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Study of the Evolution of the Vegetable Architecture of 27 Manioc Cultivars (Manihot Esculenta Crantz) in Bengamisa, Tshopo in DRC

Valentin Lomboko O[1], Ruffin Mbuse [2], Claude Mozenga[3] and Albert Okungo L[4]

[1,2].Phytotechnie Laboratory, Institut Supérieur d'études agronomiques de Bengamisa R.D CONGO

[3].Laboratory of Applied and Functional Entomology, InstitutFacultaire des Sciences Agronmiques de Yangambi (LENF-IFA)

[4].Plant Ecophysiology and Nutrition Laboratory. Institut Facultaire des Sciences Agronomiques de Yangambi R.D CONGO.

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ABSTRACT

A study was carried out to evaluate the plant architecture of 27 local cassava cultivars (Manihot esculenta Crantz) in the Bengamisa region. The aim was to find out which cultivars could be used as monocultures or in crop associations for better weed control. We used a randomized complete block design with 27 treatments (27 cultivars) repeated four times. These parameters were measured: height of first branch, number of branches and petiole length after three months' planting. The results obtained showed that the 27 cultivars gave three groups of cultivars in relation to the height of the first branching and the number of branches (early, medium and late cultivars). They also showed that there are early cultivars that can be used in monoculture for better weed control (Apolina, Adjele and Atua); medium cultivars that can be used for both cropping systems (pure or associated) and late cultivars, better indicated for crop association.

1. Introduction

Cassava is a Euphorbiaceae cultivated in tropical regions mainly for its tuberized roots and secondarily for its iron- and magnesium-rich leaves, consumed as a vegetable in several Sub-Saharan African countries, although no data are available on the quantities produced (Aduni et al., 2005). It is an important source of calories for much of the world's population. It is the fifth most important foodstuff in the world after wheat, rice, maize and potatoes, and feeds over 700 million people in Sub-Saharan African countries (FAOSTAT, 2009).

In the Democratic Republic of Congo (DRC), cassava plays a particularly important role in the diets of the rural households that produce it. The tuberized roots lend themselves to a variety of culinary uses (Foufou, Chikwangues, Gari,) (Nweke et al.2002), while the leaves are consumed as a vegetable (Achidi et al., 2005).

In the Bengamisa region of Tshopo province, several cassava cultivars are grown. Farmers distinguish them by the morphology and coloration of organs such as leaves, petioles, stems and tuberized roots. Other farmers, however, distinguish them by plant habit, cycle length, yield, processability and taste.

Cassava varietal improvement aims to offer growers varieties that perform well in relation to key selection criteria, including high yield, resistance to pests and diseases, good root dry matter content, low hydrocyanic acid content, as well as any other criteria of local importance (N'Zué, 2018).

Under normal conditions, many cultivars produce two types of branching: trichotomous or sylleptic, which originates from the transformation of the terminal apex into a floral axis. This transformation leads to the simultaneous emission of 2 to 4 vegetative or sylleptic axes, which in turn flower and develop new axes, and a lateral or proleptic one that originates from lateral buds on the lower part of the stems (Litucha, 2010).

2. Materials

The plant material for this study consisted of 27 local cassava cultivars collected from nine production basins in the Bengamisa region (Bawi, Bayangene, Bangdwade, Badambila, Bandima, Babise-Bamboli, Ngelema, Mara and N'sele):adjakuladose,andjele,agbokombi,akokoli,alongata,amanamolisa,apolina,atua,bakpele,bibisombe,dale,dirigeant,kelenga,kobe,linzanza,makpele,mbongo,mondangi,mombebe,mondjala,mopute,motomboki,muzungu,mwasizomba, ngela, ngonge and zakando . The collection was made in collaboration with the farmers, who gave us these names in the local language. Technical equipment: tape and slat measure, calipers, data collection sheets, computer, etc.

3. Methods

a. Experimental design

The experimental set-up adopted was that of completely randomized blocks with 27 treatments and four replications, the treatments were local cassava cultivars, the distance between blocks was 4 m, the elementary plot measured 25 m long by 1 m (one line represented one plot) wide, i.e. an area of 25 m² with a total of 25 plants per plot. The plots were rows of 25 plants randomized as shown in figure 01. The 15-20 cm cuttings were placed horizontally on the ground at spacings of 1x1m. Each elementary plot was labelled (cultivar name).

Tele:
E-mail address: lombokovalentin.o@gmail.com

b. Data collection

Observations were made three months after planting. The following parameters were measured: height of first branch and petiole length using a lath, and number of branches by counting.

c. Statistical analysis

The data were subjected to single-factor analysis of variance using Graph Pad Prism 5 software, and a Bonferroni post hoc test was also performed to identify different cultivars at the 5% significance level.

4. Results

A. Height of first branching

This paragraph presents (fig.1) the height at which branching of local cultivars began in our experimental field, three months after planting.

Figure 1 shows that of all the local cultivars studied, the Makpele cultivar did not reach its branching height after three months of planting. Also, the cultivaralenga had its first branching at 1.5 m in height, and the cultivar Apolina is the earliest in terms of first branching, which occurred at less than 0.5 m. In terms of first branching, these cultivars can be divided into three categories: only three are the earliest, starting their first branching between 0.4 and 0.65 m (Apolina, Adjele and Atua), which can quickly control weeds ; 10 cultivars are medium-early, with first branching between 0.75 and 1.01 m (MwasiZoba, Mondjala, Mombembe, Dale, Bibisombe, Dirigeant, Mbongo, Amenamolisa, Alongata, Mozungu and Kobe) and 12 cultivars are late, with first branching above 1 m in height (Muzungu, Agbokombi, Adjakuladose, Mopute, Bakpele, Ngela, Akokoli, Linzanza, Mondangi, Motomboki, Ngonga and Kelenga), which can be grown in association with other (vegetable) crops for better weed control. Analysis of variance showed a highly significant difference between cultivars (P=0.0001). However, Bonferoni's post hoc test showed a highly significant difference between late and early cultivars (P=0.0001), a highly significant difference between some late cultivars and medium-late cultivars and between some medium-late cultivars (P=0.001) and early cultivars; also, a significant difference between some late and medium-late cultivars (P=0.01). On the other hand, no difference was found between certain cultivars in these three categories (P>0.05).

a. Number of branches

The number of branches per cultivar is shown in Figure 2 below.

This figure also shows three categories of cultivars: cultivars with more than 3 branches (Ngela, MwasiZoba and Atua), which are well suited to weed control. The second category is made up of cultivars (7) that have produced 3 offshoots that can control weediness well, and the third is made up mainly of cultivars that have had at least two offshoots and have average control. Analysis of variance showed a highly significant difference between these cultivars (P=0.0001).

b. Petiole length

This point shows the petiole length for each cultivar studied in comparison with the others (fig.3).

Figure 3 shows that there are only two cultivar categories: the first is made up of cultivars with petioles measuring between 2.7 and 3 cm, and the second comprises only 8 cultivars with petioles between 3.2 and 3.75 cm (Mbongo, Ngela, Agbokombi, Adjakula, Bakele, Linzanza, Makpele, Mondangi, Akokoli and Kalenga). Analysis of variance showed a highly significant difference between the two cultivar categories (P=0.0001).

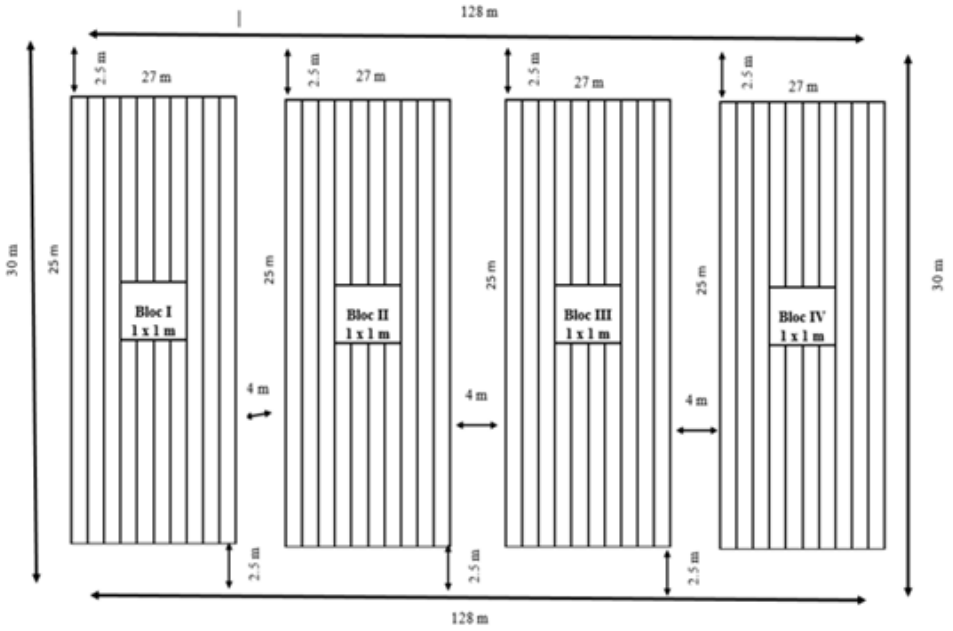
5. Discussion

The cultivars studied from a plant architecture point of view were divided into three categories with regard to the height of the first branch and number of branches, which corroborates the studies of Gmakouba et al. (2017); also those of Djaha et al. (2017). This gives farmers a choice in establishing a cassava field knowing the characteristics of each cultivar. It has been shown that early-branching cultivars (Apolina, Adjele and Atua) + are best indicated for weed control by depriving weeds of light very early and also reducing production costs (Bakayoko et al., 2013) and late-branching cultivars are better indicated for crop association. For the rest, the choice of one or other cultivar will depend on the farmer himself according to his objectives (pure or associated crop). These cultivars also offer breeders a wide choice for the creation of hybrids adapted to farmers' realities. In terms of petiole length, these cultivars have been grouped into just two categories. The majority were cultivars with a petiole length of 30 cm, and only 9 had a petiole longer than 30 cm, enabling them to cover a given area and control weediness.

6. Conclusion

The aim of this study was to investigate the evolution of the plant architecture of 27 local cassava cultivars in the Bengamisa region, in order to determine which cultivars could be used in monoculture or intercropping. A randomized complete block design with 27 cultivars (treatments) repeated four times. First branch height, number of branches and petiole length were studied after three months of planting.

The results showed that the 27 cultivars gave three categories in terms of height of first branching and number of branches. The study showed that there are early cultivars that can be used in monoculture for better weed control; medium cultivars that can be used for both cropping systems; and late cultivars that are better suited to intercropping.



Experimental design

Legend: Total area: 3840 m²; block area: 675 m² (25 m x 27 m); distance between blocks: 4 m; aisles: 2.5 m; spacing: 1 x 1 m.

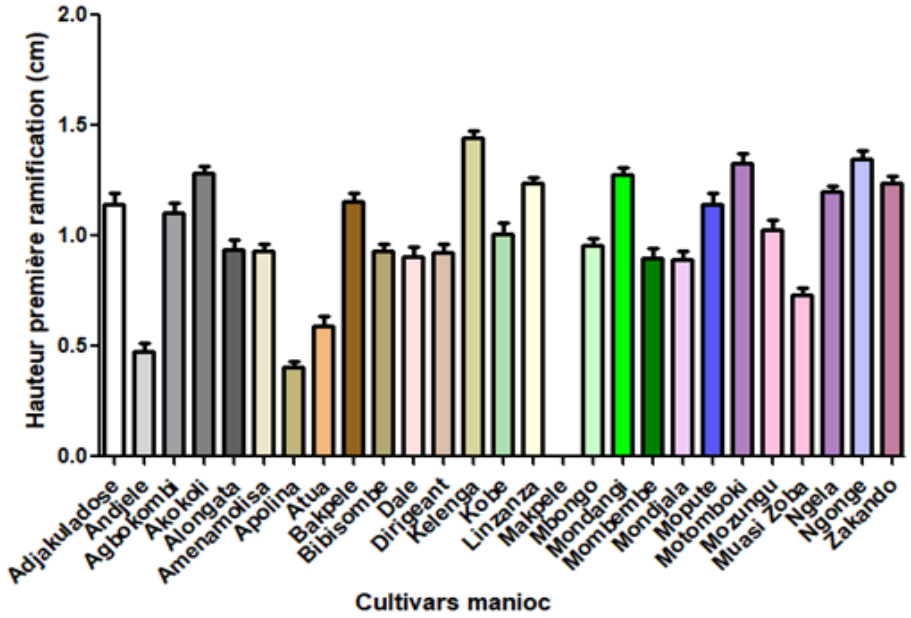


Figure 1. Height of first branching

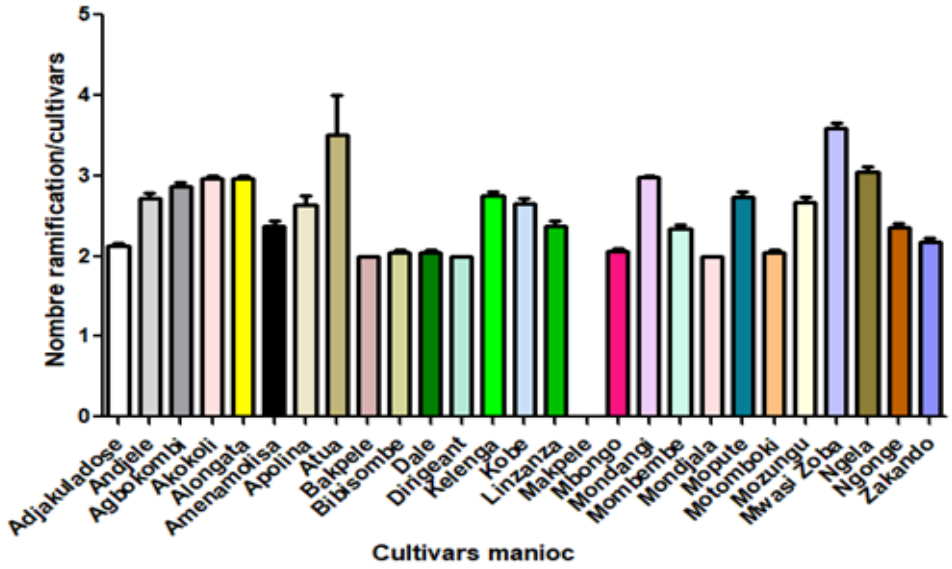


Figure 2. Number of branches

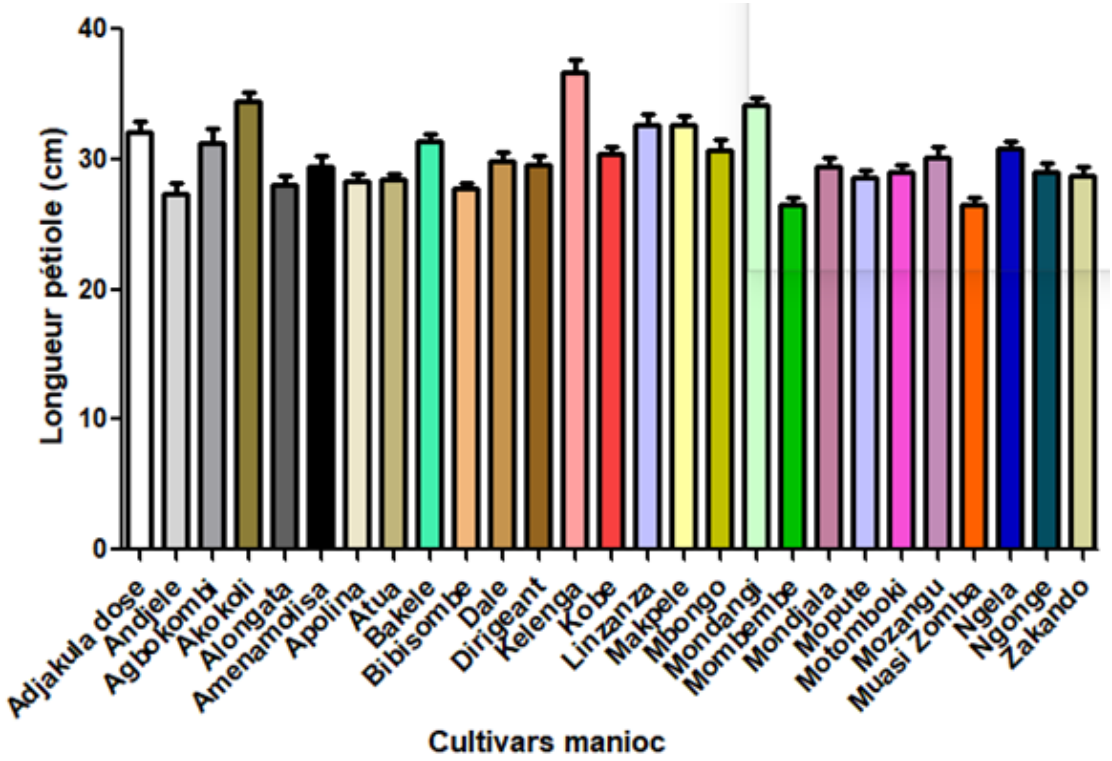


Figure 3. Petiole length (cm)

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