

Interim report I

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Project title	Development of agropastoral alternatives to promote the propagation of <i>Azelia africana</i> in Benin, a species threatened with extinction



1. Introduction

A. africana is a multipurpose tree widespread in West and Central Africa, used for timber, charcoal, fodder, and medicinal purposes (Donkpegan et al., 2020). It is also a leguminous, nitrogen-fixing species that improves soil fertility and plays an important role in agroforestry systems (Kitin et al., 2021). Because of its high protein, energy, and mineral content, *A. africana* is widely used as a livestock feed supplement during the dry season to compensate for the shortage of annual herbaceous fodder (Sèwadé et al., 2016; Sidi Imorou et al., 2016). The species is sometimes heavily pruned, occasionally without sparing certain individuals, in order to promote the population's evolutionary dynamics (Nacoulma et al., 2011). This practice leads to reduced diameter growth, lower fruit production, and poorer seed quality in pruned individuals, resulting in low regeneration density (Gaoue and Ticktin, 2007; Nacoulma et al., 2017; Amahowe et al., 2018).

Faced with this situation, several initiatives have attempted to introduce juveniles into natural habitats, but these efforts have failed due to the vulnerability of young seedlings to browsing by animals. Yet one of the remaining questions is: what alternatives are available for the sustainable conservation of *A. africana* in the context of pastoral livestock systems? In other words, what agricultural innovation can meet the demand for fodder during the dry season while reducing the pruning pressure on trees in protected areas? Due to the high costs involved, fodder production based on herbaceous species during the dry season does not

appear to be a suitable solution for livestock keepers in developing countries (Klein et al., 2014). Consequently, producing fodder biomass in nurseries using *A. africana* may help meet livestock feeding needs during the dry season while reducing the pruning of fodder trees.

Funded by The Rufford Foundation, the project "*Development of agropastoral alternatives to promote the propagation of Afzelia africana in Benin, a species threatened with extinction*" aims to (i) train local communities on advanced nursery production and planting techniques for *A. africana*, (ii) develop biomass production techniques in nurseries using *A. africana*, (iii) implement awareness-raising and environmental education programs focused on the conservation of *A. africana* and its habitats, and (iv) carry out reforestation activities in suitable habitats to increase the density of *A. africana* and ensure its long-term sustainability. This interim report aims to summarize the activities carried out under objective 3.

2. Methodology

2.1. Seed and Organic Manure Collection

To preserve the genetic diversity of the *A. africana* population, we implemented a systematic seed collection strategy across Benin's three main agroecological zones: Guinean, Sudanian–Guinean, and Sudanian (Fig. 1). This approach ensured optimal genetic representation and strengthened the species' resilience to diseases, pests, and environmental changes. We also collected seeds from spatially distant trees with diverse genetic traits to minimize inbreeding and promote effective genetic mixing. The organic manure used consisted primarily of cow dung collected from the animal production unit of the Baka experimental farm. According to Abdelilah et al. (2015) and Usman et al. (2023), these types of organic manure are known to positively influence seedling growth performance.

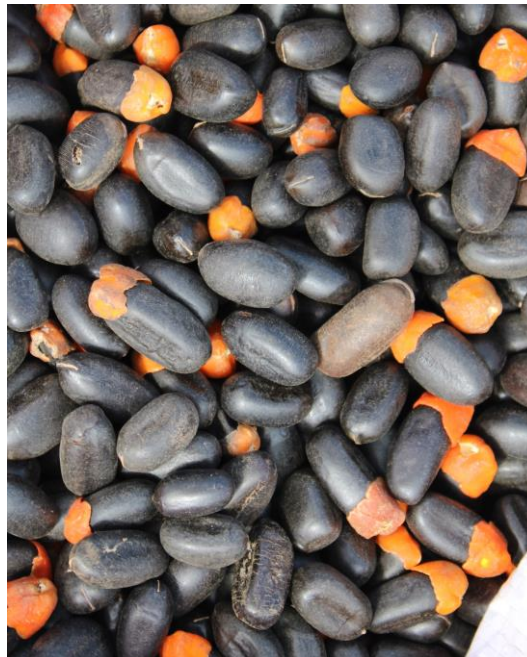


Fig. 1. Seeds of *A. africana* collected.

2.2. Experimental setup

A split-plot design with three treatments and three replications was implemented for each biomass harvesting technique (Fig. 2). Two *A. africana* seeds were sown per hole, spaced 0.2 m × 0.2 m apart to increase the chances of obtaining at least one sprout per hole (Fig. 3). We evaluated the effect of organic fertilizers on the growth performance of *A. africana* by applying different doses of cow manure and poultry droppings (0, 20, and 30 t/ha) to each 9 m² plot. Two different biomass harvesting techniques were applied to the seedlings in order to compare and identify the most effective method: pruning (Fig. 4), and leaf harvesting while sparing the

terminal buds (Bationo et al., 2009)(Fig. 5). Before the first harvest, five *A. africana* seedlings were randomly selected and marked in each plot to monitor their growth.



Fig.2. Experimental setup.



Fig. 3. Sowing seeds of *A. africana*.



Fig. 4. Cut after the first three leaves.



Fig. 5. Leaf harvesting while sparing the terminal buds.

3. Key findings

3.1. Germination rate

In this experiment, the germination rate of *A. africana* seeds was 61.40% (Table 1).

Table1. Germination rate of *A. africana* seeds.

Plot	Germination rate (%)
1	61.98
2	60.33
3	61.57
4	59.92
5	58.68
6	53.30
7	54.13
8	63.63
9	70.66
10	61.98
1	59.09
12	49.17
13	98.34
14	54.13
15	54.95
Total	61.40

3.2. Effect of treatments on the number of leaves of *A. africana* seedlings

The number of leaves among seedlings under the different treatments (Fig. 6) was significantly different before and after cutting (P-value < 0.001). After cutting, the highest number of leaves was obtained with the treatment consisting of cutting after the first three leaves (every two months) (10.17 ± 4.56), and the lowest number was recorded with the treatment of harvesting on standing plants while sparing the terminal buds (every two months) (8.02 ± 3.55). Cutting after the first three leaves therefore promotes leaf development in *A. africana*.

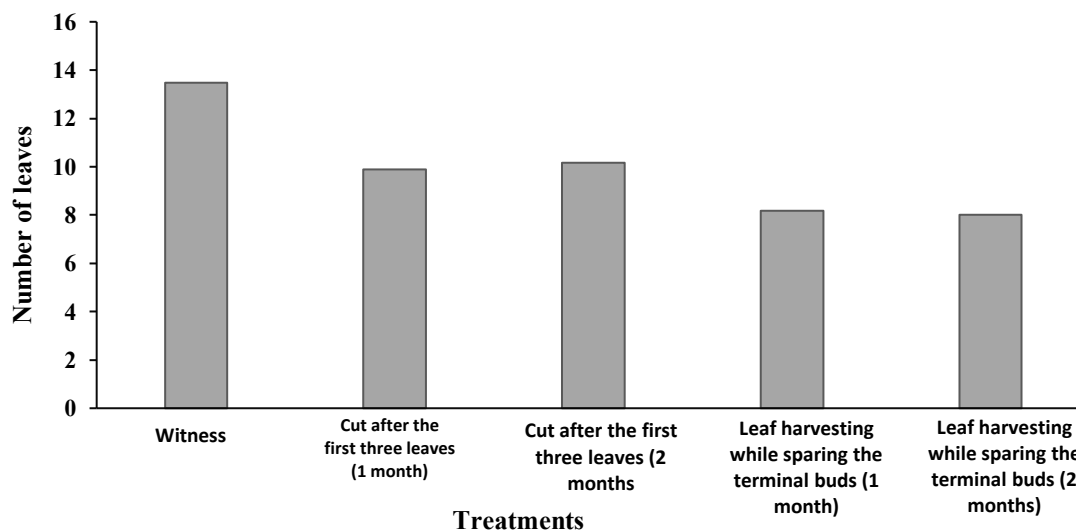


Fig. 6. Number of leaves of seedlings after cutting.

3.3. Effect of treatments on collar diameter of *A. africana* Seedlings

The collar diameter of seedlings under the different treatments (Fig. 12) was significantly different after cutting (P-value < 0.001). After cutting, the highest collar diameter was obtained

with the treatment consisting of cutting after the first three leaves (every one month) (9.99 ± 1.17), and the lowest value was recorded with the treatment of harvesting on standing plants while sparing the terminal buds (every two months) (9.47 ± 1.13). Cutting after the first three leaves therefore promotes an increase in collar diameter in *A. africana* seedlings (Fig. 7).

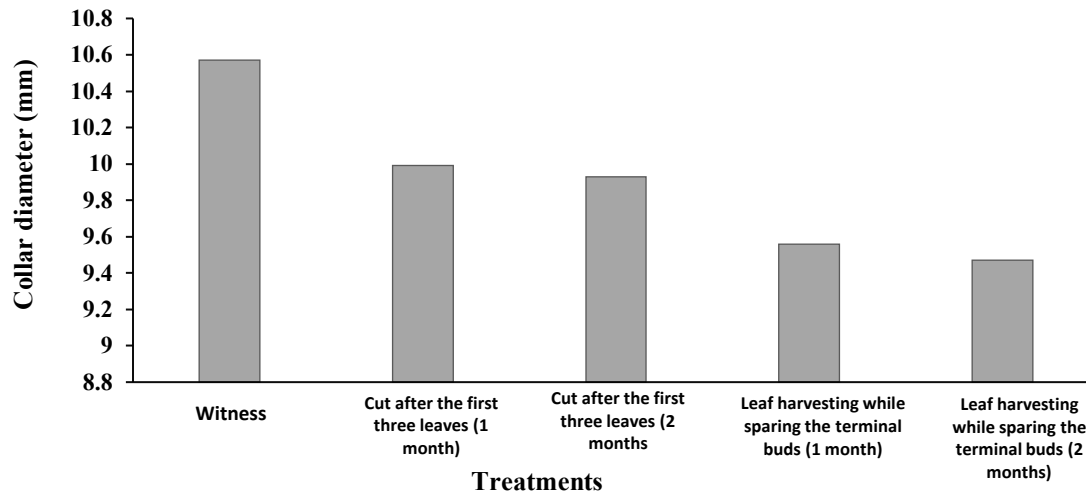


Fig. 7. Collar diameter of seedlings after cutting.

3.4. Effect of treatments on fodder biomass

Fodder biomass differed significantly among treatments during both the first and the second harvest (P -value = 0.024 and 0.005 respectively). The fodder biomass obtained during the second harvest with the treatment consisting of cutting after the first three leaves (72.68 ± 5.95) was higher than that obtained with the treatment of harvesting on standing plants while sparing the terminal buds (45.85 ± 5.92). Cutting after the first three leaves therefore promotes fodder biomass production (Fig. 8).

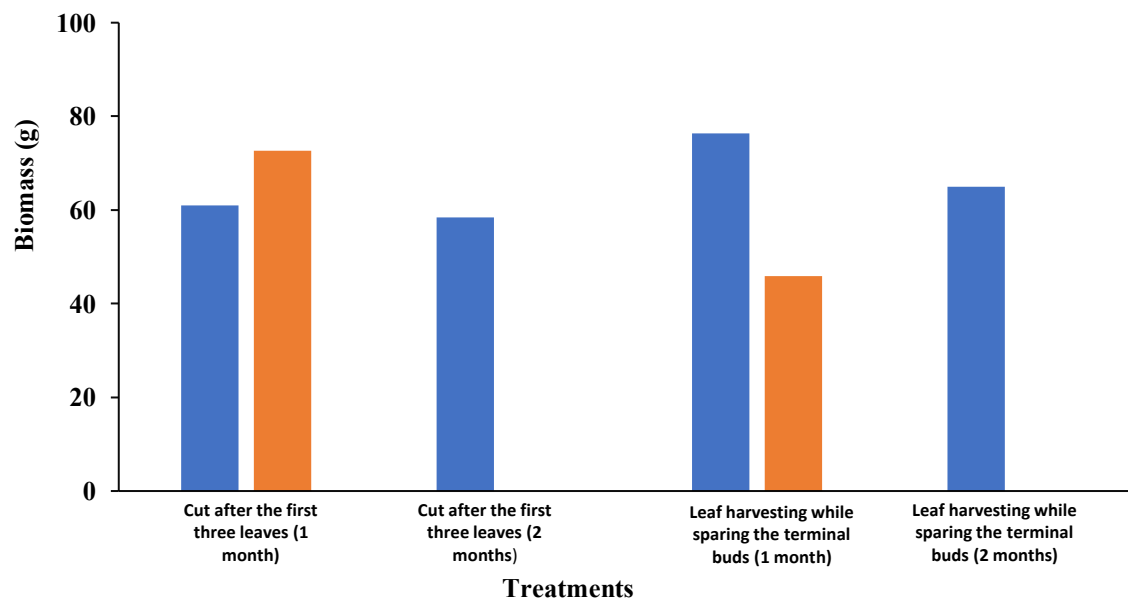


Fig. 8. Dry biomass of seedlings during the first and second cuts. In the figure, the blue color represents the values from the 1st cut (with a p -value = 0.024). The orange color represents the values from the 2nd cut (with a p -value = 0.005).

4. Conclusion

The results show that cutting seedlings after the appearance of the first three leaves clearly improves leaf development, increases collar diameter, and enhances fodder biomass production. This technique thus proves to be the most effective method for optimizing nursery biomass production in *A. africana*. It provides a solid basis for developing improved management practices aimed at increasing biomass yield in this species.

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Appendix: some photos of the experimentation



Watering of the nursery plots.



Harvesting of fresh biomass.



Weighing of fresh biomass.



Sampling of 100 g for oven drying.



Drying of samples in the oven.