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Agro-Morphological Performance of Banana and Plantain Cultivars (*Musa* spp.) Collected and Cultivated in the Open Field, Maniema Province, DR Congo

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ABSTRACT

This study aimed to evaluate the agro-morphological performance of banana and plantain (*Musa* spp.) cultivars collected in 7 territories of the Maniema Province and cultivated in the open field, Democratic Republic of Congo. A single factorial design of elongated plots with 11 repetitions was set up. Eleven cultivars were used: Tala lola (Mbudi: AAB), Leese (Mukokoonde: AAB), Nguku (Kangindi: AAB), Kamboloso (Kakumbi: AAB), Litete (Bondjilo: AAB), Lokusu (Mbole: AAB), Losakala (Mudioko: AAB), Libanga likale (Kileka: AAB), Andula (Akondo: AAB) for plantains, Kamaramasenge (Kamera: AAB) and Yangambi Km 5 (IBOTA: AAA) for bananas. The field was 40 m x 40 m, the spacings chosen were 3 m x 3 m with a density of 121 feet. Thus, the results obtained showed a strong agro-morphological variability due to genetic differences and the adaptability of banana and plantain cultivars in relation to the influence of biotic and abiotic environmental factors. The growth parameters (height of the pseudo-stem, diameter at the collar, leaf surface, day at flowering and the number of suckers emitted per plant) and production (number of hands per bunch, number of fingers per hand, weight of a finger, bunch weight and yield) contribute very significantly to determining the agro morphological performance of banana and plantain cultivars. The best yields were obtained with the Yangambi Km 5 cultivar (43,7t/ha) for bananas and the Tala lola cultivar (30 t/ha), followed by the Losakala cultivar 23,7t/ha for plantains. Thus, for large-scale production for profit, we recommend using the Yangambi Km 5 cultivar for bananas and the Tala lola and Losakala cultivars for plantains.

Keywords: performance, agro-morphology, collected bananas and plantains

INTRODUCTION

Bananas and plantains constitute, in terms of world production, the fourth agricultural product after wheat, rice and corn. They occupy the first rank in fruit production (Dhed'a *et al*., 2019). Cultivated bananas (dessert and plantains) constitute a food source for millions of people around the world with an annual production of 50 million tonnes of dessert bananas and 45 million tonnes of plantains (CIRAD, 2019). At the regional level, 57% of production comes from Asia, 28% from Latin America and 15% from Africa. As for the plantain type, Africa accounts for 60.9% of its world production, or more than 39 million tonnes. The plantain type is mainly cultivated by small farmers for self-consumption and sale on the local market. According to the base scenario, production is expected to be slightly above 255 million tonnes by 2028 (FAOSTAT, 2018).

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The production of bananas and plantains in DR Congo ranks 10th in the world. Compared to other food products, their production comes second after cassava; they play an important role in improving the income of the population because of their high market value. They constitute a culture playing a major role in food security (Dhed'a, 2001; Mukwa *et al*., 2014). Banana cultivation occupies an important place in the life of man in general and of farmers in particular. Its importance is manifested on the food, socio-economic, cultural and environmental levels (Ndungo, 2008; Nzawele, 2012). Plantains are rich in energy, mineral salts (potassium, calcium and phosphorus) and vitamins A, B and C. Banana plants produce fruits that are eaten raw after ripening, called sweet bananas, dessert bananas or table bananas. In terms of global fruit trade, bananas occupy first place in terms of turnover (Frisson and Sharrock, 1999).

In DR Congo, the banana tree is grown in all habitats (forest and savannah) and at different altitudes. In low altitude regions, we find plantains while in high altitude regions, we find Bisamunyo. They are grown mainly for self-consumption, thus playing an important role in the food security of the population in the different agroecological zones (Dhed'a *et al.*; 2019, Swennen, 2001). Production is thus distributed throughout the country, on large and especially small farms; cultivation is mainly practiced in home gardens, fallow land and in open fields in the forest (Dowiya *et al.*, 2009; Ngama *et al*., 2014). However, this production is limited by several biotic and abiotic factors; these include traditional farming practices, soil exhaustion, lodging due to increasingly violent winds at the start of torrential rains, attacks by diseases and pests (Dhed'a *et al*., 2019; Shadari *et al.*, 2023).

The objective of this study is to demonstrate the quality of plant material (bananas and plantains) used by farmers through agro-morphological evaluation, with a view to identifying growth and production performance in their edapho-climatic conditions. The contribution of this study is scientific and practical. It allows us to know the cultivars which still retain their vegetative and productive potential despite the level of physicochemical conditions of the soil, and the influences of biotic and abiotic factors in the environment.

MATERIAL AND METHODS

Framework of the Study

The study was carried out in the Democratic Republic of Congo, Maniema Province more precisely in the territory of Kailo, community-chiefdom of Bangengele, at PK17 Lokando axis, Kimbembe Village at an altitude of 500 mr. The geographical location of the experimental site was that of the Maniema Province. Located in the Center - East of DR Congo, the Province extends between 0° and 5° South latitude and 24° 55' and 28° 8' longitude, it is limited to the East by the North-Eastern provinces. Kivu and South Kivu, to the North by the Province of Tshopo, to the West by the Province of Sankuru and to the South by the Provinces of Lomami and Tanganyika. Its total area is 132,520 km2 or 5,6% of the total area of the country. Indeed, the geographical coordinates collected on the experimental site are presented as follows:

Kimbembe Village: Position: S 02.88313° longitudes, E 025.78465° latitudes and 500 m altitude.

Experimental Field

Position 1st side: S 02.88033° longitude, E 025.76365° latitude and 475 m altitude. Position 2nd side: S 02.87997° longitude, E 025.76359° latitude and 488 m altitude. Position 3rd side: S 02.88033° longitude, E 025.76324° latitude and 492 m altitude. Position 4th side: S 02.88001° longitude, E 025.76316° latitude and 487 m altitude. Figure 1 below shows the map of the experimental site.

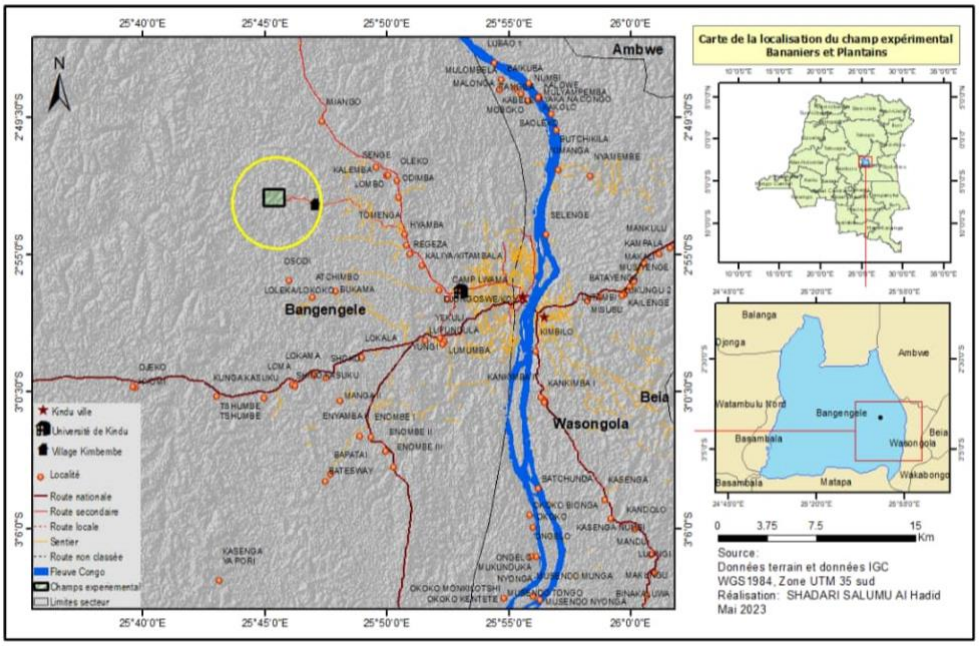

Figure 1: Descriptive map of the experimental site in Maniema Province, DR Congo

Climate

The climate that prevailed throughout the test period was that of the province of Maniema. A hot and humid tropical climate of the AW type according to the Köppen and Martonne classification. The latter evolves towards the equatorial type (AW1) in the North and towards the Sudanese type (AW4) in the South. In these two trends, the duration of the dry season is 2 to 3 months and 3 to 4 months respectively. It includes two major seasons; the dry season and the rainy season. The average annual temperature is 27°C and annual precipitation amounts to 1650 mm of water per year (Makondambuta, 1997).

Soil

The soil of Maniema varies from sandy type (Kibombo) to compact clay type (Pangi and Kasongo). Depending on the parent rock, we distinguish three types of soil: sedimentary with soft, coarse and red sandstone, clay and shales; metamorphic with silicified limestone, quartozitz, gneiss and metamorphic rocks; eruptive with eruptive granitic rocks (PAPRBIO, 1999). It should be noted the presence of ferralsol of the Yangambi type which is identified in the North of Lubutu (Makondambuta, 1997; CTCPM, 2002).

Vegetation

The experiment was carried out in a secondary forest, the previous crops identified were essentially made up of species such as: Pandamus musanga, Elaïs guineinsis. We also noted the presence of trees of the cycadaceae family and other species of branched and non-branched plants.

Material

Plant Material

The material used as part of this experiment consists of banana and plantain cultivars collected in the 7 territories of the Maniema Province considered less sensitive to banana bushy top disease in accordance with the results of Shadari *et al.* (2023); they are: Tala lola (Mbudi: AAB), Leese (Mukokoonde: AAB), Nguku (Kangindi: AAB), Kamboloso (Kakumbi: AAB), Litete (Bondjilo: AAB), Lokusu (Mbole: AAB), Losakala (Mudioko: AAB), Libanga likale

(Kileka: AAB), Andula (Akondo: AAB) for plantains, Kamaramasenge (Kamera: AAB) and Yangambi Km 5 (IBOTA: AAA) for bananas (Nzawele, 2012, Adheka *et al.*, 2018).

Technical equipment

We used as technical equipment among others the following instruments: machete (it was used to clear and cut grass during field experimental activities); hoe (this instrument we used to do superficial plowing, stump removal, digging, and weeding); magnifying glass (this device helped us visualize aphids on leaf sheaths and banana leaves); tape measurer (allowed us to take different measurements of the field and banana plants when collecting data in the field); twine (allowed us to trace stakes and planting lines); scale (also used to weigh the weight of harvest products) and GPS (helped us to take the geographical coordinates of the experimental site in order to develop the map of said site).

Methods

Experimental setup

A single factorial extended plot design with 11 repetitions was used. The spacings chosen were 3 m x 3 m, or a density of 121 feet. The field had a quadratic shape of 40 m x 40 m and plots 3 m wide by 33 m long. The total area of the field was 1600 m2.

Observation and data collection

We collected data on the following growth and production parameters: height of the pseudo- trunk at flowering (m); diameter at the collar at flowering: $= \frac{2\sqrt{c}}{\pi}$; Leaf area at flowering: = L×l×0,81; day to inflorescence (difference in days from the date of planting to the date of flower appearance); number of releases emitted per foot; number of hands per regime; number of fingers per hand; Weight of a hand (kg); Weight of a finger (g); Diet weight (kg); Yield in tonnes per hectare : $= \frac{Superficie\ d'1\ Ha}{Superface\ de\ la\ plante} \times Poids\ du\ régime$

Statistical analysis

We used analysis of variance (ANOVA). The Tukey test allowed us to compare the means at the 5% threshold using the STATGRAPHICS_Centurion_XVI version 16.20.04 software.

RESULTS

Physico-Chemical Quality of the Soil in the Experimental Field

Analyzes of texture, pH, conductivity, organic carbon, NPK, exchangeable base and cation exchange capacity (CEC) were carried out. The results obtained on texture, pH, conductivity, organic carbon, NPK, exchangeable base and cation exchange capacity (CEC) before installing the experimental device in the field are presented in Table 1 below.

Table 1: Physicochemical state of the soil in the experimental field

Samples	DEPTH (Cm)	Nitrogen Dosage (ml)	Carbon Dosage (ml)	Phosphorus	Exchangeable base (ml)	pH	PRANULOMETRIC ANALYSIS					
							A+L			A		
		Average 1st and 2nd Titration	Average 1st and 2nd Titration				B.V (g)	B+E (g)	‡	B.V (g)	B+E (g)	‡
A	**0 to 20**	2,77	15,77	0,39	8,75	4,29	18,78	18,81	0,03	18,78	18,79	0,01
	20 to 40	1,12	20,2	0,2	9,5	4,69	18,74	18,82	0,08	18,74	18,79	0,05
B	**0 to 20**	1,15	20,4	0,34	9,3	5,73	28,56	28,65	0,09	28,56	28,64	0,08
	20 to 40	0,85	22,85	0,2	9,45	4,29	26,57	26,59	0,02	26,57	26,58	0,01
C	**0 to 20**	0,85	21,27	0,17	9,35	5,52	30,41	30,46	0,05	30,41	30,43	0,02
	20 to 40	2,07	20,1	0,17	9,2	4,43	30,99	31,05	0,94	30,99	31,04	1,95
D	**0 to 20**	2,35	14,97	0,13	9,5	6,06	19,04	19,11	0,07	19,04	19,1	0,06

	20 to 40	2,12	21,02	0,37	9,4	6,71	29,66	29,75	0,09	29,66	29,7	0,04
E	**0 to 20**	2,37	17,72	0,18	9,3	4,21	29,44	29,51	0,07	29,44	29,5	0,06
	20 to 40	0,75	22,12	0,14	8,4	4,47	30,99	31,06	0,07	30,99	31,03	0,04
BLANCO			**22,55**									
General Average		1,64	20,07222222	0,229	9,215	5,04	26,318	26,381	0,151	26,318	26,36	0,232

Legend: *A: 1st sample, B: 2nd sample, C: 3rd sample, D: 4th sample, E: 5th sample*

With regard to the preliminary analyzes found in table 1, it is important to specify that the soil which supported our crops was made up of the following elements: Nitrogen (1, 64 ml), carbon (20, 07 ml), phosphorus (0,229 ppm), exchangeable base (9, 215 meq/100g), pH (5, 04) and particle size 26, 3%.

Growth Parameters

The different measurements taken on the height of the pseudo-stem, the diameter at the collar, the leaf surface, the day at flowering and the number of suckers emitted per plant are recorded in Table 2 below.

Table 2: Agro-morphological parameters of cultivars

Cultivars	Vernacular names	Pseudo-trunk height (m)	Diameter at collar (cm)	Leaf area (cm^2)	Day at flowering	Number of suckers emitted/cultivar
Libanga likale	Kileka (AAB)	1,723636^{i}	4,911818^{bcd}	9650,455^{cd}	376,3636^{a}	11,272727^{a}
Kamboloso	Kakumbi (AAB)	2,287273^{ef}	4,981818^{bc}	11045,909^{bc}	364,5455^{ab}	8,454545^{ab}
Kamaramasenge	Kamera (AAB)	2,791818^{ab}	4,520000^{ef}	11791,364^{b}	286,9091^{e}	5,636364^{bcd}
Leese	Mukokoonde (AAB)	2,438182^{cde}	5,042727^{b}	11628,818^{bc}	300,3636^{de}	7,545455^{abc}
Andula	Akondo (AAB)	2,544545^{bcd}	4,647273^{cde}	8164,909^{de}	250,9091^{f}	5,636364^{bcd}
Lokoka	Bonjilo (AAB)	2,114545^{fg}	4,248182^{f}	6410,091^{e}	356,0000^{ab}	4,727273^{bcd}
Lokusu	Mbole (AAB)	2,622727^{bc}	4,809091^{bcde}	8028,636^{de}	346,4545^{bc}	3,272727^{d}
Losakala	Mudioko (AAB)	2,976364^{a}	5,838182^{a}	15065,818^{a}	320,8182^{cd}	6,272727^{bcd}
Yangambi Km 5	Ibota (AAA)	1,948182^{gi}	5,161818^{b}	15084,909^{a}	320,2727^{cd}	5,090909^{bcd}
Nguku	Kangindi (AAB)	2,945455^{a}	5,008182^{b}	10869,364^{bc}	369,3636^{ab}	5,545455^{bcd}
Tala lola	Mbudi (AAB)	2,293636^{def}	4,567273^{def}	6472,545^{e}	353,1818^{ab}	4,272727^{cd}
p-value		**0,0000******	**0,0000******	**0,0000******	**0,0000******	**0,0000******

Legend: *Distinct letters next to numbers indicate significant difference, while same letters next to numbers indicate insignificant difference. ****: Very highly significant difference.*

The results shown in Table 2 show that the highest pseudostem height was 2, 976364 m for the Losakala cultivar and the lowest pseudostem height was 1, 948182 m for the Yangambi cultivar. Km 5. Furthermore, the analysis of variance shows that there is a highly significant difference between the different means on the height of the pseudo-stem of cultivars (p-value = 0, 0000) at the probability threshold of 0, 05%. It is observed that the highest collar diameter was 5, 838182 cm for the Losakala cultivar and the lowest collar diameter was 4, 248182 cm for the Lokoka cultivar. The analysis of variance reveals that there is a highly significant difference between the different means of neck diameters (p-value = 0, 0000) at the probability

threshold of 0, 05%. The highest leaf area was 15,084 cm2 for the cultivar Yangambi Km 5 and the lowest leaf area was 6472 cm2 for the cultivar Tala lola. However, the analysis of variance showed that there is a highly significant difference between the different means of leaf areas (p-value = 0, 0000) at the probability threshold of 0, 05%. It also appears that the highest flowering day was 369 days for the Nguku cultivar and the earliest flowering day was 250 days for the Andula cultivar. Furthermore, the analysis of variance reveals that there is a highly significant difference between the different means of days to flowering (p-value = 0, 0000) at the probability threshold of 0, 05%. The highest number of suckers emitted per cultivar was 11 suckers for the cultivar Libanga likale and the lowest number of suckers emitted per cultivar was 4 suckers for the cultivar Tala lola. Thus, it appears from the analysis of variance that there is a highly significant difference between the different means on the number of suckers emitted per cultivar (p-value = 0, 0000) at the probability threshold of 0, 05%.

Production Parameters

The different measurements taken on the number of hands per bunch, the number of fingers per hand, the weight of the bunch, the weight of a finger, the weight of a hand and the yield in tonnes per hectare are recorded in Table 3 below.

Table 3: Production components

Cultivars	Vernacular names	Number of hands/ regimen	Number of fingers/ hand	Diet weight (kg)	Weight of a finger (g)	Weight of a hand (kg)	Yield in ton/Ha
Libanga likale	Kileka (AAB)	6,181818^{bc}	6,272727^{ef}	7,454545^{efg}	315,72727^{bc}	2,427273^{bc}	8,09091^{efg}
Kamboloso	Kakumbi (AAB)	3,181818^{d}	6,636364^{ef}	4,881818^{g}	297,54545^{bc}	2,018182^{bcd}	5,29091^{g}
Kamaramasenge	Kamera (AAB)	7,181818^{b}	11,727273^{c}	4,781818^{g}	99,54545^{d}	1,381818^{d}	5,26364^{g}
Leese	Mukokoonde (AAB)	6,454545^{bc}	6,909091^{ef}	10,545455^{d}	272,00000^{c}	2,681818^{b}	11,6818^{de}
Andula	Akondo (AAB)	7,363636^{b}	8,363636^{de}	8,636364^{def}	239,63636^{c}	1,490909^{d}	9,54545^{de}
Lokoka	Bonjilo (AAB)	5,727273^{bcd}	10,272727^{cd}	6,700000^{fg}	128,29091^{d}	1,754545^{cd}	7,38182^{fg}
Lokusu	Mbole (AAB)	6,545455^{b}	7,727273^{ef}	11,090909^{d}	366,36364^{b}	1,945455^{bcd}	12,2909^{d}
Losakala	Mudioko (AAB)	11.272727^{a}	12,454545^{bc}	5,5156801^{c}	278,72727^{bc}	2,463636^{bc}	23,7909^{c}
Yangambi Km 5	Ibota (AAA)	12,181818^{a}	15,181818^{a}	38,636364^{a}	124,63636^{d}	1,854545^{cd}	43,790909^{a}
Nguku	Kangindi (AAB)	5.090909^{cd}	5,636364^{f}	9,818182^{de}	314,63636^{bc}	1,781818^{cd}	10,8636^{de}
Tala lola	Mbudi (AAB)	1,00000^{e}	14,454545^{ab}	28,718182^{b}	2772,72727^{a}	28,718182^{a}	30,0364^{b}
p-value		**0,0000******	**0,0000******	**0,0000******	**0,0000******	**0,0000******	**0,0000******

Legend: *Distinct letters next to numbers indicate significant difference, while same letters next to numbers indicate insignificant difference. ****: Very highly significant difference.*

In view of the results recorded in Table 3, it appears that the highest number of hands per bunch was 12,181818 hands for the cultivar Yangambi Km 5 and the lowest number of hands per bunch was one hand for the cultivar Tala lola. Indeed, it appears from the analysis of variance that there is a highly significant difference between the different means of number of hands per regime (p-value = 0, 0000) at the probability threshold of 0, 05%.

The highest number of hands per bunch was 12,181818 hands for the cultivar Yangambi Km 5 and the lowest number of hands per bunch was one hand for the cultivar Tala lola. Indeed, it appears from the analysis of variance that there is a highly significant difference between the different means of number of hands per regime (p-value = 0, 0000) at the probability threshold of 0, 05%. The highest number of fingers per hand was 15,181818 fingers for the cultivar

Yangambi Km 5 and the lowest number of fingers per hand was 6,272727 fingers for the cultivar Libanga likale. Furthermore, the analysis of variance proves that there is a highly significant difference between the different means of number of fingers per hand (p-value = 0, 0000) at the probability threshold of 0, 05%. The highest bunch weight was 38,636364 kg for the cultivar Yangambi Km 5 and the lowest bunch weight was 4,781818 kg for the cultivar Kamaramasenge. On the other hand, the analysis of variance shows that there is a highly significant difference between the different weight means of the diet (p-value = 0, 0000) at the probability threshold of 0, 05%. The highest finger weight was 2772, 7272 g for the Tala lola cultivar and the lowest finger weight was 99, 54545 g for the Kamaramasenge cultivar. The analysis of variance proves that there is a highly significant difference between the different means of weight of a finger (p-value = 0, 0000) at the probability threshold of 0, 05%. The highest hand weight was 28,718182 kg for the Tala lola cultivar and the lowest hand weight was 1,381818 kg for the Kamaramasenge cultivar. Nevertheless, it emerges from the analysis of variance that there is a highly significant difference between the different means of weight of a hand (p-value = 0, 0000) at the probability threshold of 0, 05%. It turns out that the highest yield was 43,790909 t/ha for the Yangambi Km 5 cultivar and the lowest yield was 5,26364t/ha and 5, 29091 t/ha respectively for the Kamaramasenge cultivars and Kamboloso. Thus, the analysis of variance showed that there is a highly significant difference between the different performance means (p-value = 0, 0000) at the probability threshold of 0, 05%.

Correlations of Growth and Production Variables

Indeed, the different correlations established between variable and variable are reported in Table 4 below.

Table 4: Variable and variable correlation

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
Pseudostem Height (X1)											
Diameter at collar (X2)	0,2637										
Leaf area (X3)	0,2637	0,6363*									
Day to flowering (X4)	-0,2487	0,0329	-0,1768								
Number of rejections issued (X5)	-0,2257	0,2103	0,1839	0,0723							
Number of hands/rpm (X6)	0,0574	0,4470	0,6196*	-0,3555	-0,0283						
Number of fingers/Hand (X7)	-0,0786	0,0300	0,1981	-0,1697	-0,2701	0,2864					
Diet weight (X8)	-0,1683	0,2928	0,3153	-0,0052	-0,2230	0,3829	0,6941*				
Weight of a finger (X9)	-0,0750	-0,1754	-0,3964	0,2060	-0,1577	-0,5695	0,3555	0,4133			
Weight of a Hand (X10)	-0,1097	-0,1898	-0,3729	0,1832	-0,1657	-0,5366	0,4164	0,4498	0,9888*		
Yield in t/Ha (X11)	-0,1554	0,3269	0,3539	-0,0171	-0,2123	0,4227	0,6907*	0,9817	0,3635	0,3952	

Legend: *: positive correlation; t: ton; X1-X12: variables; Ha: hectare

The analysis of the results shown in Table 5 shows that the different variables demonstrated sometimes positive or negative correlations between them. Indeed, a positive correlation was noted between the diameter at the collar and the leaf area (r = 0, 6363). We

also noted that there is a positive correlation between leaf area and the number of hands per bunch (r = 0, 6196). A positive correlation was also observed between the number of fingers per hand and the weight of the bunch (r = 0, 6941). Furthermore, there was a positive correlation between the number of fingers per hand and performance (r = 0, 6907); that is to say, the yield increases as the number of fingers per hand increases. On the other hand, a positive correlation was observed between bunch weight and yield (r = 0, 9888); this means that the yield increases as the weight of the bunch increases.

Finally, a positive correlation was observed between the weight of a finger and the weight of a hand (r = 0, 9888); which means that, the weight of a finger increases as the weight of a hand increases.

DISCUSSION

The agro-morphological evaluation study of banana and plantain cultivars (*Musa* spp.) in the Maniema Province in DR Congo, is a key element to determine the level of vegetative and productive performance of banana and plantain cultivars open field collection. Starting with the soil which had borne our crops, we found a quantitative variability of mineral elements which characterize the fertility of the soil of this part of the country; essential support of cultures. These results corroborate those of Dowiya *et al.* (2009) which show that the soils of eastern DR Congo are characterized by a diversity ranging from loam-clay and sandy-loam type, to well-drained clay soils. The water pH ranges from 5, 1 to 6, 5, which is moderately acidic and is in the optimal range for banana with a very acidic bulk soil CaCl2 pH 3, 98 to 4, 59. The Katana/Luhihi division, which constitutes the most important source of East African high altitude banana (EAHB) in South Kivu, is characterized by soils with a pH of 6, 2 in water and 5, 8 in CaCl2. We found a strong agro-morphological variability of banana and plantain cultivars. The Losakala cultivar showed the highest pseudostem height (2,97m) and highest collar diameter (5,838182cm). The Yangambi Km 5 cultivar achieved a higher leaf area (15,084 cm2). The Nguku cultivar flowered late, 369 days after planting. The Kamboloso cultivar has a very high number of suckers, on average 8 suckers in the first cycle. These results are completely true, when compared with those of other researchers in the past. Thus, this strong agro-morphological variability could be attributable to genetic differences in banana plants in comparison with the results of Magee (1953). These results also relate to those of Carreel (1994) in his study on the evaluation of genetic diversity in diploid bananas (*Musa* spp.). Mobambo *et al*. (2018) noted in semi-controlled cultivation (macropropagation) a strong proliferation which is strongly dependent on the cultivar. Dhed'a (2011) reports that the emission of suckers depends on the axillary buds and the number of leaves. According to the same author, the banana tree is in its state of balance from the lateral buds ensuring the sustainability of the plant. He continues by specifying that the bulb changes functions depending on whether the banana tree is in the vegetative phase (production of leaves and shoots) or whether it is in the fruiting phase "diverts" all the energy of the plant for its own benefit and uses it to raise the terminal bud of the horn in the pseudo-trunk made up of leaf sheaths intertwined one inside the other. Indeed, Gary (1973) obtained similar results to us, in his research on the study of the development of the banana leaf system as a function of temperature. The different variables sometimes correlated positively or negatively with each other. We noted a positive correlation between collar diameter and leaf area (r = 0, 6363). We also noted a positive correlation between leaf area and the number of hands per bunch (r = 0, 6196).

CONCLUSION

The general objective of this study was to evaluate the agro-morphological performance of banana and plantain (*Musa* spp.) cultivars collected and cultivated in the open field at PK17,

Kimbembe Village in the Maniema Province, Democratic Republic of Congo. A single factorial design of elongated plots with 11 repetitions and 11 cultivars was set up. Thus, the results obtained showed that there is a strong agro-morphological variability of banana and plantain cultivars expressed in vegetative and production performance which is due to genetic differences of the cultivars. The growth parameters (height of the pseudo-stem, diameter at the collar, leaf surface, day at flowering and the number of suckers emitted per plant) and production (number of hands per bunch, number of fingers per hand, weight of a finger, bunch weight and yield) contribute very significantly to determining the agro morphological performance of banana and plantain cultivars. The Losakala cultivar presented a higher pseudostem height (2,97m) and a higher collar diameter (5, 838182 cm) than the other cultivars. The Yangambi Km 5 cultivar achieved a higher leaf area (15,084 cm2). The Nguku cultivar flowered late, 369 days after planting. The Kamboloso cultivar has a very high number of suckers, on average 8 suckers in the first cycle. The best yields were obtained with the Yangambi Km 5 cultivar (43,7t/ha) for bananas and the Tala lola cultivar (30 t/ha), followed by the Losakala cultivar (23,7t/ha) for plantains.

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