

Adapting selected grafting techniques to propagation of *Vitellaria paradoxa* ssp. *nilotica* (the shea butter tree) in Uganda

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Abstract

This preliminary study is being carried out in Adwari Sub County, Otuke District (Northern Uganda). The aim of the study is to adapt an appropriate grafting technique for propagating *Vitellaria paradoxa* in Uganda. Two grafting techniques (splice and top wedge) have been tested on varying ages of *V. paradoxa* wild seedlings and saplings. The results so far indicate that grafting methods had no significant ($P = 0.423$) effect on scion survival before 16 weeks after grafting. However, the splice grafting method had 14.3 % and top wedge grafting method had 0% scions' survival up to 5½ weeks. The age of rootstock had no significant effect on grafting success ($P = 0.423$). Grafts on seedlings had the highest rate of survival of scions at a decreasing rate than saplings up to 5½ weeks after grafting. Further experiments are still needed to determine with certainty whether the response of *V. paradoxa* grafts to scions survival can or can not be influenced by both grafting methods and ages of the wild rootstock.

Key words: Grafting techniques, splice and top wedge, *V. paradoxa*

Résumé

Cette étude préliminaire est réalisée dans le sous-comté d'Adwari, District d'Otuke (au Nord de l'Ouganda). L'objectif de l'étude est d'adapter une technique de greffage appropriée à la propagation de *V. paradoxa* en Ouganda. Deux techniques de greffage sélectionnées (enture et coin supérieur) ont été explorées sur différents âges de semis et de jeunes arbres sauvages de *V. paradoxa*. Les résultats ont montré jusqu'ici que le méthode de greffage n'a pas d'influence significative sur la réponse en pourcentage de *V. paradoxa* ($P = 0,423$) et le pourcentage de survie du scion lors d'un succès décroissant sur les différents âges des porte-greffes avant 16 semaines après le greffage pour les deux techniques de greffage. La

méthode de greffage par enture a eu 14,3% et celle de greffage par coin supérieur a eu la survie des scions de 0% jusqu'à 5 semaines et demie. L'âge du porte-greffe n'a eu aucun effet significatif sur la réussite du greffage de *V. paradoxa* ($P = 0,423$) avec des greffes sur les semis ayant le plus haut taux de survie des scions à un taux décroissant que de jeunes arbres jusqu'à 5 semaines et demie après le greffage. D'autres expériences sont encore nécessaires pour déterminer avec certitude si la réponse de greffons de *V. paradoxa* à la survie des scions peut ou ne peut pas être influencée par les deux méthodes de greffage et l'âge des porte-greffes sauvages.

Mots clés: techniques de greffage, enture et coins en haut, *V. paradoxa*

Background

Although the Shea butter tree (*Vitellaria paradoxa*) can play a significant socio-economic role in sub-Saharan Africa due to domestic and commercial values of its fruits/nuts (Sanou *et al.*, 2004), currently, its fruit production has been constrained by the quick loss of viability of its seeds, long juvenile phase, old age with low regeneration potential and lack of knowledge on its silviculture (Zewge, 2003). In order to address some of these constraints effectively, further exploration of the effectiveness of the splice and top wedge grafting techniques are required.

Literature Summary

Vitellaria paradoxa has been propagated principally by seedlings. The tree takes up to 30 years to mature although on good soil with initial care it may bear fruits in 15-20 years (Katende *et al.*, 1995). Whilst fruit production may commence at 20 years, full production is only reached after 40 to 50 years (Ruysen, 1957). These factors have been reported to discourage farmers from planting Shea tree unless more productive planting stock can be developed through vegetative propagation. Shea nut tree is also regarded as the most difficult-to-propagate tree species in the tropics (Zewge, 2003). Farmers tend not to plant these trees because they view the trees as 'wild' – nature gifts, which are now fast disappearing. In the tropics grafting is being practiced on a relatively small number of commercially important trees (ICRAF, 2002). Grafting, however, is a viable option to domesticate several under-utilised agroforestry tree species including *V. paradoxa*. Generally grafting being a method of vegetative propagation that allows productions of individuals of the same genetic constitution facilitates the multiplication of desirable genotypes. According to Hartmann *et al.* (1997), grafting can be used to enhance the

Study Description

multiplication of trees in the reproductive phase through plus-tree selection and by taking scions from ontogenetically mature crowns of large trees. In this way the juvenile phase of trees is greatly shortened.

The present preliminary study was carried out in Adwari sub-county, Otuke District in the Northern Uganda located between 2°25'–2°47'N and 33°02'–38°38'E. The terrain in the area is generally flat with minor depressions created by River Moroto and its tributaries (Apunyu, 1997). According to LDSOER, (1997), the largest part of the sub-county has acidic and deeply weathered soils with low cation exchange capacity and average minimum and maximum temperatures of 22.5 °C and 25.5 °C, respectively. The average annual rainfall is 1200 mm (Agea *et al.*, 2010). The first experiment (Experiment 1) was set in October 2011 in a completely randomised block design such that the wild seedlings and saplings formed the treatments (T1 & T2). The two selected grafting techniques: top wedge (Tp) and splice (Sp) formed the blocks. A total of 140 dormant and healthy scions were replicated into 35 scions per grafting technique and further replicated for each treatment at different locations. The second experiment (Experiment 2) was set in December 2011 in a completely randomised block design such that the wild saplings formed the treatments (T3). The two different grafting techniques top wedge (Tp) and splice (Sp) grafting techniques formed the blocks. A total of 100 dormant and healthy scions were replicated into 50 scions per grafting technique and further replicated for each treatment at different locations. Thus, two (2) blocks comprising of splice and top wedge grafting methods and one treatment comprising of saplings of the same age were set up making up a total of 2 experimental units. The third experiment (Experiment 3) was set in February 2012 in a completely randomised block design such that the on-farm saplings formed the treatments (T4). The two different grafting techniques top wedge (Tp) and splice (Sp) grafting techniques formed the blocks. A total of 80 dormant and healthy scions were replicated into 40 scions per grafting technique and further replicated for each treatment at different locations. For this study, the two (2) blocks comprising of splice and top wedge grafting methods and one treatment comprising of wild saplings of the same age was set up making up a total of two experimental units.

Research Application | So far, the two selected grafting techniques that have been tried indicated no significant influence ($P = 0.423$) on the survival percentage of *V. paradoxa* grafts (Table 1).

Table 1. The response of *Vitellaria paradoxa* to top wedge and splice grafting techniques.

Grafting methods	Count	Sum	Average	Variance		
Top wedge	2	0	0	0		
Splice	2	5	2.5	12.5		
Source of variation	SS	df	MS	F	P-value	F crit
Between groups	6.25	1	6.25	1	0.423	18.513
Within groups	12.5	2	6.25			
Total	18.75	3				

In experiment I, 14.3% of *V. paradoxa* wild seedling rootstocks responded to splice grafting method. No *V. paradoxa* wild seedling rootstocks responded to top wedge grafting method within 5½ weeks. Besides, none of the wild sapling rootstocks survived when grafted using both splice and top wedge grafting techniques within the same 5½ weeks after grafting. It has also been observed that 10% of *V. paradoxa* wild sapling rootstock responded to splice grafting method. Again none of the wild sapling grafts survived when grafted using top wedge grafting technique 5 weeks after grafting. In experiment 3 (in which 1% concentration of jik was used to flash the sap), only 10% of *V. paradoxa* wild sapling grafts responded to top wedge grafting techniques. None of them responded to splice grafting technique at the fourth week after grafting. On the other hand, 14.3% of scions grafts on the wild seedling rootstocks grafted using splice grafting techniques survived at a decreasing rate up to 5½ weeks after grafting while none of those grafted using top wedge techniques survived within 5½ weeks after grafting. Although about 14% of wild seedlings grafted using splice techniques survived, age of rootstock has had no significant effects ($P = 0.423$) on grafting success of *V. paradoxa* in all the experiments (Table 2).

Both on-farm and on-station further studies focusing on splice and top wedge grafting techniques will be continued in the different seasons especially in November 2012 when *V. paradoxa* is expected to be vegetative and prior to rainfall in March - April 2013.

Table 2. The influence of age of rootstock on grafting success of *V. paradoxa* in Uganda.

Age of rootstock	Count	Sum	Average	Variance		
Seedlings	2	5	2.5	12.5		
Saplings	2	0	0	0		
Source of variation	SS	df	MS	F	P-value	F crit
Between Groups	6.25	1	6.25	1	0.423	18.513
Within Groups	12.5	2	6.25			
Total	18.75	3				

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