

SILVICULTURAL PRACTICES OF GUM ARABIC TREE (*Acacia senegal*): A REVIEW

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ABSTRACT

*The silvicultural practices of *Acacia senegal* (Gum Arabic tree) are reviewed in this paper. *Acacia senegal* is a tree of multiple uses and the main gum Arabic producing *Acacia* species. Its contribution towards environmental protection and economic development in the Sudano-sahelian is highly significant. The paper analysed the main environmental and climatic factors supporting the growth and development of the plants. *Acacia senegal* is grown in large areas of West, East, Central and Northern Africa and Asia. The climate, soil and water needs are well suited for its growth and development. Available literatures confirm that the tree can be produced at a seedlings stage in the nursery under a controlled environment up to the stage that will be ready for transplanting when the rainy season has fully established.*

Keywords: *Acacia Senegal, Silvicultural Practices.*

INTRODUCTION

Trees and shrubs play vital roles in maintaining the ecological balance of dry land ecosystem, improving the livelihood of people in the dry land region of the world (FAO 1989) and helping to combat the devastating effects of desertification (FAO, 1989, Ffolliott, Brooks, Gregersen and Lunddgren 1995) (*Acacia senegal*) is a multipurpose African tree (sub family Mimosoideae, family Leguminosae), highly valued for centuries for gum Arabic production. Today, *Acacia senegal* is grown primarily for gum, although it plays secondary roles in agricultural systems, restoring soil fertility and providing fuel and fodder. It is one of the few trees that can be grown economically in the sub desert zone relying on rainfall alone for its soil moisture. The tree attains a height of 3-5 meters under a rainfall of 300-500mm (Okatahi, 1999). This paper reviews some silvicultural practices of *Acacia Senegal*

DISTRIBUTION, CLIMATE, SOIL AND WATER REQUIREMENTS OF GUM ARABIC

Acacia senegal is a drought resistant tree which grows with annual rainfall mainly between 300-400mm, and 5-10 month dry periods. It tolerates high daily temperature (mean maximum temperature of up to 45°C), dry wind and sand storms. Generally the tree cannot withstand frost. (Cossalter, 1991). *Acacia senegal* tolerates a wide range of soils, prefers (sandy or light loam soils, coarse textured soils such as fossil dunes) but grows well on slightly loamy soils and skeletal soils such as lithosols. *Acacia Senegal* grows on heavy clay soils with approximately 800mm annual precipitation. The best sites have ph of 5-8 (Cossalter, 1991).

Acacia senegal, variety *senegal* is found in west, east, central and northern Africa and Asia. It has been introduced in Egypt, Australia, Puerto Rico, and the Virgin Islands. Variety *kerensis* is found in Ethiopia, Somalia, Uganda, Kenya and Tanzania. Variety *rostrata* is found in Somalia, Uganda, Kenya, Mozambique, Zimbabwe, Botswana, Angola, Namibia, and South Africa. Variety *leiorhachis* occurs in Ethiopia, Somalia, Kenya, Tanzania, Southern Zambia, Zimbabwe, Mozambique, Botswana, and South Africa (Nagappen, 2002)

Acacia Senegal is common in areas with 300-400mm rain/year but can grow in areas with as little as 100mm, and dry periods of 8-11 months. Altitude range of 100-1700m. It has very high drought resistance and tolerates high daily temperatures but sensitive to frost. Prefers well drained, soils but can grow on slightly loamy sands (Obeid and Seif el Din, 2006)

NURSERY MANAGEMENT

Normal nursery practice for raising *Acacia senegal* trees have been outlined follows:

- 1 Begin the nursery practice 3-4 months before the rainy season (March - April).
- 2 Starts with the best quality seeds, collect seeds only from mature *Acacia Senegal* tree, which produce the best quality gum Arabic.
- 3 Prepare seed by planting them in polythene pots filled with a 2: 2:1 mixture of soil, sand, and composted manure.
- 4 Plant 2-4 seeds per pots
- 5 Protect the young seedling from direct sunlight by building a small shade structure above the nursery.
- 6 Water twice a day until about four weeks after the seed has germinated. There after, water the seedling ones a day.
- 7 Prune the seed when they start to grow out of the pots.
- 8 Thin to one seedling per pot after 4-6 weeks.
- 9 "Harden up" the seedling 3-4 weeks before planting them out. To harden them, decrease watering the seedlings to ones every other day. Then gradually expose them to more sunlight by removing the shade structure.
- 10 Seedlings are ready to be planted when they are at least 3- months old. (Abdullahi, 2004)

SEED COLLECTION, STORAGE AND PRETREATMENT

Seeds should be harvested before pods have dried for easy collection and to avoid insect attack. The pods are harvested by shaking the branches over a tarpaulin on the ground. Seeds are easily extracted by hand. Freshly extracted seed should immediately be dusted with an insecticide. Seed will remain viable for 3-4 years in keep if opaque, air tight container (FAO, 1974). The seed of *Acacia senegal* are orthodox and store well in a cool, dry, insect-free place. At 10°C and moisture content of 5-7%, viability can be maintained for several years (Joker, 2000) Unlike other *Acacias*, *Acacia Senegal* is not impermeable to water even after storage, and scarification is normally not necessary (Joker, 2000) However, pre-treatment techniques such as soaking have been reported to improve seed germination. (Abdullahi,2004) reported that soaked *Acacia Senegal* seeds in cold water for 12-24 hours and observed a significant improvement in the germination compared to unsoaked control. Seed should be sown immediately as further delay in sowing may reduce germination capacity (Abdullahi, 2004).

SOWING AND GERMINATION

As a typical specie it is easy to propagate from seed and germination is fast and uniform. The seed are sown polypots or in 30cm long tubes, 2-4 seeds per tube, thinned to one seedling after 4-6 weeks. Frequent root pruning is necessary in container plant as the tap root is fast growing. Planting out can take place after 4-6 months. Weeding is necessary in the first two years. For intercropping, 10x10m spacing is suitable. See appendixes. For gum production, plants can be raised in the nursery or in direct seeded plantation spaced at about 4x4m. Planting scheduled for *Acacia* in sub Saharan Africa are set so that the seedlings will be well developed for planting at their permanent site immediately after the on set of the rainy season which is also the beginning of the planting season (Ffolliott, Brooks, Gregersen and Lunddgren 1995).

It is important that the condition for growth in the nursery be controlled to meet the target date. Other wise, more time in the nursery is scheduled, moving up the date for sowing. Nursery operations are scheduled in relation to the planting season that coincides with rainy season in most dry land situations (FAO 1989, Ffolliott, Brooks, Gregersen and Lunddgren 1995) when the rainy season begins, therefore, a nursery must be able to deliver the required planting stock. Nursery operation in areas with summer rainfall likely will follow a different schedule of operation than that of a nursery in an area with winter rains.

GROWTH AND ADAPTATIONS

The rooting habits of *Acacia* species are especially suited to making maximum utilization of available moisture. Germinating seed develop a long tap root reaching about 2meters in two months, then growth of lateral roots develop in the second and third year. This branching and far rooting enables the young seedling to grow even after the rain has stopped.

FLOWERING AND FRUITING HABITS

In general, flowering in *Acacia senegal* begins just before or at the beginning of the rainy season when the leaves emerge and the seed mature in the dry season (Joker, 2000). The effect of variety of flowering time has been reported in areas with more than one variety. In this area, there can be large variations in flowering and fruiting time. Pollination is probably by insect (Joker, 2000).

USES OF *Acacia senegal*

Acacia senegal is a pioneer, nitrogen-fixing tree that is mainly grown for production of gum Arabic but also used for fuel wood, fodder, rope, dune

stabilisation and soil improvement. The tree produces the only acacia gum evaluated toxicologically as a safe food additive (Anderson, 1995). The gum is also used in pharmaceutical preparations (Nagappen, 2002). Leaves and pods are browsed by sheep, goats, camels, impala, and giraffe. The leaves are reported to contain 10%-13% digestible protein and 0.12-0.15% phosphorus, while the pods contain 15% digestible protein and 0.12-0.14% phosphorus (Abdullahi, 2004) Dried seeds have also been used for human consumption (Abdullahi, 2004). The tree is highly suitable in agro forestry system (See appendixes).

CONCLUDING REMARK

Silvicultural practices of gum arabic tree (*Acacia senegal*) were studied to determine the main environmental and climate factors supporting the growth and development of the plants. *Acacia senegal* has been identified as a tree that is well adapted to poor soil and low rainfall. It is cultivated primarily for gum production, but plays a secondary role in agricultural systems, restoring soil fertility and providing fuel and fodder. There is need therefore, to cultivate this tree for commercial purposes. Government on their part should encourage the cultivation of this tree by providing incentives to interested farmers to boost the practice of silviculture in Nigeria.

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APPENDIX

Table1: A summary of some silvicultural parameters of *Acacia senegal*

Parameters	Acacia senegal	Sources
Soils	olerates a wide range of soil, prefers sandy or light loamy soils sand, coarse textured soils such as lithosols.the best sites have ph of 5-8	Cossalter (1991)
Water	Grows in site with annual rainfall between 100-900mm, mainly between 200-600mm.	Cossalter (1991)
Temperatures	Is sensitive to frost but is very heat tolerant (mean maximum temperature of up to 45oc)	Cossalter (1991)
Climates	Ranging from warm temperate thorn through tropical thorn to dry tropical forest life zone	Cossalter (1991) Nagappen (2002)
Distributions	Widespread in tropical Africa from Mozambique, Zambia, to Somalia, Sudan, Ethiopia, Kenya and Tanzania. cultivated in India, Nigeria and Pakistan	Nagappen (2002)
Habitats	It is common in areas with 300-400mmrain per year, but can grow in areas with as little as 100mm and dry period of 8-11 months. Altitude range of 100-1700m	Obeid and Sief el Din (2006)
Seed collections	Seeds should be harvested before pods have dried for easy collection	Ffolliott et al (1995)
Storage	Seeds are orthodox and store well in a cool, dry, insect free place at 10oc and moisture content of 5-7%	Joker (2000)
Dormancy and pre-treatment	Is not permeable to water even after storage. Seed are soaked in cold water for 12-24 hours before sowing	Abdullahi (2004)
Germination and sowing	Propagate from seeds and germination is fast and uniform. Plants can be raised in nursery or in direct seeded plantation spaced at about 4x4m	Nagappen (2002)
Watering	Twice a day after 4 weeks ones before planting. The amount of supplementary water depends on the age and size of the plant and weather conditions.	Nagappen (2002), Okatahi (1999)
Flowering	Flowering begins just before or at the beginning of and fruiting the rainy season when the leaves emerge and the seed mature in dry season. In areas with more than one variety there can be large variation in flowering and fruiting	Joker (2000)
Pollinations	By insects	Joker (2000)
Weeding	Direct sport sowing is the normal method of establishment requires intensive weeding over the first two years	Okatahi (1999)
Thinning	Thin to one seedling per pot after 4-6 weeks	Okatahi (1999)
Growth and adaptations	The rooting system are especially suited to making maximum utilization of available moisture, this system enables the young seedlings to grow even after the rain have stopped	Macrae and Merlin (2000)
Uses	A pioneer, nitrogen fixing tree that is mainly grown for production of gum Arabic but also used for fuel wood, fodder, rope, dune stabilization and soil improvement. Leaves and pods are browsed by sheep, goats, camels, impala, and giraffe. Dried seed are also used for human consumption. It is highly suitable for agro forestry system.	Anderson (1995) Nagappen (2002) Abdullahi (2004)
Taxonomy	Family- fabaceae(mimosoideae) Var-rostrata(Brenan) Var-leiorhachis(Brenan) Var-kerensis(Schweinf) Var-senegal	Brenan (1983) Cossalter (1991)