World Journal of Agricultural Sciences 15 (4): 215-219, 2019
ISSN 1817-3047

DOI: 10.5829/idosi.wjas.2019.215.219

Pre-Severance and Post-Severance Survival, Growth and Fruiting of *Allanblackia floribunda* Oliv. Marcots

H.O. Okonkwo, O.A. Koyejo and R.I. Oyediran

Swamp Forest research station, Onne, Rivers state, Nigeria

Abstract: Studies on the vegetative propagation of *Allanblackia floribunda* for domestication purposes have been in progress since 2004. However investigation tracing the journey of marcots from pre-severance to post-severance treatments, establishment and fruiting is rare. The study therefore was designed to achieve this and particularly to assess the survival rate of marcots from pre-severance through post-severance weaning, field establishment and the fruiting age of marcots of the species. A total of 525 marcots were set on female trees of *A. floribunda*. Rooting medium used was sterilized (by boiling) decomposing saw-dust while mean crown depth of marcotted trees was 187 cm. Pre-severance marcot survival after 14 months was in the branch diameter range 3.4 cm (19 marcots), 4.04 cm (22 marcots) and 4.54 cm (25 marcots), followed by 2.54 cm (6 marcots), 3.54cm (7 marcots), 5.04cm (8 marcots) and 5.54cm (9 marcots) while the lowest, surviving marcots were those with 2.04cm (1 marcot), 6.04cm (2 marcots) and 7.04 cm (1 marcots) and twelve of the marcots grew only callus tissues. Marcots grew leaf buds in a week and flower buds in 3 weeks in the humid chamber. Post-severance weaning survival was 58% and 42% mortality while post-severance field establishment survival was 50% and 8% mortality. Marcots fruited after four years for the first time after field establishment. To improve post-severance marcot survival during weaning future work should focus on the influence of irradiance, potting medium and temperature on the survival of marcots.

Key words: Weaning · Mortality · Fruiting Age · Survival Rate · Branch Diameter · Indigenous Fruit Trees

INTRODUCTION

Allanblackia is a small genus of the family Clusiaceae, named after Allan Black, a 19th century botanist [1]. *Allanblackia* is dioecious. Nine species of *Allanblackia* are indigenous to the African tropics. Three of the nine species, *Allanblackia stuhlmannii*, *A. floribunda* and *A. parviflora,* are important in food (margarine) and cosmetic (soap and detergent) industries. *A. floribunda* is indigenous to Nigeria and is found growing well in the Niger Delta, region of Edo, Rivers and Cross River states. However it is also found in Ogun, Ebonyi, Ondo, Osun, Imo, Enugu, Anambra, Abia, Ekiti and Lagos States [1].

A. floribunda is a multipurpose indigenous fruit tree. Potentially, it is an important alternative source of income to farmers. The seeds of *A. floribunda* are rich in oil. A new agri-business based on the oil is being developed in Nigeria, Ghana, Cameroon and Tanzania [2]. Very large quantities of both seed and vegetatively propagated plants will be required to supply this demand for planting materials.

Research on the vegetative propagation of *A. floribunda* is important for the following reasons [2, 3]:

- The difficulties in handling seed, especially very slow germination, means that alternative means of propagation are desirable.
- The clonal nature of vegetative propagation brings the opportunity to control the female to male ratio of *A. floribunda* trees (the genus being dioecious). The other is the ability to sample and then multiply 'true-to-type' elite varieties that have superior production characteristics.
- A concern with *A. floribunda* grown from seed is the relatively long time (12 years) taken to produce fruit. Experience from other tropical fruit trees suggests that the period to maturation may be reduced by at least half through vegetative propagation, allowing

Corresponding Author: Okonkwo Henry, O., Swamp forest research station, Onne, Rivers state, Nigeria.
Tel: +234 70 32213189.

production from planted stands to begin considerably earlier than would otherwise be the case.
- Information on propagation techniques is scarce and undefined.

Studies on the vegetative propagation of *A. floribunda* for domestication purposes have been in progress since 2004 with the first study on published in 2006 [4]. As an agroforestry species, the desire has been to rapidly acquire higher yields, early fruiting, better quality nuts and oil while also producing fruit bearing female trees due to dioecy in *A. floribunda.* Through cloning, there is the possibility to developed clones or cultivars that could offer more uniform products that would better meet market demands. Several vegetative propagation techniques have been utilized to achieve this, including the use of stem cuttings, marcots and grafting [5]. For example 40-70% of rooting success can be obtained from juvenile cuttings and 40-80% marcot success rate in *A. floribunda* [2]. However report tracing the journey of marcots pre-severance to post-severance weaning, establishment and fruiting in *A. floribunda* is rare. The study therefore is designed to achieve this and particularly to report the survival rate of marcots pre-severance through post-severance treatments and the fruiting age of marcots of the species.

MATERIALS AND METHODS

A total of 525 marcots were set in August as described by Munjuga *et al.* (2008) on female trees of *A. floribunda* at Nyowii in Khana LGA (Lat. 4°42^{l}0 N and Long. 7°21^{l}0 E) after an awareness campaign in the community about the importance of the species and the inherent economic potential in the domestication. Rooting medium used was sterilized (by boiling) decomposing saw-dust while mean crown depth of marcotted trees was 187 cm.

Marcots were harvested October the following year which amounts to 14 months after marcots were set. Rooting started in the marcots about three months earlier but they could not be harvested due to issues with access to the site. Harvested marcots were potted in 20 cm × 20 cm polypots using forest topsoil as the potting medium and kept in a humid chamber at the nursery of the swamp forest research station (Lat. 4°42^{l}10N and Long. 7°10^{l}32E). The humid chamber (Figure 1) is similar to the green house except that the frame is made of wood and the covering was transparent nylon. Relative humidity within the chamber is around 90% [6, 7]. Marcots were watered daily in the chamber: the high humidity level in the chamber made sure marcots did not get dehydrated. Five months after harvest marcots were moved from the chamber to a partially shaded area and two months later they were planted out in the field at 4m×4m spacing.

Fig. 1: Post-severance weaning of marcots in the humid chamber.

RESULTS AND DISCUSSION

Marcot Pre-Severance Survival: Highest surviving rooted marcots after 14 months on the tree were in the branch diameter range 3.4 cm (19 marcots), 4.04cm (22 marcots) and 4.54cm (25 marcots), followed by 2.54cm (6 marcots), 3.54cm (7 marcots), 5.04cm (8 marcots) and 5.54cm (9 marcots) while the lowest, surviving marcots were those with 2.04cm (1 marcot), 6.04cm (2 marcots) and 7.04cm (1 marcots) (Fig. 2). It has been reported by several authors [5, 8-10] that marcots within the diameter range 3.0cm to 5.0cm root better as a result of high carbohydrate and auxin reserves while those below and above these range are likely not to root very well and the highest and medium surviving marcots in this study are within the range. Therefore the high food reserve within these branches could also have been responsible for the ability of these marcots to survive the long period before harvest as they drew from the storage to survive the drought. The benefit of the present study is that it reveals that the high carbohydrate reserves in larger diameter branches that promotes rooting also promotes and supports the survival of marcots while still attached to the mother tree.

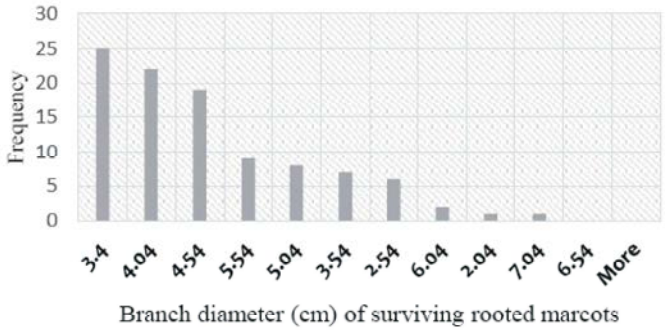

Fig. 2: Branch diameter of harvested *Allanblackia floribunda* rooted marcots after 14 months

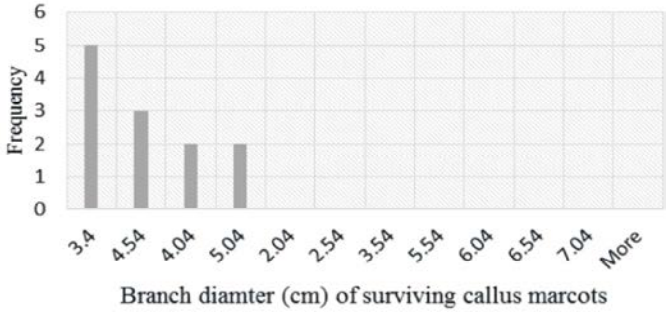

Fig. 3: Branch diameter of callus forming marcots after 14 months.

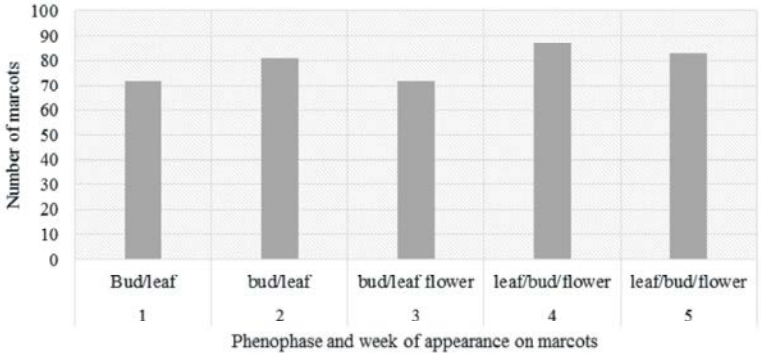

Fig. 4: Weekly appearance of phenophases on marcots in the humid chamber.

Twelve of the harvested 100 marcots grew only callus tissues (Fig. 3). This is in agreement with Bridgemohan *et al.* [11] who also found that some marcots in *Artocarpus altilis* formed calli. These marcots were found to equally fall within the diameter range (3.0cm-5.0 cm) as the well rooted marcots in figure 2 above. Since calli are root primordial [12] it means that 14 months after marcot setting fresh rooting was still going on in the braches and gives a clue to how long marcotted branches in *A. floribunda* can survive the procedure while retaining rooting vigor pre-severance.

Marcot Post-severance Growth and Survival: Marcots started growing leaf buds in a week and flower buds in 3 weeks in the humid chamber (Fig. 4). This is in agreement with Bridgemohan *et al.* [11] who observed flowering in *Artocarpus altilis* in the poly pot in the nursery. The result is however contrary to Tsobeng *et al.* [13] who reported flowering in *A. floribunda* grafts after 3 years. This provides an excellent opportunity for studies on floral biology and breeding system of the species ex-*situ.*

By the time marcots were moved out of the humid chamber to the weaning shed of a partially shaded area mortality rate was 42% within the space of 5 months (Fig. 5). This is contrary to Tchoundjeu *et al.* [7] who recorded high mortality rate of up 90% in *Irvingia gabonensis* marcots during weaning.

Marcot Survival and Fruiting after Field Establishment: Seven months after marcots were harvested they were planted out in the field at 4cm×4cm espacement. Another five months later 8 marcots died from the shock

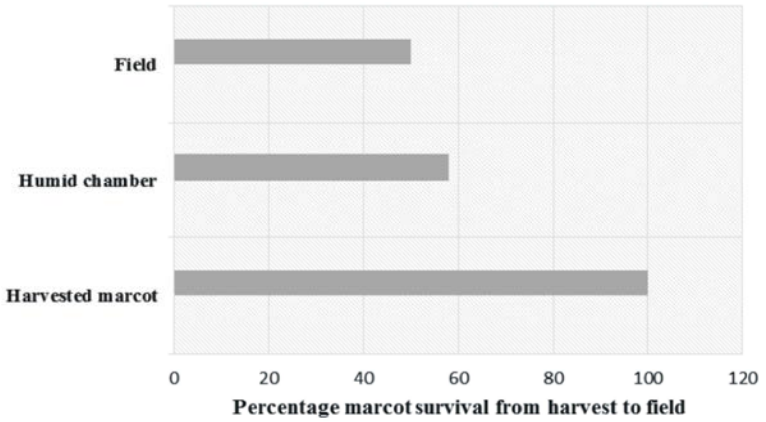

Fig. 5: Survival of *Allanblackia floribunda* marcots from harvest to the field

of transplanting leaving 50 healthy marcots that started fruiting for the first time in the fourth year after planting (Fig. 5). This is contrary to Tsobeng *et al.* [13] who reported fruiting in *A. floribunda* grafts after three years. This is an indication that *A. floribunda* grafts fruit earlier than the marcots. Furthermore the study shows that post-severance mortality was higher during weaning (42%) than during establishment on the field (8%) in *A. floribunda* marcots. Therefore the place to concentrate attention at reducing post-severance mortality of *A. floribunda* marcots is in the area of marcots handling and management during weaning. Weaning temperature, rooting medium and irradiance are factors that can possibly be manipulated to determine precisely their role in the survival of marcots during this critical period in the life of marcots.

CONCLUSION

Following the journey of *A. floribunda* marcots from pre-severance to post-severance weaning, establishment and fruiting in the field the study found that marcotted branches of the species can survive and retain rooting vigor pre-severance for up to 14 months on the mother tree. The branches that survive the long period before harvest are similar in diameter (3.0-5.0cm) to those reported in the literature to root better in other species. The high post-severance mortality during weaning (42%) compared to 8% after field establishment show that marcot management during weaning requires research attention to reduce the mortality rate. An investigation of the role that irradiance, potting medium and temperature plays in the post-severance survival of the marcots during weaning can possibly solve the puzzle. *A. floribunda* marcots were found to fruit after four years of field establishment compared to the three years fruiting age reported for grafts of the species in the literature.

REFERENCES

1. Badejo, S.O., 2005. A progress report by the Executive Director Forestry Research Institute of Nigeria, Ibadan.
2. Munjuga, M., D. Ofori, C. Sawe, E. Asaah, P. Anegbeh, T. Peprah, M. Mpanda, L. Mwaura, E. Mtui, C. Sirito, A. Atangana, S. Henneh, Z. Tchoundjeu, R. Jamnadass and A.J. Simons, 2008. Allanblackia propagation protocol. World Agroforestry Centre (ICRAF), Nairobi, Kenya, ISBN 978-92-9059-231-0.
3. USAID, 2007. Vegetative propagation techniques. Perennial crop support series Jalalabad, Afghanistan publication No. 2007-003 November 18 2007. International Agricultural programs www.rootsofpeace.org. pp: 39.
4. Atangana, A.R.., Z. Tchoundjeu, E.K. Asaah, A.J. Simons and D.P. Khasa, 2006. Domestication of Allanblackia floribunda: Amenability to vegetative propagation. Forest Ecol Manag, 237: 246-251.
5. Asaah, E.K., 2012. Beyond vegetative propagation of indigenous fruit trees: case study of Dacryodes edulis (G. Don) H. J. Lam and Allanblackia floribunda Oliv. PhD. Thesis, Faculty of Bioscience Engineering, Ghent University, Belgium, pp: 231.
6. Leakey, R.R.B., J.F. Mésen, Z. Tchoundjeu, K.A. Longman, J.M. Dick, A. Newton, A. Martin, J. Grace, R.C. Munro and P.N. Muthoka, 1990. Low technology techniques for the vegetative propagation of tropical trees. Commonw. For. Rev., 69(3): 247-257.

7. Tchoundjeu, Z., A.C. Tsobeng, E. Asaah and P. Anegbeh, 2010. Domestication of Irvingia gabonensis (Aubry Lecomte) by air layering. Journal of Horticulture and Forestry, 2(7): 171-17.
8. Kengue, J., 2002. Safou, Dacryodes edulis (G. Dom) H. J. Lam. ICUC, RPM Reprographics, Chicghester, Angleterre. pp: 144.
9. Mialoundama, F., M.L. Avana, E. Youmbi, P.C. Mampouya, Z. Tchoundjeu, M. Mbeuyo, G.R. Galamo, J.M. Bell, F. Kopguep, A.C. Tsobeng and J. Abega, 2002. Vegetative propagation of Dacryodes edulis (G. Don) H. Lam by marcotts, cuttings and micro-propagation. Journal of Forests Trees and livelihoods, 12(1): 85-96.
10. Leweniqila, I.L.V.A., 2013. An evaluation of marcotting techniques on breadfruit (Artocarpus altilis) variety, 'bale kana' for improved multiplication of planting materials in Fiji. Master's thesis, School of Agriculture Food and Technology, Faculty of Business and Economics, the University of the South Pacific.
11. Bridgemohan, P., M.E. Mohamed, A. Ramoutar, K. Singh and R. Bridgemohan, 2016. Air Layering (Marcotting) of Breadfruit (Artocarpus Altilis). International Journal of Research and Scientific Innovation (IJRSI), 3(9): 1-4.
12. Park, J., K. Lee and S. Lee, 2002. Histological study of callus formation and root regeneration from mung bean (Vigna radiata W.). Journal of plant biology, 45(3): 170-176.
13. Tsobeng, A., E. Asaah, Z. Tchoundjeu, P.V. Damme, D. Ofori and R. Jamnadass, 2017. Growth, flowering and fruiting of stecklings, grafts and seedlings of Allanblackia floribunda Oliver (Clusiaceae). Agroforestry system, 91(2): 259-270.