# *Original Research Article*

## Effect of Pruning on Disease Incidence and Development of a Variety Local Cassava (Manhiot Exculentus C.)


### ABSTRACT

This study was carried out within the Nkoemvone agricultural research station in southern Cameroon, on cassava in September 2022. Its aim was to provide farmers with the right cultivation techniques so that they can improve their yield. The objective of this work is to evaluate the effect of pruning on the growth of cassava stems. It is specifically a question of looking for the right period in which to operate the pruning among which (T1= pruning in rainy weather; T2= in the absence of rain and T0= not pruned) on two parameters which are in particular the number of regrowth and the presence of diseases more specifically mosaic. The study was conducted on 150 stems, i.e. 50 per treatment. The ANOVA allowed us to do the different analyses. The protocol used to assess the effect of size is a completely randomized design. The results show that there is a significant difference between T0, T1 and T2 with the respective averages T0= 2, T2= 4 and T1= 6 regrowths per stem. In addition, significant differences were observed for severity, well illustrated here by the severity index, which is 16.8% for T1, 19.6% for T0 and 63.8% for T2. These results teach us that cuttings should be harvested during the rainy season for the sustainability of a seed field and pruning during this season would reduce the presence of diseases. On the other hand, pruning in the dry season is very harmful and could even lead to the drying out of the stems.



*Keywords: pruning, apical dormancy, severity index, severity, cassava stem*


## • INTRODUCTION

Cassava with the scientific name *Manihot esculenta* Crantz is native to Central America in Brazil, Paraguay, Colombia and Venezuela. It was introduced to Africa by the Portuguese at the end of the 16th century [9]. Cassava belongs to the Euphorbiaceae family, the cultivated species is *Manhiot esculenta*, all species of the Manihot genus have 2n = 36 chromosomes which sometimes favors sexual reproduction when creating new varieties [17]. Depending on the variety, cassava can measure between 1 to 6 meters in height and present several architectural types related to its mode of branching. The tuberization of its roots can go on cycles of 6 months to 3 years and a cutting can produce one or more stems compared to the medium where it is [10]. The leaves are alternate, simple and deciduous with different colors ranging from green to purple red. The flowers form an inflorescence and the fruits are dehiscent capsules with 3 lobes, each containing one seed [13]. Cassava roots are divided into bundles of tubers measuring between 30 and 50 cm long by 5 to 10 cm in diameter. Each tuber can weigh between 2 and 5 kg [4]. Cassava has the advantage of being sold from the leaves to the roots. The tubers can be subjected to different transformations, which increases its potential for local industrial growth, and which allows the transport of products nationally and internationally cassava tubers [15].

Cassava is a primary food for more than 800 million people in the world and 500 million in Africa [18]. It is the 6th most important food crop after wheat, rice, maize, potato and barley worldwide [14]. Cassava represents 32% of the world production of food tubers after the potato which contributes to a rate of 45% of the total, 13% for sweet potato, 8% reserved for yams and the remaining 2% for other roots and tubers [1]. Cassava production is about 250 million tons per year in the world, and therefore 47% of global production held by Africa with Nigeria in the lead then the DRC, Angola, Ghana and Mozambique Then 33 % for Asia including Thailand, Indonesia, India, China and Vietnam and finally

20%. For Latin America. Currently, cassava production in Cameroon is relatively low, varying between 1,000 and 200,000 tons per year and 10 to 30 tons per year and per hectare [2]. In 2020, Cameroon ranked 16th in the world with a production of 4.9 million tonnes per year [3].

Improving the productivity and efficiency of the cassava sector will require the knowledge of much more advanced techniques to greatly reduce current imports, not only of rival products but also to slightly reduce cereal imports from major countries. producers such as Russia and Ukraine. By observing several fields and conducting a few small surveys we have found that some practices are done lightly, it is here about pruning. Pruning is a technique that allows you to rid the stem of all kinds of bulky elements, to optimize its potential. It is done at several levels, firstly eliminating the dwarf and thin stems, which are considered the gourments, to leave only one or two healthy stems. Second subtract diseased branches, too inclined or very high finally to balance the stem. Trimming cassava stems would seem to some farmers as a technique with little significant effect on the development and even on the yield of the latter. Pruning is a cultural technique that is practiced in cassava, sweet potato and even cocoa to reduce the height and length in these species. Pruning also reduces apical dormancy (this is a biological phenomenon that contributes to the main stem growing vigorously to the detriment of secondary branches). The apical crown uses enough water and improved sap for its growth and this does not allow the plant to store carbohydrates in the tubers in an efficient way. Many growers prune simply to reduce the height, others by follow-up and some even if they know the importance of this technique, the fact remains that the majority do it in a hazardous way. without taking into account the right time, the level of development of the plant, the weather and even to the detriment of certain deficiencies and diseases observed in the plant. With a view to providing an answer to all these concerns highlighted above for an improvement in cassava yield, once its potential is fully expressed by applying cultural practices ensuring good vigor and that the constraints exerted on production will be reduced through the acquisition of appropriate techniques. This study is undertaken to evaluate the development of cassava that has undergone pruning compared to stems that have not undergone this practice with regard to regrowth and susceptibility to diseases.

## 2. MATERIAL AND METHODS

### 2.1 Materials

### 2.1.1 Study site

The work was carried out in the plots of the IRAD station of Nkeomvone in the locality of Ebolawa. This site is located in the agro-ecological zone of Cameroon, in particular zone V called the wet forest zone with bimodal rainfall. The area is located in the tropical region in the south of the country, characterized by four seasons, including two dry seasons and two rainy seasons. The small dry season which goes from June 30 to August 15 and the big dry season from November 15 to March 15 and the rainy season from March 15 to June 30 for the big one and from August 15 to November 15 for the big one this taking into account the changes climatic.

#### 2.1.2 Biological material

The biological material used for the test is a local variety taken from the field of a native in the locality of Ebolawa. This local variety is called (Ecobeli) in the vernacular and it has a development cycle ranging from 09 to 12 months. Its production is less expensive and generally gives a high yield under optimal maintenance conditions. The morphological criteria in the field can be observed on (fig.1).

**Fig.1. image of a stem of the local variety used (march to august 2022).**

### 2.1.3 Statistical analysis

To analyze and compare the different treatments we used an analysis of variance (ANOVA) finally to determine the correlation that may exist between the results obtained in the field at a threshold by 5%.

## 2.2 METHODS

### 2.2.1 Experimental device

The trial was set up on March 1, 2022 on a 450 m² plot, respecting the spacing of 1m between the lines and 1m between the pockets. The stems of the 03 treatments were randomly selected over the entire plot, vigorous and well-developed stems were chosen. The first treatment was carried out 03 months after sowing precisely on May 30 on 50 stems at random throughout the extent of the field. The second treatment was done a month later, on July 1 of the current year and finally, the absolutely uncut stems were the witness. This allowed us to observe 150 stems and therefore 50 per treatment. Data collection began after a month and a half (August 15 to be precise) after the second treatment. The treatments were defined as follows: T0 corresponds to the unpruned control, T1= pruning during the rainy period and T2 = pruning when the rain stops. The evaluation of these different treatments was made on parameters such as the number of regrowth on the pruned stems and for the control we considered the branches of the first ramification and finally the presence of diseases.

### 2.2.2 Evaluation of the number of regrowths on the treatments

The evaluation of the number of regrowths per treatment was made by counting the regrowths on the pruned stems and for the control, the branches of the first ramification. A number of volunteers will allow us to estimate the quantity of cuttings that we could have in the case of a seed field.

### 2.2.3 Evaluation of the degree of disease on the treatments

The degree of disease on the level of the treatments was evaluated by observing the stems attacked finally to determine the severity and the severity index of the 03 three treatments then compare them. This allowed us to say precisely which treatment is less sensitive or more tolerant. To assess the severity, five classes were used to measure the intensity of the symptoms, then the severity index was calculated using the following formula: Severity index (SI in %) = $(\sum(N_i \times S_i)/(N_t \times 5)) \times 100$ [6].

$N_i$: Number of plants in severity class i, i ranging from 1 to 5.

$S_i$: Severity class number.

Nt: Total number of plants observed per treatment

0: no symptoms.

1: slight attack covering less than 20% of the leaves.

2: slight attack less than 50% of the leaves.

3: attack involving a very large number of leaves.

4: attack affecting all the leaves, with a reduction in the leaf area.

5: An intensity of 5 is sometimes used and applies when there is deformation and reduction of leaf surfaces (fig.2).


**Fig.2. The five severity classes and the symptoms observed in field**

## 3. RESULTS AND DISCUSSION

### 3.1 Results

The results obtained showed some variation of the different treatments on parameters such as the number of regrowths and susceptibility to diseases

#### 3.1.1 Effect of pruning on the number of regrowths

The number of regrowths, represented here by the branches of the first node for the absolutely untreated control (T0 = voluntary ramifications) varies from 1 to 3 regrowths per stem selected. The number of regrowths of the treatment (T1= pruning during the rainy period) varies from 4 to 8 regrowths per stem studied. The number of regrowths of the treatment (T2 = pruning when the rains stop) varies from 2 to 6 regrowths per stem (fig.3). Similarly, the analysis of variance shows that there is a significant effect between these three treatments on the number of regrowth (Table 1). In order to better visualize this result, we then drew a regression line which shows a normal distribution of the facts (fig.4).

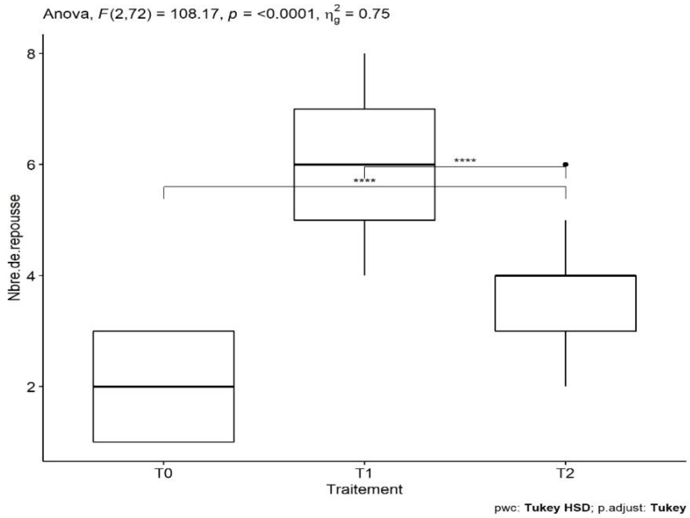


**Fig.3. Number of regrowths according to the different treatments Table**

**Table1. ANOVA of the effects of treatments on regrowths**

| **Effect** | DFn | DFd | F | p | p<.05 | ges |
|---|---|---|---|---|---|---|
| **Treatment** | 2 | 72 | 108,173 | 2,03E-22 | * | 0,75 |

*indicates a significant effect at the 0.0001 level

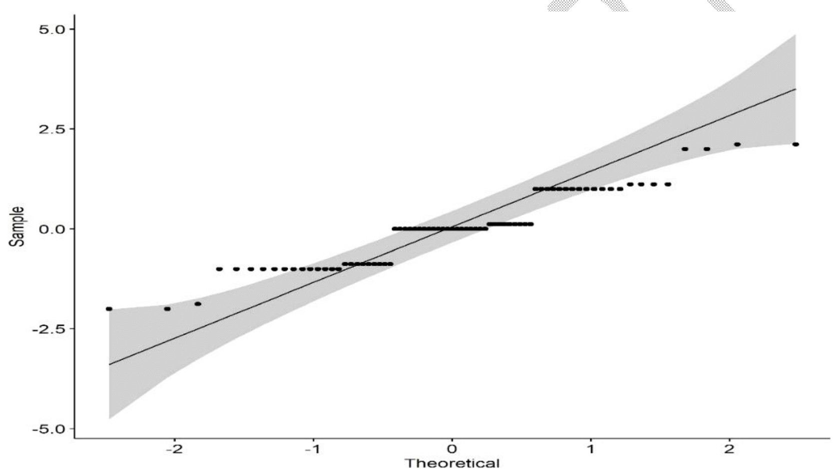


**Fig.4. The regression curve of the number of regrowths**

### 3.1.2 Effect of pruning on the presence of diseases

The presence of diseases according to different treatments was made based on the severity and the severity index of each treatment. The average severity varies from one treatment to another ranging from 1.2 for T0, 1 for T1 and 3.1 for T2 illustrated by (fig. 5). The results indicate that the degrees of severity of the stems of the treatments T0 and T1 are less important, remaining around 1 compared to T2 which is greater than 3. At the same time, an analysis of variance indicates that there is an effect highly significant of T2 compared to T0 and T1 shown by (****). In addition, the regression curve shows a normality of the point cloud along the curve (fig.6). The difference in severity between these three treatments is even more visible with the noted severity index (SI) calculated in (Table 2). These results show that the severity indices of T1 and T0 are different but without a significant effect, on the other hand the T2 is highly significant than the treatments T0 and T1 at the 5% threshold.

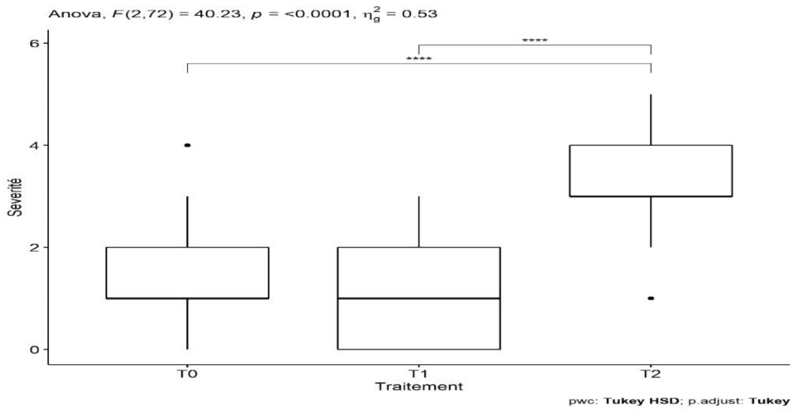


**Fig.5. The severity of the disease according to the treatments**

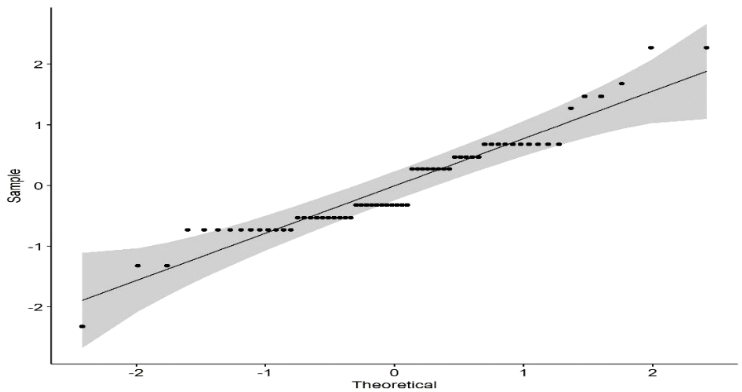


**Fig.6. The severity regression curve**

**Table 2. Severity indices by treatment**

| TREATEMENTS | T0 | T1 | T2 |
|---|---|---|---|
| **INDICE DE SEVERITE%** | **19,6%** | **16,8%** | **63,8%** |

## 3.2 DISCUSSION

The experimental device carried out for the determination of the effects of the treatments, in order to evaluate the effectiveness of the treatments shows a significant effect whatever the character (the number of regrowths and the severity of the disease). The effect of pruning initially remains very advantageous when T1 is done at the right time, which is highly significant compared to T0 and T2, with a very high number of regrowths. These results corroborate those of [12], working on the ability of the cocoa tree to emit orthotropic suckers and [16] on cocoa certification and high-risk strategies, showed that well-conducted pruning more precisely one month after beginning of the rainy season, not only makes it possible to rejuvenate the plant, but also to rebalance its crown, which would increase its diameter at the collar and even improve the production of the cocoa tree, as far as we are concerned, there are many cassava shoots and vigorous compared to those therefore pruning was done in the dry season case of (T2), below the waist. However, this result is partly similar to those of [7] in conducting this work on potato varieties, indicated that the size of the vegetative organs such as the stem and the leaves positively influences the development of the plant and even on the diameter of the main stem.

In addition, significant differences were noted between the T2 treatment which presents a very high severity, confirmed here by its severity index which is three times those of the T0 and T1 treatments.

Indeed, the presence of diseases is very accentuated in this treatment (T2), this being due to the fact that the plant is subjected to a stress conditioned by the lack of water, a second stress caused by the size probably makes the plant vulnerable diseases, this is closely related to the work of [8] on vineyards and which emphasizes that cultural practices that cause injuries such as pruning would increase the susceptibility of vines to infections by the main pathogenic agents associated with this decay. On the other hand, the treatment (T1) is very resilient to diseases compared to the control (T0) but without there being a significant effect between the two. This is explained by the fact that the young regrowth of T1 being very vigorous remains less or very little sensitive and even free from disease. This work shows that we can fight against certain diseases such as mosaic therefore the virus lives inside the plant and by eliminating certain parts of the plants, this can contribute to reducing the impact of the disease. This result is compatible with those of [8] working on the circulation of sap in the vine have meant that pruning is a cultural operation which has a major effect on yield but also on the health and behavior of the plants. Moreover [11] by studying the yield potential in tomatoes, they found it necessary to prune the plants for better aeration as well as to limit the development and spread of diseases. This reflection can indeed be supplemented by that of [5] which stipulates that the biology of the plant, the cultural care, the main parasites and diseases have led farmers to opt to prune the pitahaya, so as to limit its volume in order to reduce disease symptoms.

## 4. CONCLUSION

The objective of this study was to evaluate the effect of pruning on two parameters which are the number of regrowth and the presence of diseases in cassava. At the end of this study, it appears that the pruning presents a strong possibility of improvement and the sustainability of the plant in the case of seed fields. Indeed, it has been observed that, if the cuttings are harvested in rainy weather, recovery is rapid and regrowth is vigorous and numerous. On the other hand, when it is done in the dry season, the recovery is slow and the regrowth is frail. Moreover, pruning during the rainy season would drastically reduce the severity of diseases and allow the young shoots to be disease-free. However, pruning in times of drought significantly increases the severity of the disease, in which case it is advisable not to prune.

## REFERENCES


1. FAOSTAT. Agricultural production food, commodities by country. Commodities_by_country. 2016; 1-3. French.
2. FAOSTAT. Comparison of country level cropland areas between ESA-CCI land cover maps. International journal of remote sensing. 2018; 5.
3. FABIO. The construction of the food and agriculture biomass input-output model. Enviroment science & technologies. 2019; 18-20.
4. Ayetiton M, Degnon GR, and Agbade R. Evaluation of production conditions and physicochemical and microbiological qualities of cassava pods in the commune of Bassila. Epac/Cap/Uac. 2016; 456-567. French.
5. Barbeau G. Red pitahaya, a new exotic fruit. Fruits. 1990; 45(2):141-147. French.
6. Cooke, Sandra E and Ellie E. Stream phosphorus and nitrogen export from agricultural and forested watersheds on the Boreal Plain. Canadian Journal of Fisheries and Aquatic Sciences 1998; 55(10): 2292-2299.
7. Djinet A I, Nana R, Nguinambaye M M, Badiel B, Konate B, Nanema L and Tamini Z. Study of the behavior of ten (10) varieties of sweet potato grown in Bongor in dry season. International Journal of Innovation and Applied Studies. 2016; 17(4), 1384. French.
8. Dubé G. Assessing the impact of pruning wounds on sap flow and bud feeding in grapevine 2018; 12. French.
9. Dufour D, Lafond M D, Lambert B and Blary D. Valorisation of cassava. CIRAD. 1993.
10. Egle K. Study of the variability of cassava (Manihot esculenta Crantz, var. 312-524) yield components in relation to soil fertility. Mémoire de fin de cycle Ingénieur agronome UNIVERSITE du BENIN, École Supérieure d'Agronomie Lomé-TOGO. 1992; 122. French.

11. Ibbari K and Kaced M. Effect of organic and mineral fertilization on production, protection and quality in a variety of Hybrid tomato (kawa) grown under greenhouse. Doctoral dissertation, University Mouloud Mammeri 2020; 167(2). French.
12. Jagoret P. Analysis and evaluation of complex agroforestry systems over the long term: Application to cocoa-based cropping systems in Central Cameroon. Doctoral dissertation, Montpellier SupAgro. 2011; 82-67. French.
13. Meunier Q, Moumbogou C, and Doucet JL. The useful trees of Gabon. Presses agronomiques de Gembloux 2015; 33(5): (in press). French.
14. Moore G and Tymowski W. An explanatory guide to the International Treaty on Plant Genetic Resources for Food and Agriculture. 2008; 57. French.
15. Ouadi L. Ecophysiological impacts of Esca: resilience of vines and effect of pruning patterns. Doctoral dissertation, University of Bordeaux. 2019; 47(6): 234-253. French.
16. Ruf F, N'Dao Y and Lemeilleur S. Cocoa certification, a high risk strategy. Inter-réseaux Développement rural. 2013; 1-7. French.
17. Vansina J. History of cassava in central Africa before 1850. Paideuma. 1997; 255-279. French.
18. Vernier P, N'zué B. and Zakhia-Rozis N. Cassava, between food crop and agro-industrial chain. 2018; 232. French.