</i>					
				P 7	<i>Mimi Abue</i>					P 7	***	
				P 8	<i>Ukom</i>							
				P 9	<i>Obino L'Ewai</i>	P 9	French Clair	P 9	Biri	P 9	***	
					Ukom Ntanga				Digondi Di-dine			
				P 10	<i>74.79³</i>			P 10	Kokou	P 10	??	
			P 11	Nyiretia apem	P 11	<i>Egjoga</i>						
					P 12	<i>Obubit Ntanga 1*</i>				P 12	***	
					P 13	<i>Akpakpak</i>						
							P 14	<i>Bobby Tannap</i>				
				P 15	<i>Mbang Okon</i> Ntanga							
									Ebang			
			P 16	Borodehene	P 16	<i>Agbagba</i>	P 16	Corne type	P 16	Guibangi	P 16	Libanga
									Didoungou			
					P 17	<i>Ngok Egame</i>						
			P 18	Borodewuio	P 18	<i>Obubit Ukom</i>					P 18	Tjei
					P 19	<i>Orishele</i>	P 19	Mbeta 2*				
						Okinima Obara						
					P 20	<i>Kiogo</i>						
					P 21	<i>Ihitisim</i>						
			P 22	<i>Asamiensa</i>			P 22	2 Hands planty				
					P 23	<i>Ubok Iba</i>						
			P 24	<i>Osoaboaso</i>								
			P 25	<i>Kaamenko</i>								

Notes: Names in italics indicate the country from which introduction was made.

* In the field genebanks a number was given whenever different cultivars were introduced with the same name.

** Present but no name was obtained.

Inflorescence and Related Characters

Bunch type is the most striking difference among plantain cultivars. The bunch types have already been described adequately by several authors (De Langhe 1961a, 1964a; Simmonds 1966; Tezenas du Montcel and Devos 1978; Tezenas du Montcel et al. 1983).

Here it is convenient to anticipate what we have to do with three plant size categories (see further). For the discussion of the inflorescence and related characters, comparisons should therefore only be made among the giant plantains (P₁-P₃, P₅-P₈), the medium plantains (P₉-P₂₃) and the small plantains (P₂₄-P₂₅).

French plantain cultivars (P₁-P₄, P₉-P₁₄) produced heavier bunches than French Horn plantain cultivars (P₅, P₁₅) and False Horn plantain cultivars (P₆-P₈, P₁₆-P₂₀) (Table 2).

This is due to the greater numbers of fruit produced by French plantain cultivars than by French Horn and by False Horn plantain cultivars. Similarly French Horn plantain cultivars produce heavier bunches than False Horn plantain cultivars because of the greater number of fruits (compare P₅ with P₆-P₈, P₁₅ with P₁₆-P₂₀ and P₂₄ with P₂₅) (Table 2). The number of fruit-bearing hands and average fruit weight is smaller in French plantain cultivars than in French Horn and False Horn cultivars (except for the False Horn plantain cultivars P₈ and P₂₀).

French Horn plantain cultivars produce about the same number of hands as the False Horn plantain cultivars but the average fruit weight is less for the former than for the latter (Table 2). With the exception of P₂₁, bunch weight of Horn plantain cultivars does not seem to differ in weight from the False Horn plantain cultivars although the former

Table 2. Some bunch characters of 25 cultivars representative of the major variability in the plantain subgroup in West Africa.

Cultivars	Bunch characters				
	Bunch weight (kg)	Number of hands*	Number of fruits	Fruit weight (kg)	
P 1	Ntanga 2	32.2 ± 3.7	8.8 ± 1.5	132.8 ± 26.3	0.25 ± 0.03
P 2	Ntanga 5	25.9 ± 1.6	9.3 ± 0.5	133.3 ± 13.5	0.20 ± 0.03
P 3	Ovang	28.6 ± 10.1	8.8 ± 2.2	132.6 ± 45.9	0.22 ± 0.04
P 4	Njock Kon	35.9 ± 2.7	9.2 ± 1.9	134.0 ± 33.4	0.23 ± 0.01
P 5	3 Vert	21.5 ± 2.6	8.8 ± 0.8	71.0 ± 12.9	0.28 ± 0.02
P 6	Big Ebanga	14.4 ± 2.0	9.4 ± 0.9	36.2 ± 3.7	0.40 ± 0.03
P 7	Mimi Abue	22.5 ± 2.3	10.6 ± 1.1	67.8 ± 13.1	0.33 ± 0.05
P 8	Ukom	8.6 ± 3.1	7.6 ± 1.3	23.2 ± 8.4	0.37 ± 0.02
P 9	Obino L'Ewai	13.6 ± 1.6	6.4 ± 0.9	80.8 ± 18.8	0.16 ± 0.02
P 10	74.79	13.5 ± 2.9	6.4 ± 0.5	75.0 ± 14.8	0.18 ± 0.02
P 11	Egjoga	16.8 ± 4.1	6.8 ± 0.8	82.4 ± 16.8	0.20 ± 0.03
P 12	Obubit Ntanga 1	10.1 ± 2.9	6.2 ± 0.4	70.4 ± 15.6	0.15 ± 0.04
P 13	Akpakpak	11.4 ± 1.1	6.0 ± 0.7	69.2 ± 12.9	0.15 ± 0.01
P 14	Bobby Tannap	15.9 ± 3.0	7.0 ± 0.0	93.4 ± 9.3	0.17 ± 0.04
P 15	Mbang Okon	14.6 ± 1.2	7.8 ± 0.8	69.2 ± 5.0	0.21 ± 0.02
P 16	Agbagba	11.2 ± 2.3	7.4 ± 0.5	31.8 ± 4.3	0.35 ± 0.04
P 17	Ngok Egome	8.2 ± 1.5	8.0 ± 0.0	31.2 ± 2.9	0.26 ± 0.03
P 18	Obubit Ukom	9.5 ± 1.6	7.6 ± 0.5	31.4 ± 3.6	0.30 ± 0.05
P 19	Orishele	12.8 ± 2.7	8.8 ± 0.8	48.0 ± 11.5	0.27 ± 0.04
P 20	Kiogo	7.9 ± 1.5	5.4 ± 1.3	15.2 ± 4.1	0.46 ± 0.07
P 21	Ihitisim	13.2 ± 2.8	4.2 ± 0.4	45.2 ± 4.7	0.29 ± 0.04
P 22	Asamiensa	9.0 ± 3.1	1.8 ± 0.4	18.2 ± 4.9	0.52 ± 0.07
P 23	Ubok Iba	10.0 ± 2.2	1.6 ± 0.5	23.0 ± 8.3	0.45 ± 0.08
P 24	Osoaboaso	10.8 ± 1.7	7.3 ± 0.5	41.5 ± 8.1	0.23 ± 0.02
P 25	Kaamenko	9.4 ± 1.8	6.6 ± 0.5	30.0 ± 3.2	0.31 ± 0.03

* Fruit bearing hands only.

have fewer hands and fingers (compare P₁₆-P₂₀ with P₂₁-P₂₃) (Table 2). However fruit weight of Horn plantain cultivars is much greater than that of False Horn plantain cultivars (except P₂₀).

If the different Horn plantain cultivars with one hand (lacking in our field genebank) had been included in our sample, it would have become clear that the average bunch weights of Horn plantain cultivars in general are less than of the False Horn plantain cultivars.

The relative decrease or increase in number of flowers per hand shows some distinct difference between French plantain, French Horn, False Horn and Horn plantain cultivars (Fig. 1). In the French plantain cultivar 'Obino L' Ewai,' the relative number of flowers increases in the second and third hand as compared with the first hand. Then it decreases sharply till the fifth hand followed by a new increase till the tenth hand. Thereafter there is a steady decrease in the number of flowers per hand. In the French Horn, False Horn and Horn plantain cultivars 'Mbang Okon,' 'Agbagba' and 'Ihitisim,' respectively, the relative number of flowers per hand decreases sharply from the first and second hand onwards. Similar figures can be drawn for other cultivars with the same bunch-type.

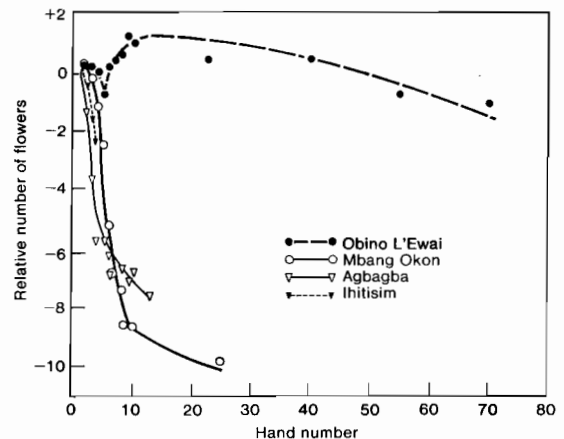


Fig. 1. Relative number of flowers/hand for four cultivars.

Plant Size and Related Characters

A second striking difference among plantain cultivars is the size of the main pseudostem at flowering. Although absolute figures have little meaning generally, because the plant size is influenced by soil fertility and plant density, the relative differences in field genebanks are invaluable.

Tall plants have a larger girth at flowering than shorter plants (Table 3) (except P₄) and need more time to flower (compare P₁-P₈ with P₉-P₂₃ and with P₂₄-P₂₅). These tall plantain cultivars (P₁-P₃ and P₅-P₈) are the 'giant' plantains. Because the size and circumference are less, the plantain cultivars P₉-P₂₃ and P₂₄-P₂₅ are considered 'medium' and 'small' plantains respectively.

Giant plantains flower later than medium plantains and medium plantains flower later than small plantains (Table 3). This becomes apparent if one looks especially at those cultivars which are morphologically very similar (compare P₆ with P₁₆ and P₂₅; compare P₅ with P₁₅ and P₂₄).

The plantain cultivars belonging to the giant and medium size categories are taller but flower earlier than the ones observed in Yangambi (De Langhe 1964a). This is almost certainly due to the different ecological conditions, despite the fact that some of the cultivars under observation were different from ours.

Giant plantain cultivars produce more foliage leaves than do medium plantain cultivars but any differences in the number of foliage leaves produced by medium plantain cultivars and small plantain

cultivars is less clear, probably due to the low number of plants under observation. The medium Horn plantain cultivars tend to produce more foliage leaves than do other medium plantain cultivars with another bunch-type (Table 3). The number of foliage leaves recorded for each plant size category agrees well with the ones from Yangambi (De Langhe 1964a). This suggests that despite different ecological conditions the number of foliage leaves produced till flowering remains an important character for the identification of a plant category.

Giant plantain cultivars produced heavier bunches with more fruit-bearing hands and more fruits than medium and small plantain cultivars (Table 2) (compare P₁-P₃ with P₆-P₁₄; compare P₆-P₇ with P₁₆-P₂₀; compare P₅ with P₁₅ and P₂₄). The fruit weight, however, seems to depend not on the plant size category but on the bunch type (Table 2).

The leaf ratio of the medium plantain cultivars does not differ among cultivars with different bunch types. The picture is not clear among the giant plantain cultivars.

The French plantain cultivar 'Njock Kon' (P₄) needs comment. It is a cultivar with characters such as circumference, time to flowering, leaf number,

Table 3. Some vegetative characters of 25 cultivars representative of the major variability in the plantain subgroup in West Africa.

		Vegetative characters				
Cultivars		Height at flowering (cm)	Circumference at 50 cm at flowering (cm)	Time to flowering (days)	Leaf number	Leaf ratio
P 1	Ntanga 2	424.0 ± 21.6	90.6 ± 2.7	397.2 ± 33.5	45.8 ± 1.3	—
P 2	Ntanga 5	467.5 ± 26.6	94.3 ± 10.0	429.0 ± 73.2	42.5 ± 6.5	—
P 3	Ovang	430.8 ± 33.5	87.5 ± 4.7	340.0 ± 41.3	40.8 ± 2.8	3.24 ± 0.01
P 4	Njock Kon	306.0 ± 28.2	87.8 ± 6.3	361.0 ± 46.7	41.8 ± 4.1	2.08 ± 0.12
P 5	3 Vert	371.0 ± 24.8	78.8 ± 6.5	338.2 ± 74.3	40.8 ± 3.5	2.81 ± 0.11
P 6	Big Ebanga	398.0 ± 11.0	76.4 ± 0.9	324.2 ± 29.3	39.4 ± 3.5	2.82 ± 0.14
P 7	Mimi Abue	417.0 ± 24.9	83.4 ± 3.1	350.2 ± 87.2	37.6 ± 2.3	2.74 ± 0.05
P 8	Ukom	390.0 ± 22.4	77.4 ± 4.5	—	40.5 ± 1.3	3.16 ± 0.22
P 9	Obino L'Ewai	334.0 ± 18.5	63.2 ± 5.8	253.6 ± 31.0	32.6 ± 0.5	2.77 ± 0.17
P 10	74.79	326.0 ± 20.4	61.6 ± 6.2	237.4 ± 15.8	31.5 ± 0.6	2.68 ± 0.21
P 11	Egjoga	322.6 ± 13.2	64.6 ± 4.9	252.4 ± 54.2	31.6 ± 1.5	2.55 ± 0.15
P 12	Obubit Ntanga 1	329.0 ± 29.0	60.4 ± 4.0	256.0 ± 29.7	30.6 ± 3.7	2.87 ± 0.18
P 13	Akpakpak	318.4 ± 19.9	60.6 ± 5.9	235.4 ± 10.6	30.4 ± 1.6	2.69 ± 0.21
P 14	Bobby Tannap	302.8 ± 11.6	63.2 ± 1.5	226.8 ± 14.0	31.6 ± 0.9	2.54 ± 0.22
P 15	Mbang Okon	351.0 ± 9.6	65.2 ± 1.9	235.6 ± 17.7	32.6 ± 1.3	2.73 ± 0.11
P 16	Agbagba	330.0 ± 16.2	62.0 ± 3.5	251.6 ± 25.8	32.8 ± 2.0	2.70 ± 0.16
P 17	Ngok Egome	332.0 ± 20.2	61.4 ± 3.0	258.4 ± 22.7	31.4 ± 1.1	2.79 ± 0.19
P 18	Obubit Ukom	342.0 ± 9.7	64.0 ± 1.2	238.4 ± 9.3	31.5 ± 1.3	2.71 ± 1.58
P 19	Orishele	349.0 ± 14.7	63.4 ± 5.1	274.4 ± 51.7	32.0 ± 3.2	2.66 ± 0.19
P 20	Kiogo	343.0 ± 8.4	60.4 ± 1.7	269.4 ± 13.0	33.2 ± 2.2	2.77 ± 0.12
P 21	Ihitisim	349.2 ± 10.7	67.2 ± 2.9	283.4 ± 17.4	34.2 ± 2.0	2.76 ± 0.07
P 22	Asamiensa	328.6 ± 12.3	69.2 ± 5.0	291.8 ± 36.2	36.4 ± 3.0	2.66 ± 0.11
P 23	Ubok Iba	378.0 ± 7.6	83.2 ± 3.0	270.8 ± 18.3	34.3 ± 1.0	2.81 ± 0.10
P 24	Osoaboaso	301.3 ± 8.5	59.5 ± 2.5	238.3 ± 22.1	32.8 ± 1.5	2.76 ± 0.08
P 25	Kaamenko	305.4 ± 22.7	58.4 ± 4.2	228.2 ± 6.8	29.2 ± 2.5	2.49 ± 0.18

bunch weight, number of fruit-bearing hands and fingers which should place it among the giant plantain cultivars (Table 2 and 3). Its pseudostem size, however, is small. Its false internodes are very reduced since the same number of foliage leaves are produced. Hence it is a dwarf mutant of a giant French plantain. This dwarf mutant has a low leaf ratio, i.e. the leaves are relatively wide. De Langhe has already pointed out that dwarfism is correlated with a lower leaf ratio (De Langhe 1964a).

Within-variety variation of the length of the ratoon was so high that no picture emerged in relation to plant size category or bunch type.

Bunch Orientation

Generally speaking the French plantain cultivars have pendant bunches (P₁-P₄, P₉-P₁₃) and the French Horn, False Horn and Horn plantain cultivars have subhorizontal bunches (P₅-P₈, P₁₅-P₂₅). A French plantain cultivar with subhorizontal bunch is Bobby Tannap (P₁₄).

Fruit Orientation

Among the 25 cultivars considered P₁-P₄ manifest erect fruits, P₅-P₁₉ and P₂₁-P₂₅ manifest subhorizontal fruits and P₂₀ manifest pendant fruits.

Subhorizontal fingers more or less point either randomly away from the inflorescence axis (P₅-P₁₈, P₂₀, P₂₁, P₂₄, P₂₅) or they all point towards the illuminated side (P₁₉, P₂₂, P₂₃).

Fruit Apex

Among the 25 cultivars considered P₁₁, P₁₃ and P₁₇ have a blunt apex; P₁, P₂, P₄, P₆-P₁₀, P₁₂, P₁₄-P₁₆, P₁₈, P₁₉, P₂₁, P₂₄, P₂₅ have a straight apex, and P₃, P₅, P₂₀, P₂₂ and P₂₃ have a salient apex.

Fruit Shape

All cultivars but two have curved fingers. P₂ and P₁₀ have S-shaped fingers.

Recommendations

Determination of the Potential for Perennial Production

Giant plantain cultivars produce heavier bunches than medium plantain cultivars (Table 2). However, the maturation time for the planted crop and following ratoon crops is very important. It is the yield per unit time which determines the perennial production potential. Therefore the perennial production potential for giant plantain cultivars which need more time to flower (Table 3), and hence to be harvested, may be the same as for medium plantain cultivars. The same could apply to small plantain cultivars.

Yield and dry-matter distribution (mother pseudostem vs. bunch vs. suckers) seems to depend on the bunch type (Table 2; Stover, in press). This could influence the type of ratooning, hence the capacity for perennial cultivation. Therefore there is a need to determine the perennial production potential of plantain cultivars belonging to the different bunch-type categories.

The aforementioned considerations can be combined in one experiment which should last at least 5 years. This would give allowance for the harvest of three crops of the giant plantain cultivars. Results would make it clear which plant size and bunch-type category is associated with high yield potential. The plantain cultivars needed for this experiment are all available in Onne and can be multiplied rapidly there by the *in vitro* technique. Hence the experiment should be conducted in Onne.

Screening for Female Fertility

There are reports which indicate that some plantain cultivars are female-fertile. At Yangambi, eight female fertile plantain cultivars were identified. They produced about one seed per bunch after cross pollination (INEAC 1959). These cultivars were all of the French bunch type (INEAC 1985, De Langhe 1961b). The female fertile cultivar 'AVP-67,' also called 'Elat' or 'Terrinha' is also of the French-bunch type (Rowe 1986; Tezenas du Montcel 1985).

Hence some plantain cultivars could possibly be used as a triploid parent instead of the AAB Lankau with its inferior cooking qualities.

In Onne we have 18 French plantain cultivars. The *in vitro* facilities enable us to introduce more cultivars which can be screened for female fertility. Alternatively the French plantain cultivars from the Onne field genebank can be forwarded to other institutions screening plantain for female fertility.

Evaluation of Existing Plantain Germplasm

Four plantain field genebanks exist in Africa, namely in Onne (Nigeria), Ekona and Nyombe (Cameroon) and Azaguie (Ivory Coast). The N'Toum field genebank (Gabon) was abandoned this year due to lack of funds. However, it was transferred to Cameroon. The Onne and Nyombe field genebanks are the largest plantain field genebanks in Africa but none can be considered as a reference field genebank since both lack many cultivars. The exchange of germplasm has just started. All these cultivars should be clearly identified and receive a common name. They should be evaluated systematically over three cycles and their characters (vegetative and inflorescence traits, disease resistance, etc.) should be measured and recorded. The data collected should serve as a base for exchange and for training.

Germplasm Collection in Zaire and Congo

Among the 26 plantain cultivars with a short habit (either small, semi-dwarf or dwarf), 14 are French plantain cultivars, five are False Horn, and two are Horn plantain cultivars. Eighteen cultivars come from Zaire (De Langhe 1964a), four from Cameroon (Tezenas du Montcel 1983), two from Nigeria and two from Ghana (personal observation). The Zairean cultivars, of which 13 are French and five are False Horn-type, are not readily available because the Yangambi field genebank has been discontinued. They should be collected again so that the French plantain cultivars can be screened for their female fertility.

As the Congo has never been systematically explored, a plantain collection expedition should be conducted to conserve valuable but unknown germplasm.

Root Ramification of Different Plantain Cultivars

Root branching of plantain cultivars is very much inferior to root branching of AA and AAA bananas (Swennen 1984; Swennen et al. 1986). The poor root branching is believed to be one of the causes of the rapid yield decline in plantain (Swennen 1984). Therefore a study should be undertaken to find out if genotypic differences in root branching exist. Plantain cultivars with superior branching should be tested for perennial cultivation.

Small in vitro plants grown in hydroponics will greatly facilitate this research which should not take more than 2 years. It could be carried out in Onne after installing some equipment needed for hydroponic culture or at the Catholic University of Louvain (Belgium) where these facilities exist.

Conclusion

Approximately 30 characters were studied on entries in the IITA plantain genebank located at Onne Substation. Most characters showed no variation between entries; however, dissimilarities were found in bunch-type (French, French Horn, False Horn and Horn) and plant size (giant, medium and small), bunch and fruit orientation, fruit apex shape and fruit curvature.

The bunch weight decreases and average fruit weight increases progressing from the French to the French Horn to the False Horn bunch-type. Horn plantain cultivars produce the heaviest fingers. Number of flowers per hand decreases slowly with increasing hand number in the French plantain cultivars. This decrease however is very sharp in the other three bunch-types.

Giant cultivars are taller and thicker, and flower much later than medium ones. They produce more foliage which results in heavier bunches consisting

of more hands and fingers than is the case with medium cultivars. Medium cultivars are superior to small cultivars for analogous reasons. Data for size at flowering and time to flowering for the giant and medium cultivars from the Onne field genebank differ from the data recorded in the Yangambi field genebank but the total number of leaves does correspond. This suggests that the latter character is independent of ecological conditions. A mutation towards a dwarf habit seems to lower the leaf length: width ratio.

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