New Techniques and Research To Improve and Enhance Production in the Sahel Region (grafting, polyclonal seeds, etc.)

By

SEYDOU NDIAYE

Research Fellow at the Agroforestry and Ecology Laboratory
Assane Seck University, Ziguinchor/Senegal
s.ndiaye2860@zig.univ.sn

PRESENTATION OUTLINE

- Introduction
- Importance of improved plant material to boost the productivity of cashew trees
- Approaches to varietal selections
- Vegetative propagation techniques
- Conclusion

1. INTRODUCTION

Cashew nuts, like other crops, have been the subject of research in **seed production**, **rootsocks**, **clonal orchards and silvicultural techniques** for improved yields.

The development of the cashew sector will help strengthen the well-being of operators on the margins of the market economy and improve their incomes.

1. INTRODUCTION

The average yield of cashew nuts in Senegal is 5kg per cashew tree compared to 20kg for the Beninese variety and 70kg for the Vietnamese variety. In addition, the small size of the nut as found in a large majority of the varieties cultivated, makes the product less competitive on the international market.

1. INTRODUCTION

The breeding of elite high-yielding trees in several countries shows that the production per cashew tree is **15.98** kg in Vietnam, **51** kg in Tanzania, between **23** and **61** kg in Côte d'Ivoire, **14.9** kg in India etc.

This varies according to the **climate** (Bello et *al.,* 2017), the **variety** (Aliyu et *al.,* 2001 ; Cavalcanti et Wilkinson, 2007 ; Aliyu et Awopetu, 2007 ; Djaha et *al.,* 2010 ; Djaha et al., 2012 ; Archak et *al.,* 2012 ; Aliyu, 2014 ; Djaha et *al.,* 2014), the **soil fertility** (Nortcliff et Gregory, 2013), **farming practices and maintenance of orchards** (Koffi et Bamba, 2008), and **to the incompatibility of pollens during fertilization** (Aliyu, 2007) etc.

2. Importance of improved planting material

2.1 Concept of planting material:

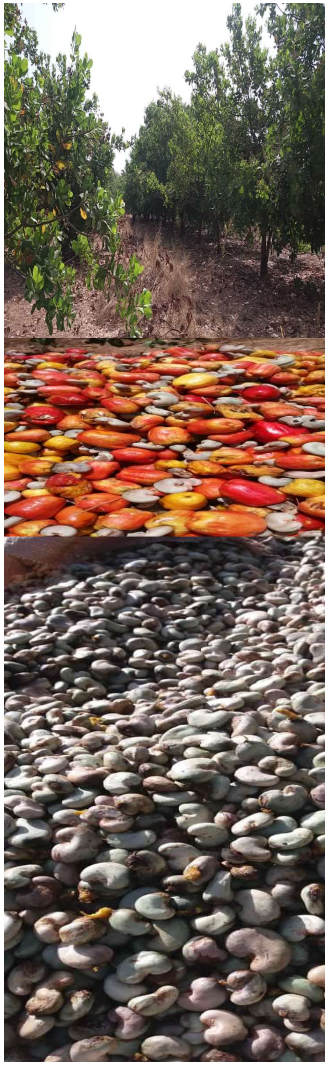
The physical nature of the plant used for production on a plot of land is determined by the best adapted propagation process. The planting material may be a plant selected from fragments or seeds of a plant:

- Seedling
- Cutting
- Layers
- Grafts
- In vitro culturing

2.2 Benefit of a good improved planting material

The choice of a planting material addresses the concerns of meeting a number of requirements or resolving some limiting factors, and among other they include:

- ❑ Resilience (adaptation) to environmental conditions
- ❑ High production capacity
- ❑ Nut quality
- ❑ Health status of the selected planting material etc.



3. Approaches to plant breeding

3.1 Identification of elite trees

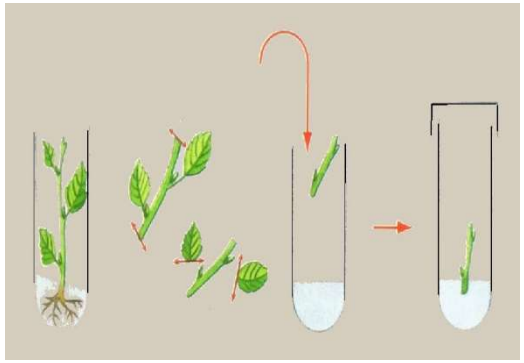
Most importantly it is an on-the-ground skill involving observation and patience.

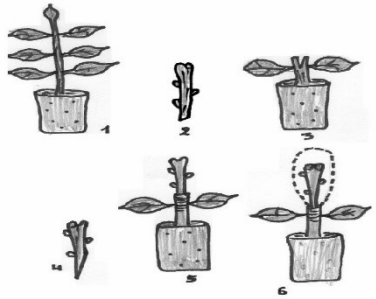
The breeding of elite trees is carried out based on regular monitoring according to **morphological** (size, weight), **physiological** (shape of the trunk, etc.) and **health requirements** (resistance to diseases).

3.2 Breeding of clones

Clonal breeding is a long process. From identifying of suitable plots of land, to the selection and approval of a clone and its propagation, it takes on average about 15 years. Thus, there are two types of cloning: **natural** and **artificial** cloning.

Clonal breeding is nothing else than mass breeding, comprising a set of agronomic and health assessments to breed a single stump corresponding to criteria determined by the breeder.





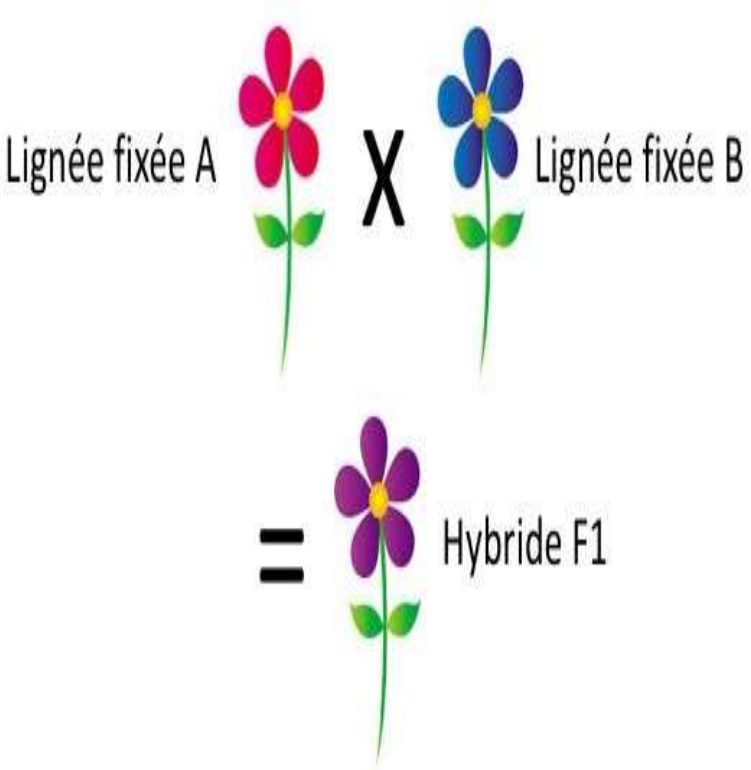
3.3 Genetic Trials and Hybridization Technique

Hybrid varieties are plants cross-bred between **two different pure varieties**, i.e. a *variety,* which has all the relevant qualities, such as **form**, **color, resistance to diseases** and **responsiveness to climatic conditions.**

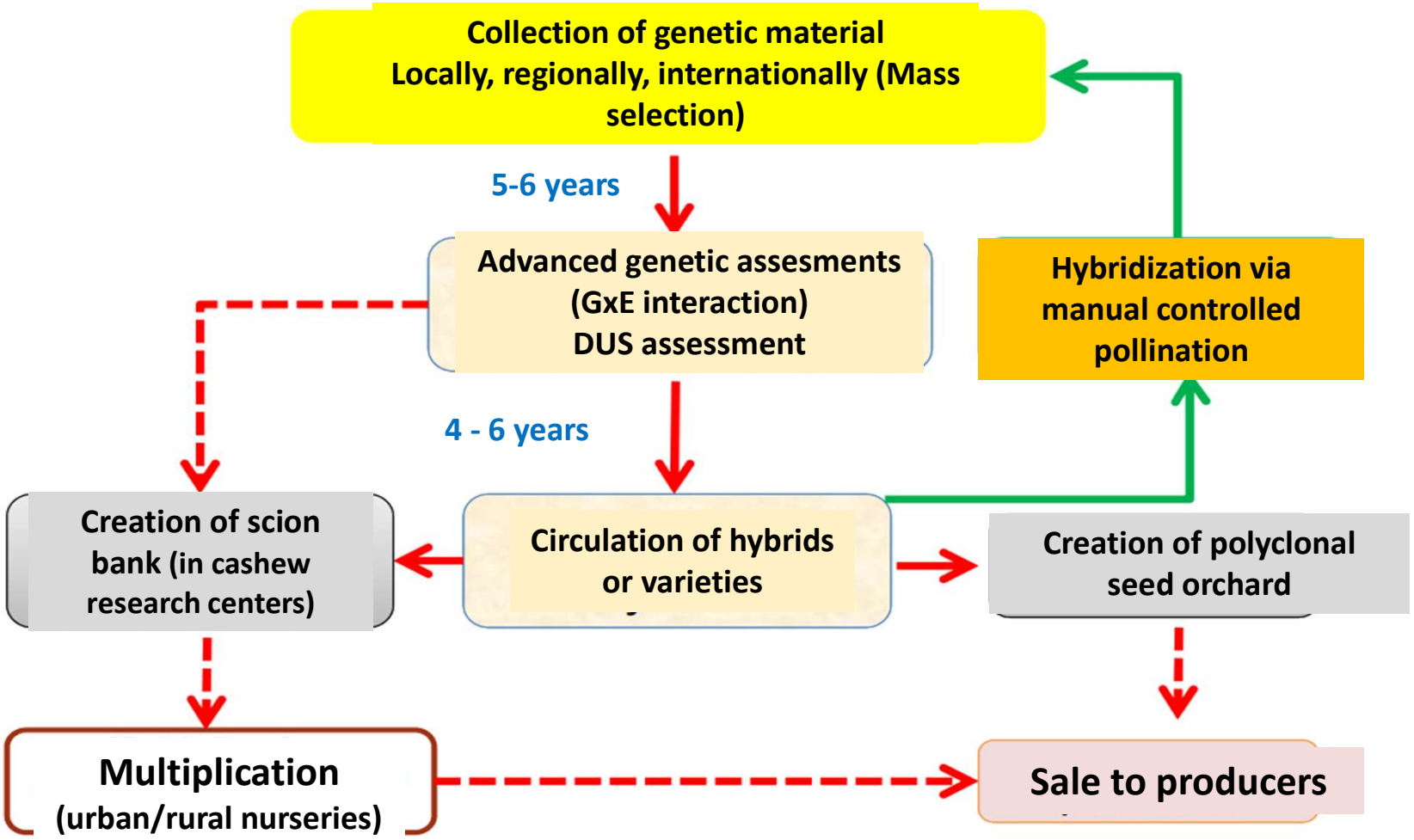
2-year old cashew hybrid (5 kg)

3.3 Genetic Trials and Hybridization Technique

To cross two plants, one must wait for the appropriate time and work with precision. It requires the following tools: a small pair of scissors and tweezers, a brush, a transparent plastic sachet and raffia bast.

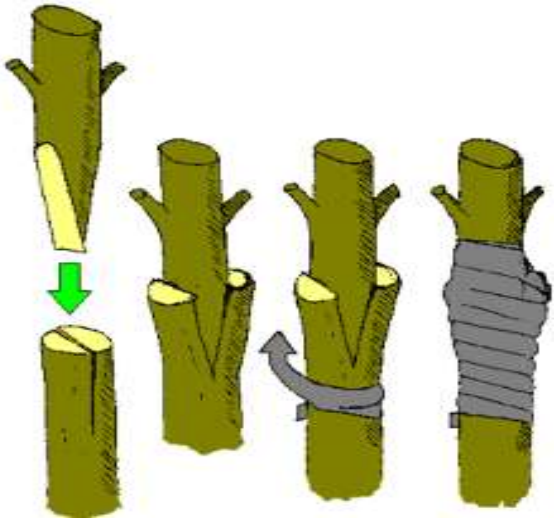


This breeding work results in plants that are often more productive and disease-resistant.



4.Techniques for vegetative propagation

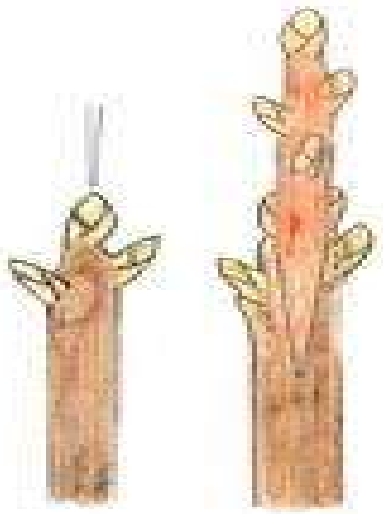
Vegetative propagation is a technique, which allows to develop plants **reliably reproducing the characteristics** emanating from the selected individual based on plant fragments (**grafts, cuttings, layers, suckers, sprouts from stumps etc.**)



4.Techniques for vegetative propagation

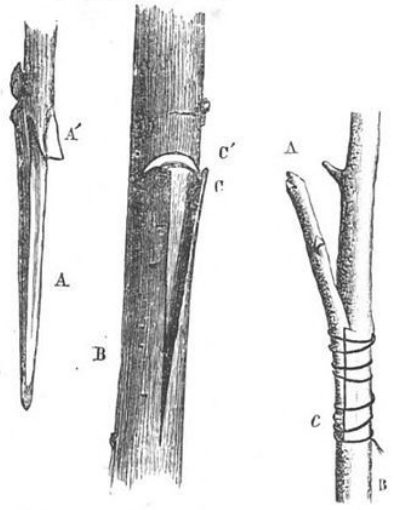
The grafting techniques used are:

- End Split Grafting;
- Side grafting;
- English grafting;
- Chip budding.



End Split grafting has recovery rates between 73% and 85% in the rainy season.

Simple side grafting has a recovery rate of +/–51% irrespective of the season.



5. Developing polyclonal seed gardens

Polyclonal seeds orchards are developed by using cashew nut varieties' seeds obtained after assessing the mother trees selected during the genetic trial.

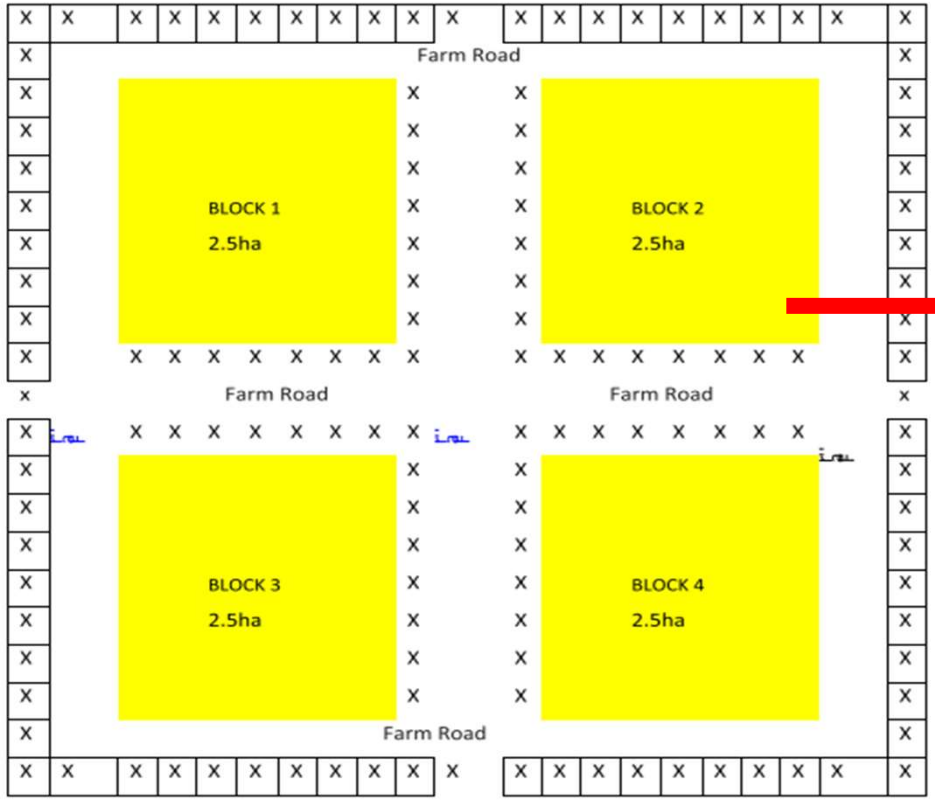
Benefits of polyclonal seeds are:

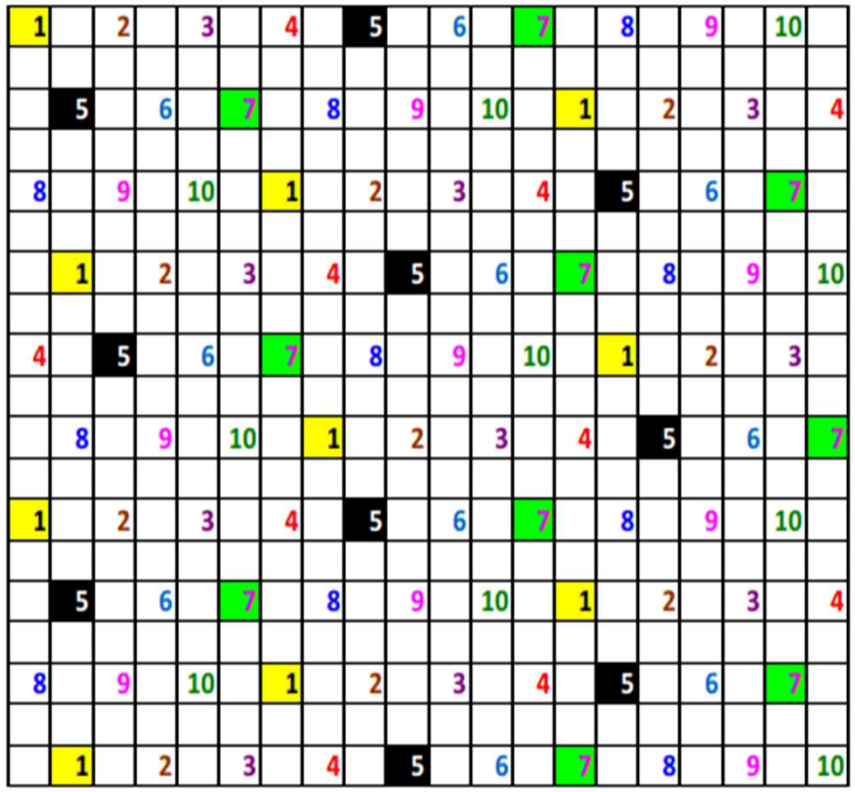
Crossed fertilization between trees from different clones with the desired genetic characteristics deliver seeds with multiple and varied qualities. As opposed to grafted seedlings, using polyclonal seeds can deliver highly effective planting material in terms of quality and ease of distribution to producers.

In order to produce polyclonal seeds the orchard must be isolated, and if possible, protected by tree hedges or wind breakers to avoid contamination with pollen from non-high yielding trees.

5.1. Experimental Mechanisms for Production of Polyclonal Seeds

Creating a polyclonal seed garden can be carried out in separate orchards in four blocks of 2.5 ha. For instance, the orchard is formed by 10 cashew clones/varieties. The layout of the plants can be done arbitrarily at a 12m x 12m distance.





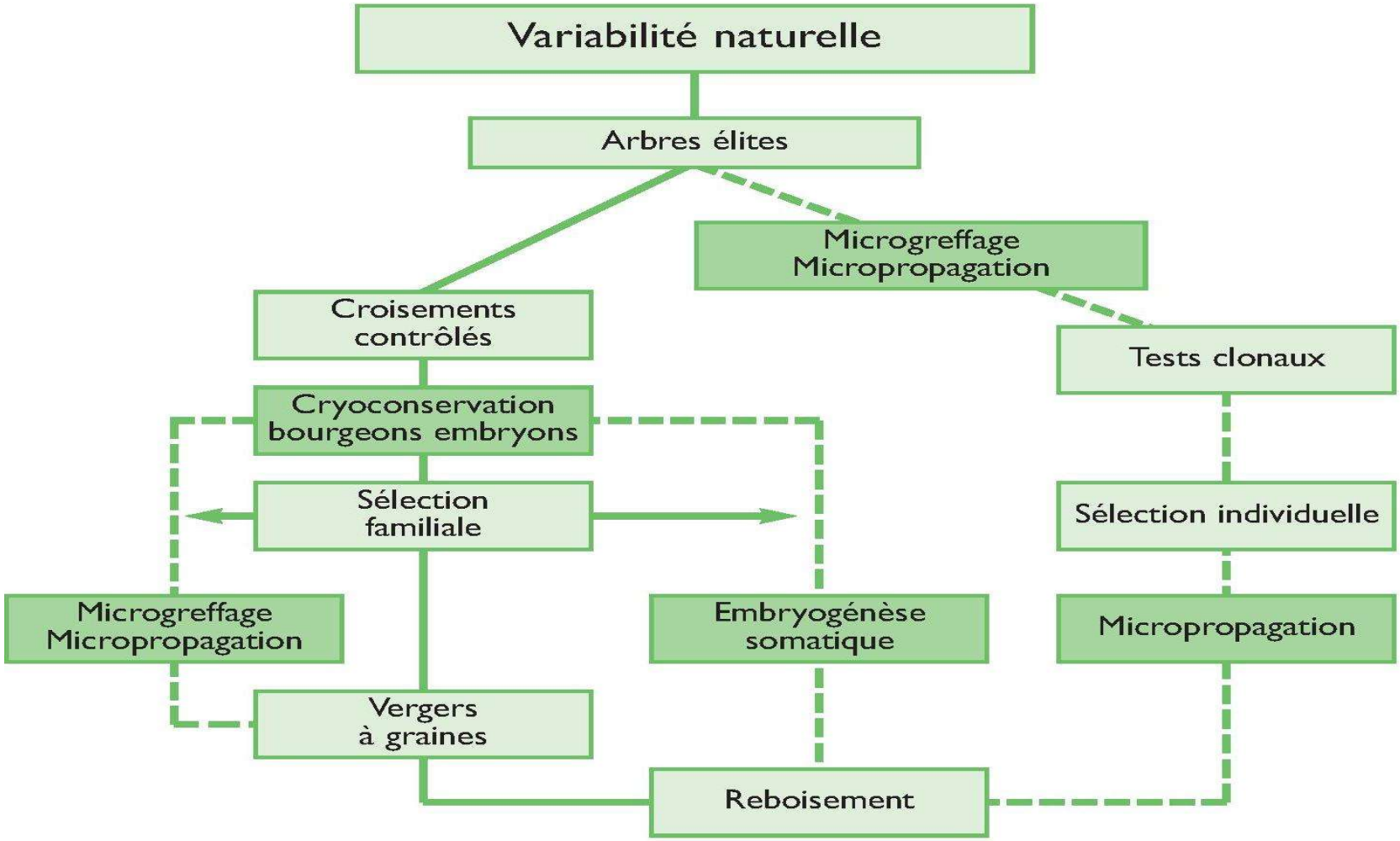
Note: *Varieties are represented by numbers 1 to 10*

5.2 . Certification of polyclonal seeds

Polyclonal cashew (nut) seeds do not need to be certified as improved since they are different from the annual crop varieties.

Every cashew (nut) seed on the same tree is genetically different. However, trials conducted in Tanzania have shown that a greater percentage of polyclonal seeds are high-yielding ones and some produce higher yields than most of the mother trees in the orchard.

5.3. Techniques for plant breeding and vegetative propagation



5. Constraints of Vegetative Propagation

- Limited accessibility of improved planting material for large-scale production.
- Research findings are often out of reach for adoption by technicians.
- Lack of training for producers on grafting techniques.

Conclusion

- Productivity is a critical criterion in the selection of seedlings, but the quality of raw cashew nuts is of cardinal importance.
- In order to strengthen seed nurseries and grafts, producers must focus on elite trees with a production value exceeding 25 kg.
- Ensure monitoring and specific propagation of grafting in order to maintain complete genetic potential.
- Coordination of research actions on cashew.
- Constant support for on-going research programs.

Thank you for your kind attention !!!