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Grafting: A New Approach to Improve Oil Palm?

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Introduction

Until very recently, grafting was thought to be impossible to achieve with monocotyledons, due to their lack of a vascular cambium and the scattered distribution of vascular bundles within the stem, preventing the establishment of functional connections between the scion (above-ground, epibiote) and rootstock (below-ground, hypobiote) portions of the plant. However, in a study by Reeves *et al.* (2022), it was shown that the undifferentiated tissues present within the hypocotyl region of monocot embryos possessed the capacity to form grafts. For Arecaceae, the technique was successfully applied to oil palm (*Elaeis guineensis)* to a small sample size (n=6).

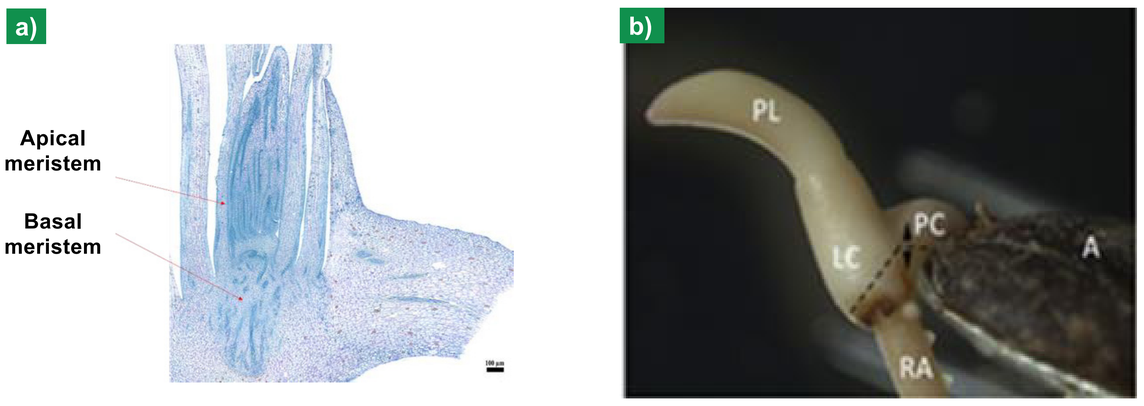
Objectives

In this context, we recently initiated the collaborative project Palmgrafting using *E. guineensis* (i) to optimize the practical conditions for oil palm grafting; (ii) to study the interactions between the scion and rootstock portions of plants during the development of the young plant; (iii) to explore the advantages that such a technique could offer to create new oil palm ideotype.

Materials and methods

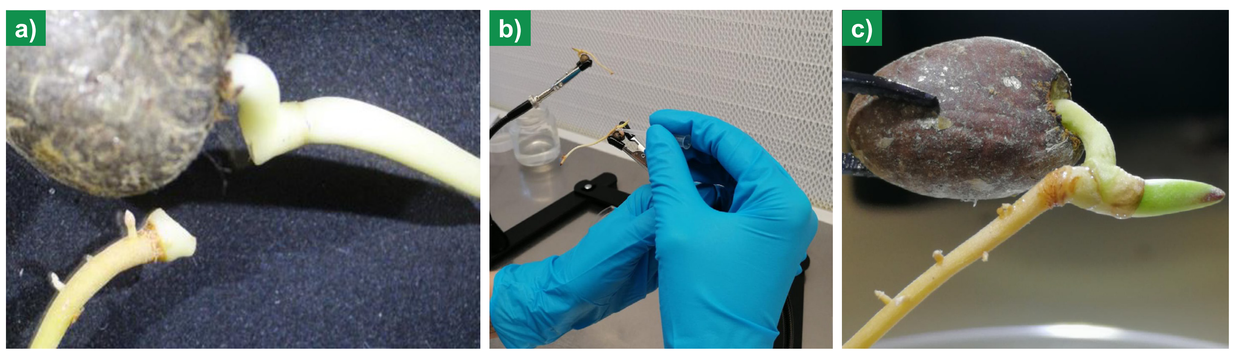
Plant Material: C1001 seeds of *E. guineensis* from PalmElit S.A.

Grafting Procedure: Seeds are removed from their shells and placed in germination after undergoing disinfection. The germination process must ensure the absence of seed contamination and synchronize shoot size and diameter.



Picture 1. a) Histological view of the germinated seed, b) escription of the germinated seed, PC: Cotyledonary petiole/PL: Plumule / LC: Cotyledonary ligule/RA: Root/A: Almond/ Kernel.

Grafting is performed in a laminar flow cabinet using the protocol developed by Reeves *et al.,* aided by histological images (Pictures 1 and 2). For the purpose of grafting, the kernel may be left attached either to the scion (S-S) or to the rootstock (S-R).



Picture 2. a) Grafting preparation. b) Grafting operation. c) Grafted plant (S-S).

Grafted seeds are placed in a growth chamber (27 °C, 12 h/12 h) for 4 weeks, then acclimatized in a phytotron for 6 weeks, and finally placed in a greenhouse.

Evaluations at three key time points:

D+14: Checking of graft union adhesion between rootstock and scion.

D+30: Development of the shoot portion (scion).

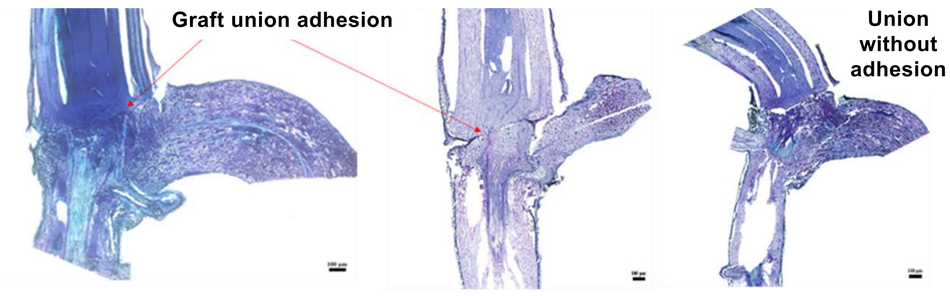
D+70: Plant growth and verification of the root system.

Results

In 2024 our team carried out 142 grafts including 52 S-S and 53 S-R (Table 1). At Day 14: 82.7 % of 'SS' grafts and 62,3 % of 'SR' grafts showed good graft union adhesion. At day 30: 73.1 % of 'SS' grafts and 58,5 % of 'SR' grafts remained viable. After 3 months in greenhouse: Overall, 9.9 % of the grafted plants showed a good development, with an effect of kernel (haustorium) positioning: (S-S) gave 13,5 % when (S-R) gave 5.7 % (Picture 3).

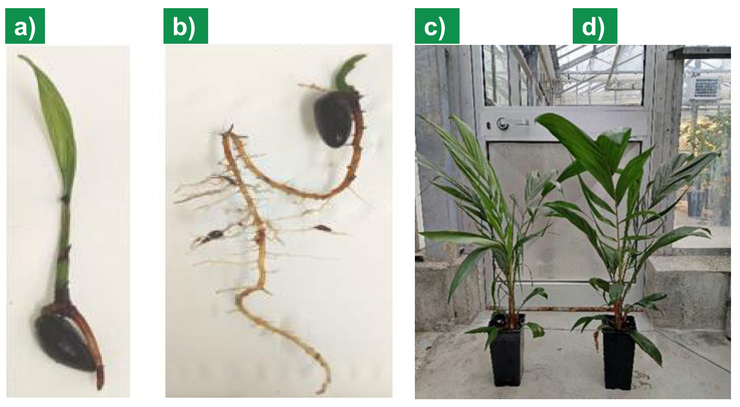
Table 1. Grafting results from D14 to greenhouse stage.

Grafting Nbr		Type	Not detached D+14	Phytotron D+30	Greenhouse D+70	Growth in greenhouse
	37	NA	32	24	12	4
S-S	52	SEED LINK TO THE SHOT (S-S)	43	38	12	7
S-R	53	SEED LINK TO THE ROOT (S-R)	33	31	11	3
TOTAL	**142**		**108**	**93**	**35**	**14**
TOTAL		%	76.10 %	65.50 %	24.60 %	**9.90 %**
S-S	52	%	82.70 %	73.10 %	23.10 %	**13.50 %**
S-R	53	%	62.30 %	58.50 %	20.80 %	**5.70 %**



Picture 3. Good grafting union (S-R) after 2 weeks, b) good grafting union (S-R) after 4 weeks (S-R), c) bad grafting union (S-R) after 4 weeks (S-R).

It should be noted that in the greenhouse, it is important to carefully check the roots of grafted plants, otherwise, 'false positive' results can occur when the almond/haustorium remains connected to the apical meristem (Picture 4).



Picture 4. Grafted plants after 70 days a) (S-S). b) (S-R), c) control palm, d) grafted palm after 6 months in greenhouse.

Conclusion and Opportunities

Our results show that optimizing the grafting process is entirely feasible, as we were able to produce grafted plants that developed after 2 months. Additionally, it will be important to assess the influence of the haustorium on the grafted seedlings. It should be noted that this grafting technique requires a sizeable amount of preparation time and technical precision.

Finally, this work opens the possibility of monitoring interspecific grafting and studying the potential benefits of specific rootstocks in conferring resistance to soil diseases and/or in optimizing oil production (e.g. rhizosphere quality, hormonal metabolism, plant growth, compatibility and interaction between selected genotypes).

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