OPEN ACCESS
Scholars Bulletin
Abbreviated Key Title: Sch Bull
ISSN 2412-9771 (Print) |ISSN 2412-897X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Subject Category: Veterinary Agronomy

Effect of Sweet Potato (*Ipomea batatas* L.) Cutting Length on Growth and Tuber Yield in Ngandanjika, Mpasu Site, Lomami (D.R Congo)

Laurent MADIMBA MBUYI[1*], Audry TSHIBANGU KAZADI[2]

[1]Exact Sciences Section, Department of Veterinary Agronomy, Higher Pedagogical Institute of Ngandanjika: ISP Ngandanjika (D.R. Congo)
[2]Plant Production Systems Research Unit, Department of Plant Production, Faculty of Agronomics Sciences, University of Lubumbashi (D.R Congo)

DOI: https://doi.org/10.36348/sb.2025.v11i07.001 | **Received:** 03.06.2025 | **Accepted:** 12.07.2025 | **Published:** 06.08.2025

***Corresponding author:** Laurent MADIMBA MBUYI
Exact Sciences Section, Department of Veterinary Agronomy, Higher Pedagogical Institute of Ngandanjika: ISP Ngandanjika (D.R. Congo)

Abstract

In Ngandanjika (Democratic Republic of Congo), there has been a decline in sweet potato root yields, explained on the one hand by the lack of propagation materials, which are vines, and on the other hand by the old age of these cuttings, which have not undergone any varietal improvement for several years. The average yield there varies from 6 to 14 tons per hectare, whereas in research stations such as Yangambi, yields easily reach 40 tons. With a view to increasing crop yields, the Mbuaya variety, one of the most widely grown varieties, was selected and the effect of the length of the cuttings (vines) on growth and yield during the 2022-2023 growing season was evaluated. The trial was conducted at the MPASU Site on a randomised complete block design with three replicates, each of which was in turn divided into five elementary plots representing the experimental treatments. The treatments consisted of cuttings 20 cm long (T1), 25 cm (T2), 30 cm (T3), 35 cm (T4) and 40 cm (T5). The results show a higher yield (14.7 tons per hectare) of roots with 40 cm long cuttings, followed by 12.7 tons per hectare obtained with 35 cm long cuttings. The lowest average is 4.5 tons per hectare for 20 cm long cuttings.

Keywords: Sweet potato, Mbuaya variety, cutting length, root yield.

1. INTRODUCTION

The sweet potato (*Ipomoea batatas* L.) is a tuberous root crop belonging to the *Convolvulaceae* family (Kouame *et al.,* 2021). It is consumed by more than two billion people worldwide (Lebot *et al.,* 2009; Doussoh *et al.,* 2016). In the province of Lomami, and particularly in the zone of Ngandajika, it is the third most important crop after yams and cassava (Doussoh *et al.,* 2017). It is generally grown on small, more or less fertile plots with few inputs and produces relatively good yields (Khoury *et al.,* 2015). It is a simple crop, undemanding and able to survive where other crops such as maize die, and also requires less labour than most other food crops (Djinet *et al.,* 2019). Agronomic characteristics such as broad climatic and edaphic adaptability, high productivity, a short cycle and high nutritional value make sweet potatoes a particularly important crop for addressing the challenge of food security in countries subject to high anthropogenic pressures and vulnerable to climate change (Bovell-Benjamin, 2007). Its tubers are rich in vitamins A and C, iron, calcium and amino acids (Tumwegamire *et al.,* 2011; Sanoussi *et al.,* 2016). The leaves and tubers of this plant are very rich in protein, β-carotene and vitamins (Adélia, 2007). In addition to human consumption, the tubers and leaves are used in animal feed (Owori *et al.,* 2007). In industry, the tubers are used to produce starch (Triqui *et al.,* 2009), fuel, alcohol and acetic acid (Romuald *et al.,* 2013). In Ngandajika, sweet potatoes are eaten cooked or fried and are minimally processed (Doussoh *et al.,* 2016). Despite their socio-cultural and economic importance, it is clear that sweet potatoes are one of the neglected species in terms of research in Ngandajika and are underutilised (Dansi *et al.,* 2012). Similarly, its production is struggling to take off in Ngandajika due to numerous problems such as a lack of planting material with good vegetative potential, the gradual loss of traditional varieties, and the influence of certain pests and diseases. Given the importance of this crop in the region, the economy of propagation material and its proper selection could be considered to meet the needs of farmers. This work fits into this framework, and the objective of this experiment was to evaluate the length of sweet potato vines on growth and production in order to propose the ideal size that would not compromise the behaviour of the crop while ensuring good yields.

2. MATERIALS AND METHOD

Experimental soil and plant material

The experiment was conducted on sandy clay soil with a pH between 5.5 and 6. When wet, the soil is dark reddish-brown (5YR 3/2). The experimental field is located at 6°45'31" south latitude; 23°52'03" east longitude and 780 m altitude (MPASU/Ngandajika). The Mbuaya variety was selected for this experiment. It is a local sweet potato variety that has not yet been certified. It is characterised by a height of 1 m, a growing cycle of 120 days and an average yield of 15 tons per hectare.

DESIGN EXPERIMENT AND DATA COLLECTION

The experiment was conducted from 5 January to 5 May 2023 using a completely randomised block design with three replicates, each of which was divided into five (5) elementary plots representing the treatments. The treatments were designed as follows: cuttings 20 cm long (T1), 25 cm (T2), 30 cm (T3), 35 cm (T4) and 40 cm (T5). The three completely randomised blocks were separated from each other by a 2 m path. Each block comprised 5 plots measuring 4 m x 3 m, i.e. 12 m2 each, spaced 1 m apart. The borders measured 4 m in all directions. The distance between the different blocks was 2 m. The total area of the experimental field, including the borders, was 27 m long and 24 m wide, or 648 m², with 304 m² of planted area. The following parameters were observed: the rate of regrowth of cuttings, the length of stems, the leaf area, the number of branches or twigs, the length of internodes, the incidence of viruses, attack by caterpillars, the number of tubers and their diameter, and yield.

DATA ANALYSIS

Analysis of variance (ANOVA) was applied using Statistix 8.0 software, and the LSD (Least Significant Difference) test was used for multiple comparisons of the means obtained from the various treatments at a probability threshold of 5%. The different results obtained are presented in tables.

3. RESULTS

The results relating to the growth, disease and yield parameters observed in order to assess the impact of cutting length on the yield of tuberous roots of sweet potatoes under the soil and climate conditions of the Mpasu site in the Ngandajika zone are listed in the following table.

Table 1: Growth parameters

Treatments (cutting length)	Lifting rate (%)	Stem lenght (m)	Leaf area (cm²)	Number of branches	Length of internodes (cm)
20 cm	42.68 d	1.02 d	40.80 c	2.00 d	4.56 a
25 cm	45.68 cd	1.12 cd	41.74 b	2.20 cd	4.56 a
30 cm	47.74 c	1.26 c	42.00 b	2.80 c	4.5400 a
35 cm	63.98 b	1.880 b	42.02 b	3.80 b	4.57 a
40 cm	82.440 a	2.64 a	43.44 a	5.00 a	4.58 a
Stand-deviation	2.126	0.070	0.1676	0.300	0.036
Coeff. of variation (en %)	5.95	7.05	0.63	15.50	1.27

In the same column of the same parameter, averages followed by the same letter are not significantly different at the 5% probability threshold according to LSD (least significant difference). The results recorded in Table 4 show that, at the 5% significance level of LSD, the 40 cm long cutting showed significantly ($P<0.05$) higher survival rates, greater stem length, larger leaf area and greater number of branches, while the 20 cm long cuttings showed significantly ($P<0.05$) lower survival rates, shorter stem length, smaller leaf area and fewer branches compared to the different lengths of sweet potato cuttings tested at our experimental site. As for internode length, all sweet potato cutting lengths remained similar with no statistically significant difference ($P>0.05$) between them. Table 2 presents the results relating to the incidence of virosis and defoliating caterpillar attacks under observation in order to assess the impact of cutting length on sweet potato tuber yield under the soil and climate conditions of the Mpasu site in the Ngandajika zone.

Table 2: Disease parameters

Treatments (cutting length)	Viral infections rate (%)	Incidence of caterpillar infestation (%)
20 cm	1. 110 a	0.42 d
25 cm	1.23 a	0.48 cd
30 cm	4.78 a	0.56 bc

Treatments (cutting length)	Viral infections rate (%)	Incidence of caterpillar infestation (%)
35 cm	1.32 a	0.61 ab
40 cm	1.35 a	0.66 a
Stand-deviation	2.2187	11.250
Coeff. of variation (en %)	18.87	0.54

In the same column of the same parameter, averages followed by the same letter are not significantly different at the 5% probability threshold according to LSD (least significant difference). The statistical analysis of these results was performed after logarithmic transformation using the formula: log (x+1.1). The results shown in Table 4 indicate that, at the 5% significance level of LSD, the 20 cm long cutting showed a significantly (P<0.05) a low attack by defoliating caterpillars, while the 40 cm cutting showed a significantly (P<0.05) high attack by defoliating caterpillars compared to the other lengths of sweet potato cuttings tested at our experimental site. As for the incidence of viruses, all the different lengths of sweet potato cuttings remained similar to each other and no significant difference (P>0.05) was statistically identified. Table 3 presents the results relating to the number of tuberous roots/stem, the size of the tuberous root and the plot yield of tuberous roots (in tons per hectare) at harvest under observation in order to assess the impact of cutting length on the yield of tuberous roots of sweet potatoes under the soil and climate conditions of the Mpasu site in the Ngandajika zone.

Table 3: Yield parameters

Treatments (cutting length)	Number of tubers per stem	Tuber diameter (cm)	Yield (tons of tubers per ha)
20 cm	2.00 e	4.14 a	4.46 e
25 cm	2.40 d	4.84 b	6.58 d
30 cm	3.20 c	4.72 bc	8.64 c
35 cm	4.00 b	4.62 c	12.74 b
40 cm	5.00 a	4.46 d	14.78 a
Stand-deviation	0.184	0.058	0.125
Coeff. of variation (en %)	8.78	1.96	2.11

4. DISCUSSION

Generally, the behaviour exhibited by each length of sweet potato cutting under study appears to depend on the number of nodes, intrinsic characteristics such as water content, and environmental factors. Among the five cutting lengths tested, the 40 cm cutting length proved to be the most effective, showing significantly (P<0.05) higher survival rates, longer stems, larger leaf area, a high number of branches, a high number of tuberous roots per stem, a large tuberous root calibre and a high plot yield of tuberous sweet potato roots at harvest in the rural area of the Mpasu site in the Ngandajika zone. This performance achieved by the 40 cm long cutting could be attributed to the fact that the longer the cutting, the slower it dehydrates, resulting in a high survival rate. The longer the cutting, the more nodes it has, resulting in a high number of branches and a high number of tuberous roots per stem. The performance of the 40 cm cutting length seems to be more related to the existence of a large number of nodes due to its greater length, which leads to the appearance of many tuberous roots in the soil and climate conditions of Ngandajika in the Mpasu site. The tuberisation process is very necessary for better exploitation of sweet potato cultivation in a given environment. These results are consistent with those found by (Pierre, 2005), who concluded in his observations that sweet potato cuttings 40 cm in length produced significantly higher yields of tuberous roots (P<0.05). Other studies conducted in eastern DR Congo by Phemba *et al.,* 1998, on the performance and stability of genotypes in various environments also showed that 40 cm long cuttings produce a high yield of sweet potato tubers at harvest (around 14.7 tons per ha). This was also confirmed by Naku (1990) and Terry (1983). The different lengths of sweet potato cuttings used in our study show significant variability in terms of regrowth rate, stem length, number of branches, leaf area, incidence of viruses, attacks by defoliating caterpillars, the number of tuberous roots per stem, the size of the tuberous roots, and the yield of tuberous roots at harvest. The evaluation of the regrowth rate of different lengths of sweet potato cuttings during growing season B yielded the results shown in table 3. The regrowth rate ranged from 42.6% to 82.4% for all the different lengths of sweet potato cuttings under study. The only hypothesis is that the climatic conditions (temperature, rainfall, relative humidity) at the time of sowing were favourable for initiating the regrowth process of the cuttings, given that they were within the range required for the regrowth of sweet potato cuttings, as reported by (Raemarkers, 2001). The results of the analysis of variance (table 3) relating to the rate of sweet potato cutting recovery show that there is a significant difference (P<0.05) between the different lengths of sweet potato cuttings under study and that the 40 cm long cutting showed a significantly higher recovery rate compared to the other lengths of sweet potato cuttings under study at our experimental site. These significant differences (P<0.05) could be attributed to the fact that the longer the cutting, the slower it dehydrates, maintaining a high moisture content that promotes better recovery. Regarding the average length of the stems, (Nkulu, 2019) mentions that it has an influence on soil cover in the fight against erosion. The longer the stem, the more the soil surface is covered in a short time and protected against erosion.

Information concerning stem length, number of branches, internode length, and leaf area are recorded in tables 2. These results highlight the following observations:

- During growing season B, there was a significant difference (P<0.05) between the different lengths of sweet potato cuttings under study in terms of stem length, number of branches and leaf area, and that the 40 cm long sweet potato cutting significantly influenced yield (P<0.05) and respectively exhibited greater stem length, larger leaf area and a higher number of branches compared to the other sweet potato cutting lengths studied at our experimental site.
- During the same growing season B, there were no significant differences (P>0.05) between different lengths of sweet potato cuttings in terms of internode length. These situations could be explained by the interaction between cutting length and environment.

These results, as observed by Raemarkers (2001), demonstrate the influence of the season on sweet potato growth through temperature, particularly temperature range and water availability. Alternatively, it may be a varietal characteristic. Nevertheless, the stem lengths, number of branches, leaf areas and internode lengths recorded at our experimental site are within the recognised values for sweet potatoes (Ahanhanzo *et al.,* 2008). The results of the analysis of variance (table 3) relating to the incidence of virosis and attacks by defoliating caterpillars reveal that there is a significant difference (P<0.05) between the different lengths of sweet potato cuttings under study in terms of attacks by defoliating caterpillars. All lengths of sweet potato cuttings remained similar with no significant difference (P>0.05) between them in terms of the incidence of viruses, while the 40 cm long cuttings showed significantly high attacks by defoliating caterpillars, while the 20 cm long cuttings showed significantly (P<0.05) low attacks by defoliating caterpillars compared to the other lengths of cuttings studied at our experimental site. These significant differences (P<0.05) could be attributed to the interactions that prevailed between the different lengths of sweet potato cuttings under evaluation and environmental factors during the experimental period. In addition, the 40 cm long cuttings showed rapid growth in stem length, which contributed to rapid ground cover by promoting a high population of defoliating caterpillars, while the 20 cm long cuttings caused a delay in ground cover, which reduced attacks by defoliating caterpillars. Our observations corroborate those of Hubert *et al.,* 1990, who reported that the growth of stems from 40 cm cuttings is rapid and results in total ground cover, which exposes the sweet potato crop to a high population of defoliating caterpillars. The number of tubers per stem varied on average from 2 to 5, the size of the tuberous root varied on average from 4.4 to 5.1 cm, and the plot yield of tuberous sweet potato roots at harvest varied on average from 4.4 to 14.7 tons per hectare.

The results of the analysis of variance (table 4) relating to these parameters show that there is a significant difference (P<0.05) between the different lengths of sweet potato cuttings under study in terms of all these parameters and that the 40 cm cutting performed well in all these parameters, showing significantly (P<0.05) and respectively a higher number of tubers per stem, a higher tuber size and a high yield of tuber at harvest, while the 20 cm long cutting showed significantly (P<0.05) and, respectively, a low number of tuberous roots per stem, a low tuberous root size and a low plot yield of tuberous sweet potato roots at harvest. These significant differences (P<0.05) could be attributed to the fact that the longer the cutting, the more nodes it has, it dehydrates slowly, retaining a good water content to generate a high rate of regrowth, rapid growth, a high number of branches, a large leaf area, a high number of tuber per stem and a high yield of tuber at harvest.

5. CONCLUSION

This experiment shows that 40 cm long cuttings exhibit rapid stem growth. This performance could be attributed to the fact that the longer the cutting, the slower it dehydrates, resulting in a high survival rate. At this length, the number of nodes is significant in producing a high number of branches and a high number of tuberous roots. It is therefore essential for farmers in the Mpasu site in the Ngandajika zone to use sweet potato cuttings of this length when planting in order to achieve significant increases in the yield of sweet potato tuberous roots at harvest. However, it would also be desirable in the future to conduct a similar study with other improved varieties grown by farmers, repeating our trial in the Ngandajika zone over time and space and during different growing seasons in order to confirm or refute our results.

BIBLIOGRAPHY

- Adélia C.B. (2007). Sweet potato a review of its past, present and future role in Human nutrition. J Agric Food Chem. 50(6) : 56-60.

- Ahanhanzo C., Gandonou C., Agassounon Djikpo Tchibozo M., Cacaï G., Dramane K. (2008). Etude comparative de l'influence des régulateurs de croissance sur la morphogénèse in vitro des quelques variétés de *Manihot esculenta* crantz(manioc-euphorbiaceae) du Benin. CAMES – série A, sciences et Médecine, 07 : 47-52.
- Bovell-Benjamin A.C. (2007). Sweet potato : a review of its past, present and future role in human nutrition. Adv. Food. Nutr. 52 : 1-59.
- Dansi A., Vodouhè R., Azokpota P., Yedomonhan H., Assogba P., Adjatin A., Loko Y., Doussou-Aminon I., Akpagana K. (2012). Diversity of the Neglected and Underutilized crop Spcies of importance in Benin. The Scientific world journal, 932-947.
- Djinet A., Koussao S., Ngaryam B. (2019). Production et commercialisation de la patate douce (Ipomoea batatas L). Dans les environs de Bongor. Appl. Biosci. 137 : 13985-13996.
- Doussoh A.M., Dangou J.S., Houédjissin S.S., Assogba A.K., Ahanhanzo C. (2016). Analyse des connaissances endogènes et des términants de la production de la patate douce (Ipomoae batatas L), une culture à haute valeur socioculturelle et économique in Benin. Int.J.Biol.Chem.Sci.10(6) : 2596-2616.
- Doussoh A.M., Dangou-Sossou J., Houédjissin S.S., Cacaï G.H.T., Assogba A.K., Ahanhanzo C. (2017). Influence of Mercuric chloride on survival and suitability fo in vitro Regeration of three sweet potato Landraces (Ipomoea batatas L.) productced in Benin Int. J. Curr. Res. Biosci. Plant Biol. 4(1) : 56-64.
- Khoury C.K., Heider B., Castaneda-Alvarez N.P., Achicanoy H.A., Sosa C.C., Miller R.E., Scotland RW., Wood J.R., Rossel G., Eserman L.A., Jarret R.L., Yencho G.C., Bernau V., Juarez H., Sotelo S., de Haan S., Struik P.C. (2015). Distributions, ex situ conservation priorities, and genetic ressource potential of crop wild relatives of sweetpotato (Ipomoea batatas L). Lam., I. series Batatas. Frontiers in plant Science 6 : 251.
- Lebot V. (2009). Tropical root and tuber crops. Eds. CABI. 413p.
- Naku,M., (1990): Phytotechnie tropicale, Note de cours IFA Yangambi.
- Owori C., Berga L., Mwanga R., Namutebi A., Kapinga R. (2007). Sweet potato Recipe Book : Sweet poato processed products from Eastern and central Africa. Kampala, Uganda, 93p.
- Phemba et Ngoyi, (1998) Performance et stabilité du rendement de génotype de patate douce dans de divers environnement à l'Est de la République Démocratique du Congo. 8-13pp.
- Pierre, N., (2005) Les plantes cultivées en région tropicales d'Altitude d'Afrique. Centre technique de Coopération Agricole. Les Presses agronomiques de Gembloux. 17-26pp.
- Romuald D. & Anna O. (2013). Micropropagation of sweet potato (Ipomoae batatas L.) from node explants. Acta Sci. Pol.Hortorum Cultus 12(4) : 127.
- Sanoussi A.F., Dansi A., Ahissou H., Adebowale A., Sanni L.O., Oribiyi A., Dansi M., Azokpota P., Sanni A. (2016). Possibilities of sweet potato (Ipomoae batatas L.) value chain upgrading as revealed by physico-chemical composition of ten elites landraces of in. African journal of Biotechnology 15(13) : 481-489.
- Terry, E., 1980 : Plantes – Racines – Tropicales. Stratégies de recherches pour les années 1980. 31 – 40pp.
- Tumwegamire S., Rubaihayo R., La Bonte D., Grûneberg, Burgos G., Felde T., Carpio R., Pawelzik E., Mwanga R. (2011). Evaluation of dry matter, protein, starch, sucrose, β - carotene, iron, zinc, calcium and magnesium in East African sweet potato (Ipomoae batatas L). germplasm. Hortiscience 46(3) : 348-357.
- Triqui Z.E.A. (2009). Contribution à l'amélioration de la patate douce (Ipomoea batatas(Lam) par application des biotechnologies : Embryogénèsesomatique et transformation génétique. Thèse de Doctorat d'Etat Université Mohammed V-Agdal, Faculté des sciences, Rabat 143p.