Physical characteristics of raw materials of 12 genotypes of plantain

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Ethics: The activities, which led to the production of this document, were assessed and approved by the CIRAD Ethics Committee (H2020 ethics self-assessment procedure). When relevant, samples were prepared according to good hygiene and manufacturing practices. When external participants were involved in an activity, they were priorly informed about the objective of the activity and explained that their participation was entirely voluntary, that they could stop the interview at any point and that their responses would be anonymous and securely stored by the research team for research purposes.

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ABSTRACT

Aloco or fried plantain is highly prized a local dish in Côte d'Ivoire. However, its production mainly relies on traditional banana varieties, which face numerous challenges due to climate change. The development of new plantain varieties more resistant to climatic hazards and offering higher production yields would be a significant relief for the population. This report describes the physical characteristics of different plantain genotypes used in the preparation of aloco. A total of 58 plantain bunches from 11 genotypes (Saci, French sombre, French Clair, Orishele, SH3640, Fhia 21, Zakoi, Big Ebanga, Corne bout rond, Pita3, corne1) were analyzed. The study focused on key parameters, including finger weight, circumference and length, pulp and skin mass. The results revealed that the Zakoi genotype displayed the lowest parameter values. Overall, the finger lengths of the plantain genotypes ranged from 17 to 21.3 cm, with circumferences between 10.25 to 13.25 cm. Finger mass varied from 80g to 163.95g, while pulp mass ranged from 41g to 93.89g and skin mass from 38g to 71.45g.

Key Words: aloco, plantain, finger, physical parameter, pulp, bunches, quality

INTRODUCTION

As part of the RTB Breeding project, Côte d'Ivoire, through the CNRA, is focusing on key agricultural crops and related ready-to-eat product pounded yam and aloco for yam and plantain, respectively. *Aloco* is a traditional Ivorian dish made by frying ripe plantains, and its production traditionally relies on several local plantain varieties. However, these varieties face constraints such as low yields, susceptibility to diseases, water stress, and the impacts of climate change. To address these challenges, new plantain varieties have been developed to better withstand climatic conditions and contribute to food security. Despite their good agronomic performance, these hybrid remain less preferred by consumers, particularly in the preparation of traditional dishes as *aloco* and *foutou banane*. Ensuring their suitability for local culinary uses is essential for their adoption by local populations.

As part of the RTB Breeding project, this report describes the physical characteristics of plantain varieties used for aloco production, providing insights into their potential for broader adoption.

1 MATERIAL AND METHODOLOGY

1.1 Material

The plant material consisted of 11 plantain genotypes from the CNRA collection in Anguededou. These genotypes include Saci, SH3640, Corne1, Big Ebanga, Corne bout rond, French Sombre, French Clair, Orishele, Pita3 and Zakoi. A total of 114 plantain bunches, representing these 11 genotypes, were received by the CTPA program in Bingerville, among which 48 were used for the physical characterization activity (Table 1).

Table 1 : Number of bunches per plantain genotypes used

Plantain genotype	Number of bunches
Orishele	04
Corne bout rond	04
Pita3	5
SH3640	8
French Sombre	5
French Clair	7
Corne1	2
Big Ebanga	4
Saci	5
Fhia21	3
Zakoi	1

7

1.2 Methodology

Physical analyses were conducted on the middle finger of the 2nd hand, as well as the 2 adjacent fingers from each plantain bunch. If a plantain variety has several bunches, a random selection was made to determine which bunches would be used for Quantitative Descriptive Analysis (QDA). In such cases, the analyses are carried out on the fingers of the chosen bunches. If a variety had a few bunches, the analyses were carried out on the middle finger and an adjacent finger, both located on the second hand.

Physical parameters analyzed included finger length, circumference, pulp and skin mass. Mass measurements were taken using a precision balance (0.1g accuracy), while lengths were measured with a tape measure. The analyses were performed following the method of Dadzie and Orchard (1997).

1.3 Statistical analysis

Results were analyzed using XLSTAT (version 2019.2.2.59614). One-factor ANOVA tests and principal component analysis (PCA) were performed.

2 RESULTS

2.1 Average length of finger

The plantain fingers lengths are presented in figure 1. Overall, there was a significant difference among genotypes. Statistical analysis classified the plantains into 3 groups. The first group comprises the Zakoi and SH3640 genotypes, with finger lengths ranging from 17 to 17.5 cm. The second group includes Corne bout rond, Pita3, French Sombre, Corne1, Fhia 21 Orishele and Big Ebanga genotypes. Genotypes of French Clair and Saci represent group 3, with average finger length exceeding 23 cm.

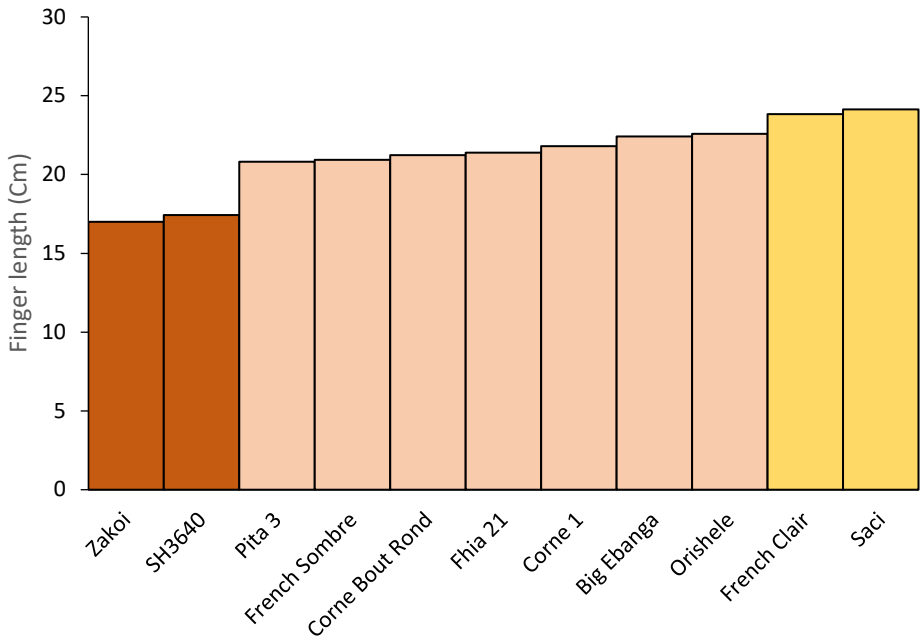


Figure 1 : **Average length of plantain finger**

2.2 Circumference of plantain finger

Average plantain finger circumferences vary according to the genotypes (Figure 2). The Pita3 genotype shown the highest average circumferences at 13.25 cm, followed by Saci with 12.83 cm and Corne bout rond with 12.73 cm. In contrast, the Zakoi genotype was the smallest average circumference, measuring 10.25 cm. Three groups of plantain were observed on the basis of finger circumference. The first represented by Zakoi, French Sombre, SH3640, Corne1, Fhia21 et French Clair. The second group is composed of Big Ebanga, Orishele, Corne bout rond and Saci. The last group is only composed of Pita3.

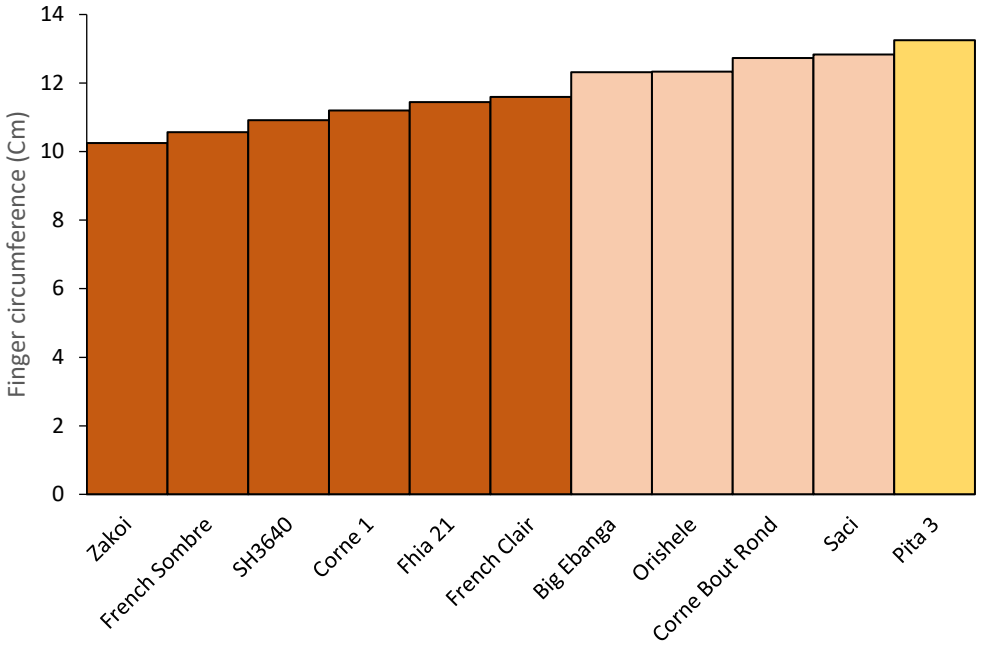


Figure 2 : **Circumference of plantain finger**

2.3 Finger mass

Figure 3 presents the average finger masses of the different plantain genotypes. Zakoi variety presented the lowest finger mass, while Corne bout rond variety had the highest. Overall, finger mass varies among plantain genotypes from 80 to 160 g. Based on finger mass, the plantain genotypes can be classified into 5 groups with the 2 extreme being composed of Zakoi, SHA3640 and French Sombre, and Pita 3, Saci and Corne Bout Rond.

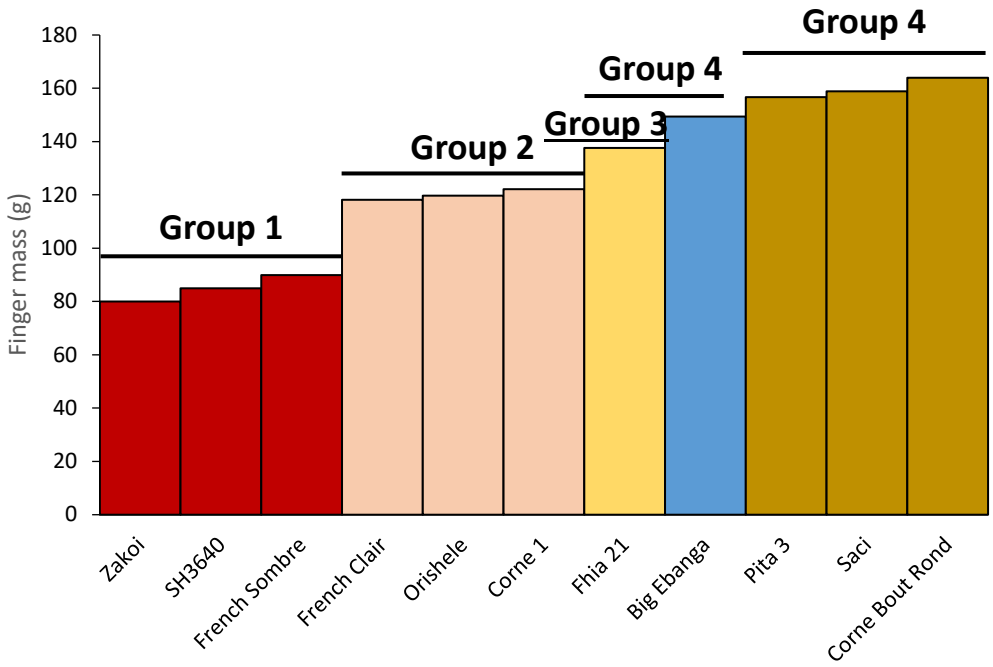


Figure 3 : Mass of plantain fingers

2.4 Pulp mass of finger

Plantain pulp mass are shown in Figure 4. The average pulp mass was ranged from 41 g for Zakoi to 93.89 g for Pita 3. Significant differences in pulp mass were observed between plantain genotypes which can be classified into 5 majors groups including SH3640, Zakoi and French Sombre (group 1), Orishele, French Clair and Corne 1 genotypes (group 2) and Corne bout rond and Pita 3 (group 5). Big Ebanga and Saci (group 4) can be considered as intermediary varieties. Fhia 21 is alone in the group 3.

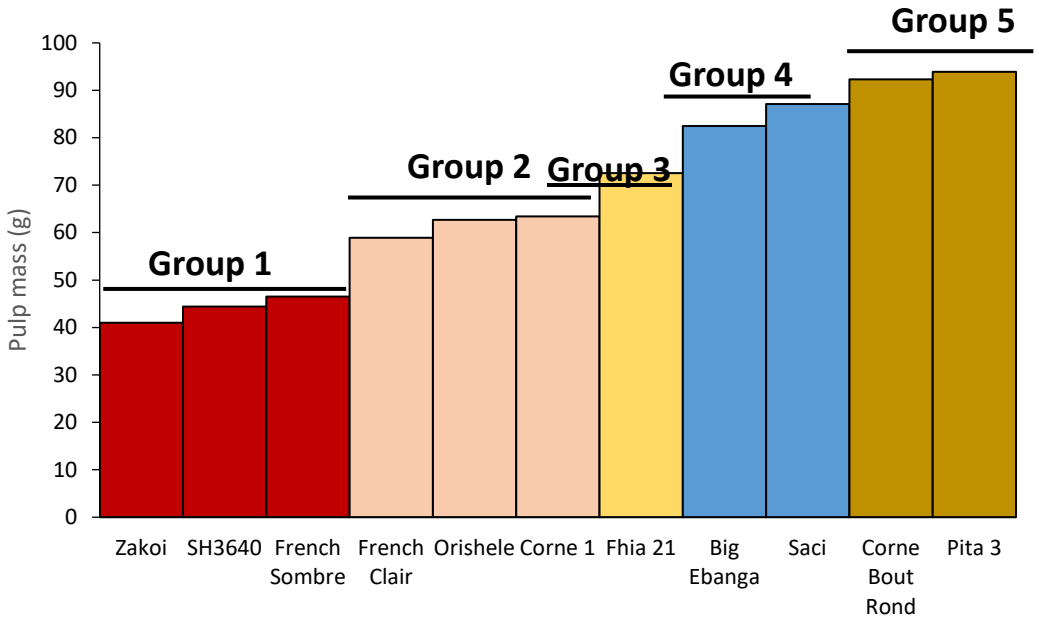


Figure 4 : Plantain pulp mass

2.5 Mass of peel fruit

The value of fruit peel mass values are shown in Figure 5. Overall, significant differences were observed between plantain genotypes with the values mass ranged from 38 g for Zakoi to 71.45 g for Saci. According to the peel mass, all genotypes can be classified into four groups including Zakoi, SH3640 and French Sombre (groupe1, French Clair, Orishele and Corne 1 (group 2), Pita 3 and Fhia 21 (group 3) and finally Big Ebanga, Corne Bout Rond and Saci (group 4).

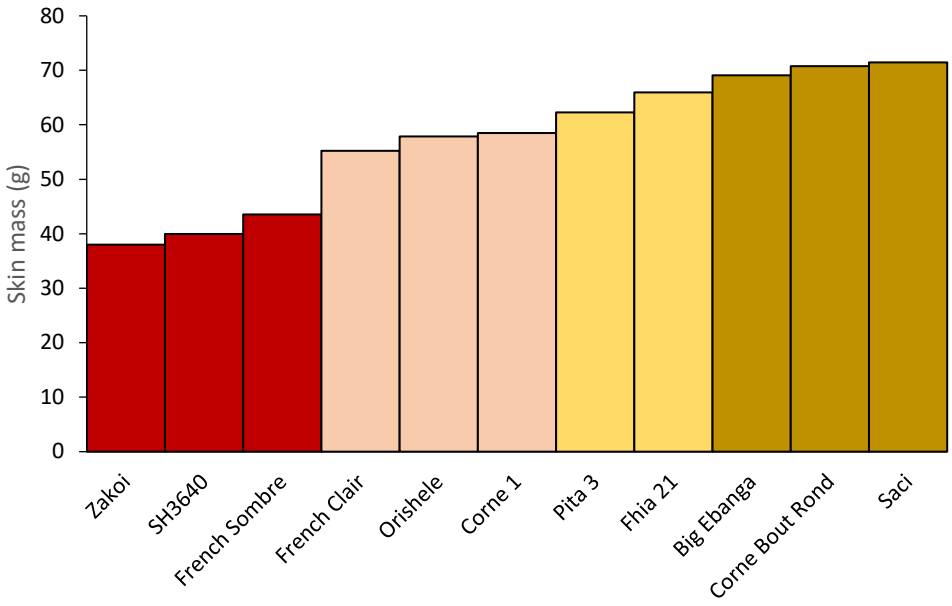


Figure 5: Finger skin mas

2.6 Principal component analysis of plantain genotypes

Axes 1 and 2 expressed 84.09% of the physical parameters of the plantain genotypes. The figure 6 shows four groups of plantains. The first group is made up of genotypes Zakoi, French Sombre, SH3640 and French Clair. The second group is represented by Corne 1, Fhia21 and Orishele. The Big Ebanga, Saci and corne bout rond genotypes made up the third group. Pita 3 is alone the genotype of last group.

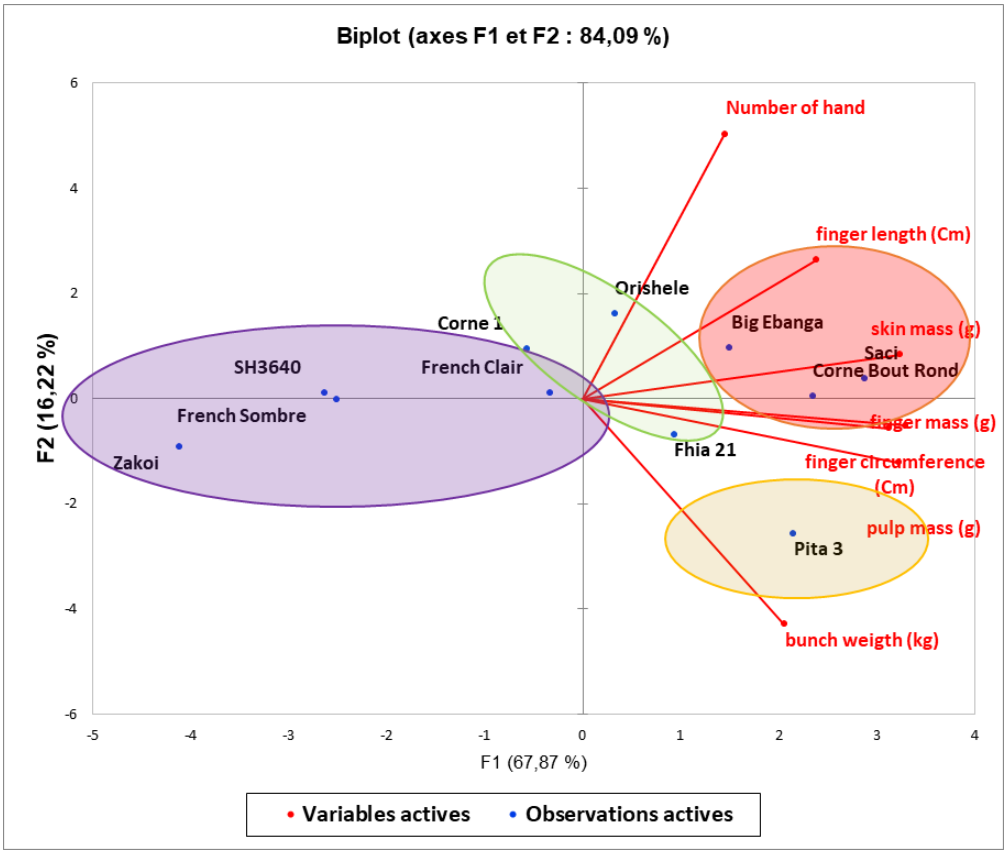


Figure 6 : ACP of plantain genotypes

2.7 Hierarchical ascending classification of plantain genotypes

Hierarchical classification of plantain genotypes on the basis of their physical parameters revealed 4 groups: the first group represented by Pita3, the second group composed of Corne bout rond, Saci and Big Ebanga, the third group represented by Fhia21, Orishele and Corne1 and the last made up of French Sombre, French Clair, Zakoi and SH3640 (figure 7).

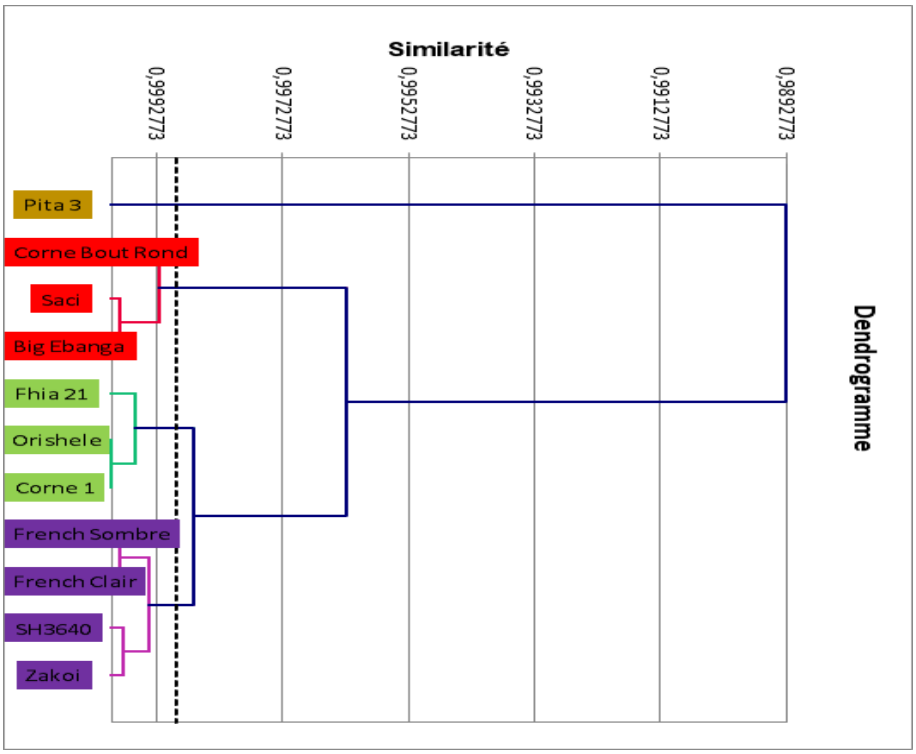
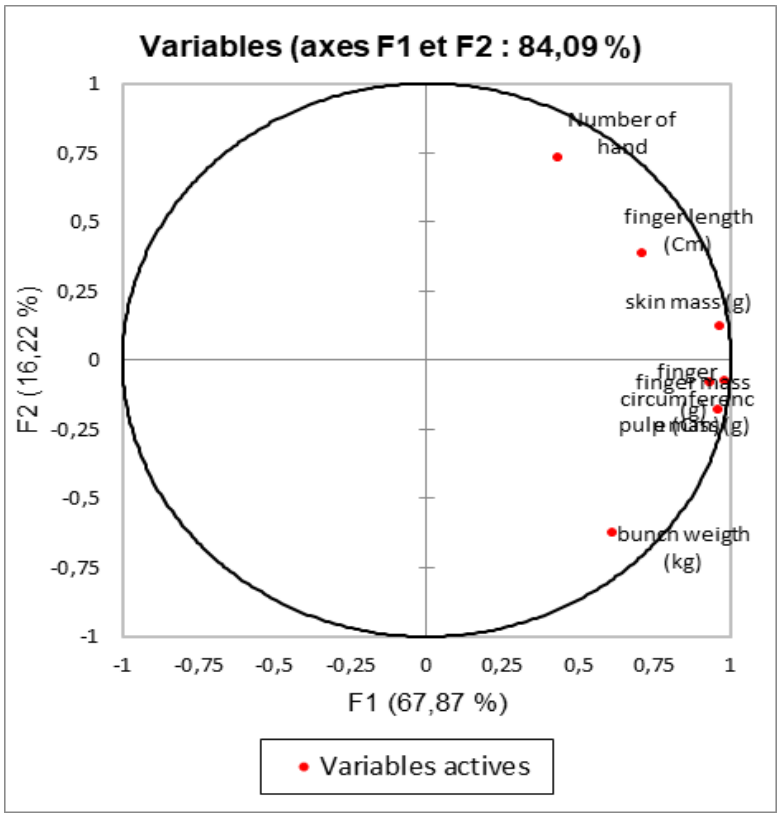


Figure 7: Hierarchical ascending classification of plantain genotypes

APPENDICES

Annex 1: Pearson Correlation matrix



Annex 2: Discriminant analysis of physical characteristics of 11 genotypes of plantain

Variables	Weigth of bunch (kg)	Number of hand	Length of finger (Cm)	Circum ference of finger (Cm)	Finger mass (g)	Pulp mass (g)	Skin mass (g)
Weigth of bunch (kg)	**1**						
Number of hand	-0,009	**1**					
Length of finger (Cm)	**0,178**	**0,366**	**1**				
Circumference of finger (Cm)	**0,583**	**0,358**	**0,583**	**1**			
Finger mass (g)	**0,585**	**0,333**	**0,638**	**0,905**	**1**		
Pulp mass (g)	**0,626**	**0,269**	**0,546**	**0,923**	**0,988**	**1**	
Skin mass (g)	**0,475**	**0,463**	**0,731**	**0,825**	**0,967**	**0,922**	**1**

Values in bold are different from 0 at significance level alpha=0.95