

NURSERY MANAGEMENT OPERATIONS FOR GUM ARABIC (*Acacia senegal*) SEEDLINGS

I.F. Ojiekpon^{1*}, E.K. Eifediyi², S.N. Ogieriakhi², E.A. Oghide², N.M. Fakuta¹ and Y. Waizah

¹Rubber Research Institute of Nigeria, Gum Arabic Sub Station Gashua, Yobe State, Nigeria

²Rubber Research Institute of Nigeria P. M. B 1049 Iyanomo, Benin City, Nigeria

Abstract

To confront the challenges posed by desertification and climate change processes coupled with their environmental and socio-economic impact, massive tree planting programmes have been promoted by different governments and individuals in sahelian regions of Africa. The success of any tree planting exercise depends largely on the use of good nursery seedlings stock. Presently, nursery techniques used in raising seedlings for the establishment of *A. senegal* plantations in the country and some of the desertification and erosion control programmes are those recommended for some other dry-land tree seedlings, which are not quite suitable for the crop. The various nursery maintenance operations (nursery demarcation, shade management, filling of failed pots, thinning, watering, root pruning, weeding and insect pest control) treated in this paper are results of *A. senegal* nursery experiments at the Rubber Research Institute of Nigeria which have been tested and found suitable for the production of healthy seedling stock.

Keywords: Nursery management, gum arabic, *Acacia senegal* seedlings

Introduction

Acacia senegal is a crop of dry-land environments cultivated principally for gum arabic used as food additive and the tree for fighting land degradation and desertification in arid and semi-arid rural and pastoral communities [1, 2 and 3]. The success of any tree planting exercise depends largely on the use of good nursery seedlings stock. Nursery is an intensive care unit in crop husbandry that provides a controlled environment for raising vigorous seedlings for transplanting. With adequate care,

seedlings of dry land *Acacias* should attain transplanting size (30 – 60 cm) in 3 – 5 months [4, 5 and 6]. To achieve this target, the following nursery care delivery systems viz: demarcation and fencing, shade and shade management, root pruning, watering etc should be undertaken.

Nursery Demarcation

Nigerian gum arabic belt (Sudan and Sahelian savannas) is heavily populated with free-range domestic animals. Most of

*Corresponding author, E-mail: ojiiekpon2@yahoo.com

these animals are mainly ruminants which nibble seedlings of *Acacia senegal*. The animals apart from eating up the crop also trample on un-protected seedlings of gum arabic. To check this menace nursery boundaries should be demarcated and fenced. The type of fence depends on the cost and availability of fencing materials. The following are possible fencing materials:

- a) Corn and millet stalks or fence made from thatched grasses can be used. They are smeared regularly with waste engine oil to make them un-attractive to the grazing animals.
- b) Live fence: Live plants especially thorny species like *Zizyphus*, *Dichrostadys*, *Acacia seyal*, *Acacia senegal* etc can be planted along nursery boundaries.
- c) Fencing wire mesh: "Cattle fencing wire mesh" is popular in this regard. It is purchased in rolls and spread out with supporting poles of 2.0 m height. The wire mesh is held on to the poles with the aid of binding wire. The poles could be angle (iron) or wooden.

Shade and Shade Management:

Gum arabic belts are usually hot and dry with temperature sometimes as high as 43°C (7). Young seedlings therefore require shade for at least the initial 1 -2 months after sowing. Shade protects the tender seedlings against sun scotch. Two types of shade are commonly used in *Acacia senegal* nursery. These are:

- a) Artificial shade: This is constructed where permanent nursery structures are not in place. It is usually constructed from woven mats,

thatched grass, corn/sorghum stalks, forked wooden stick and wooden or iron poles.

- The forked sticks are used as vertical supports to raise the shade from the ground at 1.5 – 2.0 m height.
 - The wooden or iron poles are used as cross bar.
 - The mat or thatched grass are laid on the cross bars and fastened to the poles with binding wires.
- b). Live shade: This is the shade cast by perennial trees in the nursery. Trees that have the capacity to retain their leaves almost all year round are usually preferred. Example of such trees in the savanna include neem (*Azadirachta indica*), *Eucalypts*, *Khaya* species etc.
 - When planting such trees, space them more than their recommended spacing. This is to prevent early canopy closure. Continuous canopy excludes solar radiation from the seedlings hence distortion in growth.
 - When the population of the shade trees is too dense, the trees should be thinned or some of the branches pruned to create space for light penetration which the seedlings also require for growth and development.

Sowing of Seeds

- Black poly bags of size 8 - 9cm diameter, 23 - 25cm depth, low density and about 37.5 microns or 150 – 200 gauge can produce sturdy *Acacia* seedlings with substantial root volume

and transplantable plant height of 30 - 60cm in 3 - 4 months.

- Potting mixture comprising of top soil, river sand and cow dung mixed at a ratio of 3:2:1 or 2:2:1 is a common practice in raising nursery seedlings of *Acacias*.
- Sow 2 - 3 scarified seeds per hole and water copiously.

Pre-germination and Re-sowing of Vacant Poly Bags:

Seed dormancy is an innate character of *Acacia* seeds. This is a protective mechanism to overcome adverse weather conditions. Pot failures can also result from die back of seedlings. To fill vacant poly bags, germinated seeds are either lifted from pre-germination chamber or sown directly with fresh seeds.

a). Pre-germination: *Acacia senegal* seeds germinate well when conditions necessary for germination are stimulated.

- Materials required are black polythene bags of about 25 cm diameter x 50 cm depth.
- Perforate 2 poly bags at the bottom to allow for drainage and light penetration.
- Fill one of them to half-full with saw dust.
- Irrigate the medium to saturation point.
- Spread scarified seeds of *Acacias senegal* on the surface of the growth medium and cover the seeds lightly with moist saw dust.
- Take the second polythene bag which is also perforated, turn it upside-down and use it to cover

neatly the growth medium. Perforation of this polythene bag is to allow light into the growth chamber.

- This design builds up heat which is also required for germination.
- On the third day, open the germination chamber. It is expected that about 80% of the seeds would have germinated with well defined radicles.
- Pick the germinated seeds and plant immediately into the failed polythene bags of the main nursery. The tender radicles can wither with prolonged exposure even for one hour.
- Use a receptacle containing water to transfer the sprouted seeds from the germination chamber to where they will be planted.
- Irrigate copiously before and after lifting.
- If seeds are left in the germination chamber for too long like one week, cotyledons of germinated seeds would have opened while the roots must have grown to the base of the bag. Where lifting is delayed in this case, handle the delicate seedlings with care. To lift, hold the plant between the radicle and cotyledons and pull out gently.
- Irrigate copiously before and after planting.

b). Re-sowing

- Vacant poly bags can be sown directly with scarified seeds. Sow 2 -3 seeds per hole.
- Start re-sowing operation towards the end of the second week. This is

because germination can be delayed for 2-3 weeks.

- During re-sowing, avoid creating planting holes at the center of the pots. This will check possible damage to germinated seeds that have not emerged.

Thinning

Thinning refers to the removal of extra seedlings or reduction in shade.

a). Thinning of extra seedlings

- Thinning should be undertaken at age 2-4 weeks when the seedlings must have had 2-3 pairs of leaves above the cotyledons.
- Thinning is done manually (with hand).
- Hold the seedlings by the stem at ground level and pull them out gently.
- Thin to one seedling per hole.
- Irrigate copiously before and after thinning.

i). Transplanting of extra seedlings: It is a good practice to transplant thinned out (culled) seedlings to fill vacant pots.

- Hold the culled seedlings in a receptacle containing water.
- Create planting holes in the tilled pots with sticks.
- Prune their root to 5-8 cm.
- Always hold seedlings by the leaves. Avoid squeezing the stem, growing tips and roots.
- To plant, lower the seedling root system in the hole. Ram the soil around the root system.
- Water copiously before and after transplanting.

- b). Thinning of shade: As seedlings mature, more light is required. The seedlings should also be exposed gradually to the harsh environmental conditions obtainable in the field. This process of gradual exposure of seedlings to sun light is called hardening. To achieve this, shading materials are removed gradually.

Watering

Water is a major input in Acacia nursery management. One of the important criteria for nursery site selection is nearness to a perennial and dependable source of water. The source of water could be ground water, near-by stream or purchased water from water vendors.

- Ensure continuous water supply by storing water in surface or overhead tanks.
- In well established permanent commercial nurseries, irrigation of seedlings can be automated. In this case, water is delivered via connecting pipes, hoses, nozzles etc using pumps or by gravitational flow.
- In small holdings, manual watering is the rule. Watering cans fitted with fine rose are used.
- In delivering water, hold the watering can with the rose slightly above the height of the seedlings.
- Water twice daily especially when temperature is high and heat is excessive.
- Watering is done in the morning or evening when evapo-transpiration is low.

- Reduce watering to once a day (morning or evening) close to transplanting time as rains must have set in.
- When watering, irrigate the potting mixture to saturation point.
- Prune other roots that may grow out from the side of the poly bags.
- Undertake root pruning exercise in the morning or evening followed by irrigation.

Weeding:

Weeding is the removal of undesirable plants that grow inside the pot or along the avenues.

- Hand pick and discard the weeds that grow inside the pots. Repeat this operation at least once every month until the seedlings mature.
- Hoe the weeds that grow along the avenues and rake the debris away. Hoe weeding once or twice will be adequate.

Root Pruning:

This operation stimulates the development of compact fibrous root system that will enhance nutrient and water uptake after transplanting into the field. The roots of *Acacia senegal* grow about two times in length as much as the shoot hence the need for control. Failure to undertake this operation causes the roots to penetrate the pots into the soil. Lifting of established seedlings apart from being difficult and labour intensive it reduces the chances of survival of field transplants.

- Carry out root pruning at least once a month from the age of 2 months.
- Prune by lifting the polythene bag from the ground to break the protruding roots or by cutting the roots off the bag using a Secateurs.

Insect Pest Control:

Locust and stem bores are the major insect pests of matured *Acacia senegal*. The locust causes severe leaf defoliation while the stem borers tunnel through the wood and in the process destroy the tissues. In the nursery, a particular species of caterpillar also feed on the leaves of seedlings. Studies leading to the identification of these insects are in progress. Also, lizards pick up cotyledons of newly germinated seeds. To control these pests in the nursery the following measures are undertaken:

- Hand-picking of the caterpillars.
- In case of severe attack, insecticide such as Dichlorvos (Nuvan 1,000 EC) can be applied at the rate of 25ml to 10 litres of water. Ultracide 40 EC applied at the rate of 10ml to 10 litres of water can keep lizards away. Watering can is suitable for application of any of the insecticides.

Conclusion

These nursery practices if well implemented it is possible to produce vigorous seedlings of gum arabic in required quantity and quality with assurance of high field survival.

References

1. J.A. Duke (1981a). *Handbook of Legumes of World Economic Importance*. Plenum Press, New York.
2. C. Cossalter (1991). *Acacia senegal* gum tree with promise for agroforestry. *Nitrogen Fixing Tree Association*. Pp 91-92.
3. J. Dorthe (2000). *Acacia senegal* (L.) Willd. *Seed Leaflet*. Danida Forest Seed Centre No. 5. 2pp.
4. R.W. Tinus, W.E. Stein and W.E. Balmer (1975). In: *Proceeding of the Symposium North America Containerized Forestry Tree seedlings*. No. 81. Great Plains Agricultural Council, USA.
5. P.J. Le-Roux (1945). Nursery techniques in low rainfall areas. *Southern African Forestry Journal*, 5, 221-228.
6. B.R. Poole (1987). Nursery establishment practices for *Acacia mangium* in Sabah. pp. 170-172. In: Tumball J.W. (ed) *Australian Acacias in developing countries*. ACIAR Canberra.
7. NAS (1979). *Tropical Legumes Resources for the Future*. National Academy of Science, Washington DC.