



Root suckering of *Vitex doniana* Sweet in the Guinean savannah highlands of Adamawa in Cameroon

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Abstract

Vitex doniana Sweet is an agroforestry species highly prized by the populations of the high Guinean savannahs of Adamawa in Cameroon, but its sexual reproduction is weak under natural conditions. The objective of the study was to test the induction of artificial root suckering on the superficial roots of 129 adult *Vitex doniana* plants. The complete section and the slight wound were adopted. After induction, 120 roots were partially exposed to air and light, while the other 120 were covered with original soil, according to a three-replication split-plot experimental design. The results show that the cut roots lend themselves better to root suckering with a success rate of 60%; on the other hand, the stripped roots did not develop aerial axes. Roots left in the open had a 65% success rate, compared to 55% for roots covered with soil. The analysis of variance does not show any significant difference ($0.3762 > 0.05$) between suckers. Induced suckers appear exclusively at the distal end of the root separated from the parent tree. 70% of the suckers appeared on the superficial face, 21% at the basal roots and 9% on both faces at the same time. No sucker has developed its own root system. Induction of root suckering is an inexpensive propagation technique that could be constitute an important way to explore in order to domesticate *Vitex doniana*.

Keywords: Domestication, Guinean savannahs highlands, Induction, Root suckering, *Vitex doniana*.

Introduction

V. doniana, or black plum, is one of the local species most appreciated by the populations of the region¹. It is locally known as “Ngalbijé” in Fulfuldé. This Verbenaceae (according to the classical nomenclature) is widespread in tropical Africa². The products from this species are important for the local population since they provide firewood, material for light local constructions, as well as many foods and medicinal products³⁻⁵. In the Adamaoua savannahs, *Vitex doniana* wood used for the production of charcoal and works of art. Bush fires negatively influence the natural regeneration of the species. This species of socio-economic interest is subject to various pressures (grazing, overgrazing, etc.). It is essential to preserve the diversity of species with multiple uses and, at the same time, to densify them by multiplying a large number of remarkable clones with a view to their future domestication^{6,7}.

The domestication of trees offers an excellent opportunity to access diversified outlets^{8,9}. The domestication of this species could help ensure food security and the conservation of biodiversity. With this in mind, low-cost vegetative propagation, in particular the induction of suckering, is easily reproducible by local populations^{10,11}. Given its importance to rural communities, this local species deserves more attention in order to maximize its potential. The objective of the study was to test the possibility of induction of root suckering in *V. doniana*;

inexpensive technique, which is an essential step in the process of its domestication.

Materials and methods

Presentation of study site: The investigations took place over nine months, in the Guinean savannah highlands periodically burned and grazed, particularly in the locality of Bini-Dang (LN: 7°24'; LE: 13°32'; ALT:1079 m). This area is subjected to a Guinean climate characterized by two seasons: a dry season from November to March and a rainy season which begins in April with a period of violent storms continuing until October. Rainfall is particularly high between July and September. For the years 2001 to 2011, the average annual precipitation is 1446.7mm, the average monthly temperature 22.3°C, the average monthly relative air humidity 66.2% and the average annual evaporation of 1651.5 mm. The human population of the locality consists mainly of herders (Bororo and Peulh) and farmers (Mboum, Dii and Gbaya). This region is covered with tree and shrub savannahs dominated by *Daniellia oliveri* (Rolfe) Hutch & Dalziel and *Lophira lanceolata* Tiegh. ex Keay¹² which sucker abundantly¹⁰.

Methodology: The cuts and wounds were carried out at the beginning of the rainy season (May). Excavations at the foot of each tree and a maximum of two superficial roots having a diameter between 1 and 4 cm were carried out induced.

Thus, 240 roots of 129 trees of *Vitex doniana* were selected and subjected to two induction modes, namely complete sectioning and wounding (Figure-1). The root suckering assessments were carried out monthly. i. A total of 120 superficial roots were induced using a pruner by taking a segment 2-4cm long, of which 60 induced roots are covered with soil while the other 60 induced roots remain exposed to light. ii. Concerning the light injury, a total of 120 superficial roots were studied, of which 60 roots were covered and the other 60 roots remained exposed to light.



(a)



(b)

Figure-1: Complete sectioning (a) and slight injury (b).

A knife was used to make the light wound by removing fragments 2 to 4cm long¹³.

The experimental device installed is a three-block split-plot. The type of induction was the main treatment. The type of root exposure (roots exposed to air and light *versus* roots covered with soil) corresponded to the secondary treatment.

Data collection and analysis: The data collected on the growth parameters were subjected to an analysis of variance. The experimental device is a split-plot with three repetitions. The main treatment is the induction type, and the secondary treatment is represented by the root exposure mode. The statistical program used was Stat graphics plus 5.0.

Results and discussion

After nine months, the species reacted favorably to complete sectioning (Figure-2) with a success rate of 60%. The slight injury did not produce suckers. The first suckers appeared two months after induction on completely sectioned roots. 72 out of 120 roots produced at least one sucker. The suckers from the roots covered with the original soil had a higher height than the suckers from the roots left in the air and in the light, but the latter recorded a higher number of leaves (Table-1). The roots left in the air and in the light showed a success rate of 65% against 55% for the roots covered with soil (Figure-3). The analysis of variance does not show any significant difference between induction mode ($0.3762 > 0.05$). The suckers developed mainly on the disconnected roots of the mother tree. The suckers appeared right near where the roots were severed. The end of the roots still connected to the mother tree do not produce suckers. It is noted that 70.83% (51 roots) of the severed roots showed rhizogenesis by the neoformation of rootlets at the level of the part of the root still connected to the mother tree (Figure-4). Roots exposed to air and light showed a dark color while those covered with original soil remained light gray.

Discussion: The results obtained on *Balanites aegytiaca*, *Diospyros mespiliformis* and *Sclerocarya birrea* show that the complete section has a higher suckering rate than the light wound¹⁴. In Uganda for *Spathodea campanulata*, Meunier et al.⁶ noted that the complete sectioning of a root always generates the neoformation of one or more distal suckers (exclusively on the distal part of the root disconnected from the mother tree), which is in agreement with our results (100% suckers on the part of the root disconnected from the mother tree). The height of suckers is greater than that of *Bombax costatum* suckers observed by Belem et al.¹⁵ in Burkina Faso.

Table-1: Growth parameter from complete sectioning in *V. doniana*.

After 9 months	Complete sectioning	
	60 roots exposed to air and light	60 roots covered with soil
Number of roots with at least one sucker	39	33
Suckers (%)	65	55
Average number of suckers per root	1.64±0.10	1.53±0.11
Average height of suckers (cm)	72.84±3.76	77.75±4.08
Number of sheets per sucker	21.33±1.01	16.84±1.09



Figure-2: After complete sectioning of a *Vitex doniana* root, a sucker formed on the proximal end of the part of the root disconnected from the parent tree.

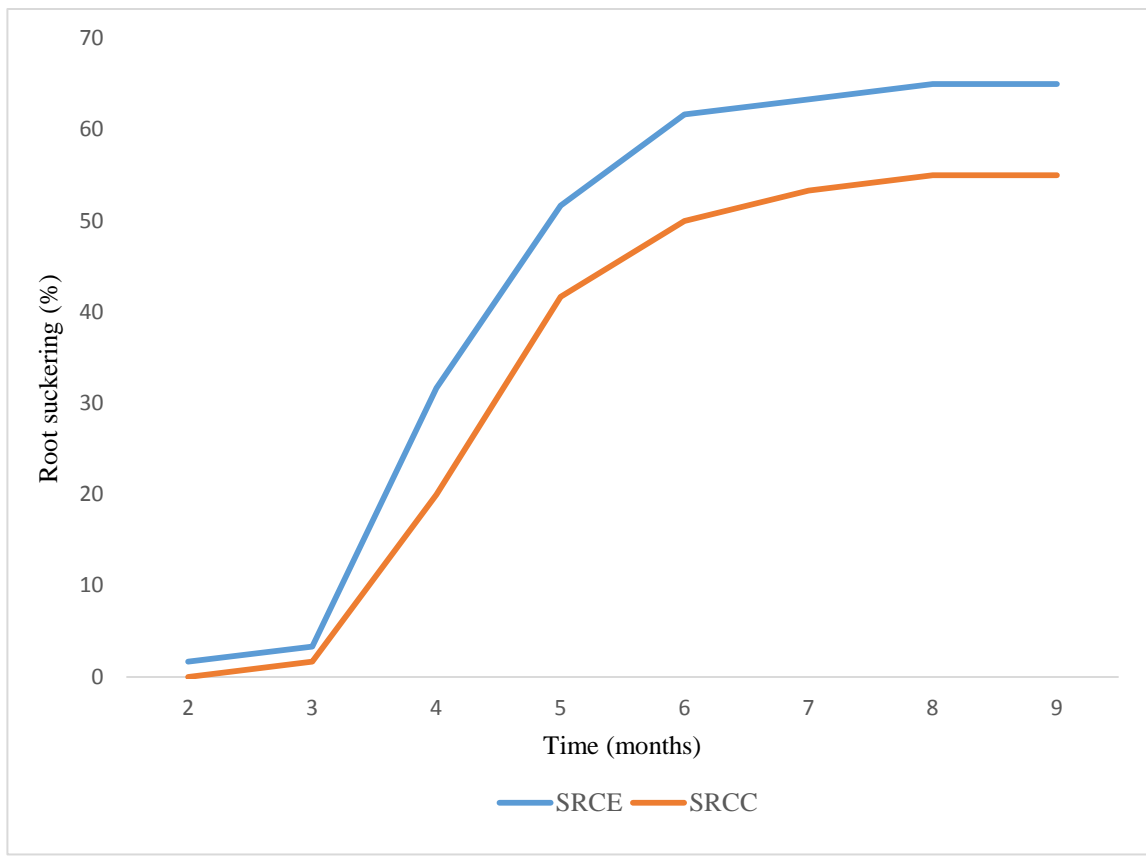


Figure-3: Evolution curves of suckers during the nine months of observation.

Legend: SRCE: severed roots completely exposed;SRCC: severed roots completely covered with original soil.



Figure-4: Rooting at the distal pole of the part (=proximal) still connected to the mother tree: root covered with soil (a) and root exposed (b). In these two photos, the mother tree is located on the left.

The Studies carried out on *Balanites aegyptiaca*, *Diospyros mespyliiformis* and *Sclerocarya birrea* show a high proportion of proximal suckers¹⁴. Physiological responses vary with species. Similarly in Uganda *Melia azedarach* has developed exclusively proximal suckers⁶. *Albizia adianthifolia* in the Democratic Republic of Congo emits suckers on both the proximal and distal end¹⁶. This result suggests that the position of development of suckers on the root varies according to species.

The suckers from the roots exposed to air and light showed higher numbers for the majority of the parameters studied than those that were covered with soil.

Exposure of the root tips to air and light (wind, sunlight) would therefore be an amplifying factor in suckering for *V. doniana*. Similar results were observed in *Lophira lanceolata* and *Ximenia americana*^{17,18}.

The suckers of *Detarium microcarpum* and *Miconia calvescens* produce their own root system¹⁰. None of the *Vitex doniana* suckers emitted their own root system. Our trials took place over nine months (from June to February), but following additional observations in the savannah of Dang, it is likely that the suckers of *V. doniana* can probably not become autonomous in a few months.

The deepening of the different aspects of suckering could contribute to the participatory domestication of this species, in order to integrate it into existing peasant production systems and to the conservation of biodiversity. In order to enrich these systems with species of socio-economic interest for various productions, *V. doniana*, having the ability to sucker, has real potential for local populations. It is also considered a litter-enriching species.

The suckers obtained did not produce their own root systems. This technique can promote the gradual re-vegetation of this

species, which will make it possible to densify it in its natural environment.

Conclusion

V. doniana shows a good aptitude for suckering by complete cutting of the root. The emergence of post-traumatic suckers appeared exclusively at the proximal poles of the distal (disconnected) parts of the mother tree. Leaving the severed root in the air and in the light amplifies root suckering in this species. If we want to use root suckering as a technique for the domestication of this species, it will be necessary to study the optimal conditions that favors the rooting and the release of the suckers produced by induction over a longer period.

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