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EFFECTS OF TENDING TECHNIQUES ON QUANTITATIVE STRUCTURES OF *ACACIA SAYEL* (WHITE THORN) IN FEDERAL UNIVERSITY GASHUA, YOBE STATE, NIGERIA

BY
Ali, B[1] Johnson Sunday Alao[2], Aminu Suleiman Abdulhamid[3], Musa Alkali Aisha[4] and Umar Lawan, A.[5]

[1, 2, 3 & 4]Department of Forestry and Wildlife Management, Federal University Gashua, Yobe State, Nigeria
[5]Department of Forestry and Environmental Technology, Federal College of Forest Resource Management, Maiduguri, Borno State

Abstract

The application of different silvicultural practices in natural forests and plantations in Northern region of Nigeria remains low due to low provision of forest extension and education services, inadequate funding of forest-related services, inadequate qualified foresters, and poor remuneration of staff among others that led to low awareness and practicing of different tending techniques, which in turn result into low tapping of the benefits associated with Acacia Seyal despites the region's naturally endowed and man-made growing Acacia tree species. This study used an experimental design to determine the adaptability and effectiveness of simple coppicing, selective coppicing, and coppicing with standard, as well as pollarding techniques on the quantitative structures of Acacia Sayel (A. Sayel) species. The study was a nine (9) months experiment, carried out in five 5 different plots of the same size (50m by 50m), each inhabited by ten 10 marked A. Sayel tree species that were selected based on vigour. The results showed that A. Sayel species were adaptable to both coppicing and pollarding, but the effects of each technique corresponded to a specific purpose. Specifically, coppicing was found to be generally more effective in terms of wood quantity (number and height/length of shoots/branches) and production of gum Arabic, while the pollarding technique was associated with diverse invertebrates and small vertebrates as well as wood quality (diameter of shoot/branch). Additionally, simple coppicing had more effects on shoot/branches, and coppicing with standard was more impact in terms of gum production, while selective coppicing was associated with some invertebrates (biodiversity) conservation. Overall, pollarded trees were found with the largest diameter branches and shoots, and were bushy, which can provide a qualitative firewood and a suitable habitat to many invertebrates and small vertebrates. The results of this study can be used by agroforestry farmers to improve the production of fuelwood and gum Arabic, that can further increase income, to improve livelihood, while the results of the study will be useful to policy and decision makers on management decisions on acacia plantation and natural forests for the promotion of economic, social and environmental aspects of forests remain naturally abundant.

Keywords: Tending, Biodiversity conservation, Gum Arabic, Poverty alleviation, Coppicing, Pollarding

INTRODUCTION

Tending in forestry refer to the activities as watering, weeding, pruning, re-spacing, thinning, sanitation, cutting, artificial pruning, roguing, coppicing, pollarding, etc that play a fundamental role in the improvement of quality and quantity of wood/timber, production of NTPFs, sustainability of the forests, soil conservation, carbon sequestration, increase biodiversity and nurturing plants to ensure they grow healthy (Umar and Mesike, 2009; National Forest, 2025). A tending operation involves removing several less-favoured trees by series of activities including the identification and marking of trees with superior form and vigour, chosen PCTs (Potential Crop Trees), removal of competing plants, and competitors to the PCTs, removal of diseased trees, removal of overly-large, malformed trees (wolves), and creation of access routes (racks) within plantation blocks for future operations (Short and Radford, 2008; National Forest, 2025). Tending prepares the forests for future management operations, as it involves activities that include the selection and marking of superior trees in every hectare to retain and choose potential crop trees (National Forest, 2025).

According to Short and Radford, (2008), the aim of tending practice is to manage and improve the growth of a forest stand throughout its life cycle through nurturing of the trees rather than just planting, but rather encompasses, managing competing vegetation and shaping the growth of the species through selective removal or manipulations through activities like pruning (remove selected matured shoots and branches to improve tree shape, promote healthy growth, and increase timber quality), thinning (removing selected healthy trees to reduce competition, improve air circulation, and promote the growth of remaining trees by weeding (controlling weeds and other vegetation), fertilization (improving soil fertility and promote tree growth by applying fertilizers), pest and disease control (managing pests and diseases to prevent damage to trees, woods and maintain forest health), fire management: (implementing measures to prevent and control wildfires by creating firebreaks, ditches and conducting prescribed burns), soil conservation (implementing measures to prevent soil erosion, such as contour planting and terracing), coppicing (cutting back a tree to the ground, allowing it to regrow from the remaining stump or roots for the purpose of sustainable wood production, increased biodiversity, soil conservation, reducing erosion and promoting root growth) (Short and Radford, 2008; Legesse, 2021).

Short and Radford (2008) stated that the purposes of tending treatments are to allow management objectives to be met at both the stand and forest level. Tending therefore, ensure that desired individual trees are provided with space, light, water and nutrients necessary for survival and growth that can improve the economic, social and environmental values of forests and plantations (Obaje and John 2022; Olatunji and Olaniyi, 2023; Abdu, Ali, and Abdul Hamid, 2024). The most common tending operation for stand improvement is the one in which residual trees are spaced and smaller desirable trees are removed to reduce competition. Stand improvement is normally carried out in conjunction with a harvest of diseased, poor health and quality trees or simply trees that are too closely spaced to other trees. Stand improvement removes trees that are larger than saplings in any size class and occurs in both selection and shelter wood stands. Some tending techniques have been used or remove small trees and saplings to reduce competition. Some manual methods, such as brush saws, have been reported in some situations; however, such a method was found to be less effective. For example, cutting of some tree saplings was observed to cause vigorous re-sprouting of multiple stems from the single cut stump (Short and Radford, 2008; Umar and Mesike, 2009; National Forest, 2025).

Effective tending in forestry is crucial for sustaining forest ecosystems, promoting biodiversity, enhancing timber production, and improving resilience to pests, diseases, and climate change. It requires knowledge of forest ecology and careful planning to balance economic, ecological, and social factors. Despites abundant Acacia tree species as trees in the forest across different areas in Yobe, the presence of the Acacia tree species in many forest reserves and homestead forest and bushes in Yobe, the application of silvicultural practices that could promote wood production, gum Arabic production, increase economic opportunities through the sales of fuelwood and gum Arabic, conserve forest and increase biodiversity remained rare, while continuing felling of the tree species (A. Sayel) and exploitation of the trees and its parts in the form of fuelwood, herb and fodder for animals remain conspicuous in Yobe State, According to Ali et al. (2023), about 80% of the population of Yobe state relied on fuelwood for cooking and heating, with the state being in the Sahel region, characterized by low biodiversity and among the top 10 State with a high poverty indices in Nigeria. Sustainable management of A. Sayel plantations are hindered by a lack of information on best silvicultural practices suitable for their optimal growth. In many parts of Sub-Saharan Africa, these trees are left to grow without proper tending, resulting in stunted growth, poor wood quality, and low biomass yield (National Forest, 2025). Consequently, forest managers and landowners are unable to harness the full potential of this important species. There is also a critical need for evidence-based strategies that can guide interventions to improve the structure and productivity of A. Sayel stands. Therefore, the a need for application of innovative silvicultural techniques and methods that can promote the production and conservation of forests and biodiversity conservation, since forests have been identified and reported as a source of income and a means of reducing poverty, especially when used sustainably.

Coppicing involves cutting back a tree to the ground, allowing it to regrow from the remaining stump or roots. This technique is often used for sustainable wood production that allows for regular harvesting of wood without killing the tree, increases biodiversity, soil conservation, and maintenance of soil health by reducing erosion and promoting root growth (Short and Radford 2008; Legesse, 2021). A Selective coppicing involves cutting back select branches or stems of a tree to the ground, while leaving other parts of the tree intact. This approach is used to promote healthy growth, increase biodiversity, and provide a sustainable source of wood. Another type of coppicing is the simple coppicing (cutting back the entire tree to the ground and the third type of coppicing is called coppice with standards, which involves leaving some trees uncut (standards) while coppicing others. Another common tending technique employed in many parts of Africa is the pollarding, which involves cutting back the branches of a tree to the main trunk or pollard head, usually at a height of 2-3 meters. The techniques, as stated by Vin (1990) and Umar and Mesike (2009), involved cutting back the branches to the main trunk or pollard head, regularly cutting back new growth to maintain the pollard head and cutting back the entire tree to the ground to rejuvenate it. A. Sayel, also known as white thorn, belongs to the Kingdom Plantae, Clade as Tracheophytes in the Division of Angiosperms. A. Sayel is Eudicots, Clade as Rosids within the Order Fabales. A. Sayel belongs to the Fabaceae family, and in the sub-family of Caesalpinioideae, and grouped under the mimosoid clade and remains in the Genus Acacia (Kamla, 2009; Abdelrahaman and Talaat, 2014). A. Sayel occurs from Senegal to the Red Sea and in Arabia, as well as many other African countries, including East and Southern Africa, north of the equator, from 10 to 12 degrees. In the Southern and Western Sudan, it is one of the most common trees in the savannah and often occurs as a pure forest over quite large areas of country. A. Sayel is specifically known and widely distributed across Egypt, Eritrea, Ethiopia, Ghana, Iran, Israel, Kenya, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Saudi Arabia, Senegal, Sudan, Syrian Arab Republic, Tanzania, Uganda, Yemen, Republic of, Zambia, and Zimbabwe (Kamla, 2009; Abdelrahaman and Talaat, 2014). A. Sayel frequently grows in groups or patches, sometimes of considerable size, in areas inhabited by A. senegal. It is tolerant to high PH (6-8), salts and periodic flooding. A. Sayel grows and survives as a small to medium-sized tree growing up to 10 meters tall, with a broad, flat crown and a straight, smooth trunk. The bark is physically smooth and gray at the sapling and young stage; however, it becomes rough and fissured with age. The leaves are compound and bear 3-6 pairs of pinnae, with each having numerous small leaflets. The flowers of A. Sayel are small, yellow, and fragrant, and well arranged in clusters along the branches. A mature A. Sayel produces Pods that are visibly long and narrow, while containing several seeds (Kamla, 2009; Abdelrahaman and Talaat, 2014). According to Abdurahman and Talaat (2014), A. Sayel is the second most important gum-producing species after Senegalia senegal and is referred to as talha in Sudan. The gum (talha) is darker than gum hashab/Senegal, which is a pale to orange–brown solid that breaks with a glassy fracture. According to Orwa et al. (2009), A. sayel has benefits that include gum Arabic production used as a natural adhesive and thickening agent, timber that is valued for its durability and resistance to termites, and fuelwood, which is used as a source of cooking and heating energy. The root, bark, leaves, and seeds have been used as traditional medicines in the forms of decoctions, infusions, powders, and ointments for various purposes such as fever reduction: rheumatism, and malaria, and the bark and leaves are used to treat skin conditions (eczema, acne, and dermatitis) wounds healings, cuts, and abrasions, while the leaves is used in the treatment of digestive issues such as diarrhea and dysentery. The leaves have also been reported as a good anti-inflammatory agent (useful for treating conditions like arthritis), antimicrobial action (treating infections) and antioxidant, making it useful for protecting against oxidative stress. (Yusuf, Sule and Lawal, 2023). A. Sayel tree species is used in soil stabilization: due to the tree's extensive root system that prevents erosion, provides shade for people and livestock, inhabits wildlife habitat, especially small mammals, and invertebrates (Legesse, 2021). Interestingly, the smoke produced during the burning of the wood of A. Sayel acts as a fumigant against insects and lice, and the bark and leaves are excellent, having phytochemical properties that kill pests such as freshwater snails (Orwa et al., 2009). Most importantly, the fruits are of A. Sayel is eaten when fresh, although it has a slightly acidic taste. Legesse (2021) observed its usage in a mixture with pulp of the fruit of Balanites aegyptiaca to make syrups as fodder, apicultural role, source of perfume and starve and rope. Propagation of A. Sayel is through self-seeding and root suckers. Natural seed collections are best made within the tree’s natural range because of the large variations of provenances in adaptation to habitat. Pretreatment is important to accelerate germination, but not essential. Scarification and sulphuric acid treatment are normally used. Essentially, the tree species is propagated through seed through nursery establishment, where seedlings are raised in nurseries before transplanting (Short and Radford, 2008; Legesse, 2021). A. Sayel species is therefore one of the earliest domesticated species in tropical drylands, and is still widely studied due to its multiple uses and contributions to livelihood. However, most of the previous studies centred on breeding initiatives that involved the establishment of provenance trials across the geographic range of the species in Senegal, Burkina Faso, Niger, and Sudan to experiment with the variation among provenances (Legesse, 2021; Larsen et al., 2011), while literature on coppicing and pollarding potentials of A. Sayel in semi-arid Nigeria remains few (Yusuf, Sule, and Lawal, 2023). Against the above backgrounds, the study aimed to determine the effectiveness and applicability of some tending techniques on A. Sayel (white thorn) tree species to understand the quantitative effects on the production of wood, gum Arabic and biodiversity conservation.

The objectives of the study are:

i. To determine the applicability of different tending techniques on A. Sayel

ii. Evaluate the effects of different tending techniques on some selected quantitative structures of A. Sayel stands.

iii. To determine the most effective tending technique(s) in terms of shoot production, wood quality, gum Arabic production and biodiversity conservation

MATERIALS AND METHODS

Study Area

The study was conducted in Federal University, Gashua (FUGA), located in Bade Local Government Area, Yobe State, Nigeria. Gashua is a riverine community situated in relatively flatland in the Northern part of Yobe State. Gashua is the Local Government headquarters of Bade that lies between 12052' 5"N and 1102'47"E. The average elevation is about 299m (Above sea level) along the famous River Yobe few kilometres from the convergence of the River Jama’are and Hadejia

(Wakawa et al. 2017; Ali et al. 2023). According to the last national population census in 2006, the population of Gashua was about 125,000 persons. This community experienced an annual average rainfall of 500 to 1000mm with a maximum summer temperature range of 38 °C to 40 °C (March-April) and a minimum temperature of as low as 23-280C in June to September (Ali et al. 2023, 2012). Bade local government area is characterized by a mean temperature ranging from 32°C to 35°C, Soil type mainly Sandy loam and clay with low organic content. The language spoken by the indigenous people of Gashua is called Bade, while the non-native population relies on the Hausa language for inter-personal communication. Gashua is one of the most developed towns in Yobe State and was regarded as having both economic as well as ecological relevance to the entire ecosystem of this region, which is largely associated with the location of the town within Nguru-Gashua Wetlands (Wakawa et al. 2017). The vegetation is entirely Sahel savannah type, which consists mainly of drought-resistant tree species (xerophytes) such as Doum palm (Hypenia thebaica), Boabab tree (Adansonia digitata), Tamarin (Tamarindus indica), Desert date (Balanites aegyptiaca), African Mahogany (Khaya Senegalis), Acacia species such as A.Sayel, Gum Arabic (Acacia nilotica), Senegal gum (Acacia senegal), Neem (Azadiricta indica), among others. Fishing, farming and hunting are the major economic activities in the area (Wakawa et al., 2017). It shares a common boundary with Yusufari, Yunusari, Bursari, Karasuwa, and Jakusko Local Government Area of Yobe State. The choice of the location was based on the adaptability of the At the cacia plantation and the availability of naturally growing A. Sayel species (Ali et al. 2023)

Materials and Methods

Materials: The materials used include Axe, Machete, Graduated Tape, PPE, thread, ruler, veneer caliper, book, and pen.

Method: This study adhered to the procedures of tending operations proposed by Short and Radford (2008) that comprised the following:

i. Planning and design:

ii. Identification of areas that need tending based on stand assessment

iii. Stand assessment: Initial inventory to determine tree species, density, health, and potential for growth

iv. Determining appropriate tending operations and timing based on species, site conditions, and desired outcomes

v. Developing a detailed work plan including crew size, equipment requirements, and operational logistics.

vi. Post-operation assessment was carried out, which included evaluation of the effectiveness of tending activities by comparing pre- and post-treatment stand conditions.

vii. Monitoring over time was carried out to identify areas needing intervention.

The experiment began with identification, marking and sanitation. The identification and marking of trees were made based on selection of superior form and vigour (PCTs/Potential Crop Trees), removal of competing trees around (where necessary), removal of diseased trees (where necessary), removal of overly-large, malformed trees /wolves (where necessary) and creation of access routes (racks) within plots blocks (Husch et al., 2003). Therefore, the researchers were involved in the marking of selected healthy living trees per plot, measuring trees' heights, taking trees' density counts per plot, counting shoot/branches in each treatment per time, recording the number of produced shoot/branches, recording observable animals (worms, insects, reptiles, mammals butterflies, bees ants etc) and Gum Arabic exudation points associated to the trees under treatments (Short and Radford, 2008).

Research Design

The study used four (4) treatments applied to 5 (five), including untended (controlled) plots of A. Sayel stands, each inhabiting ten (10) trees of 15 years old. Therefore, primary data were collected from the experimental plots as the study employed an experimental research design using a complete randomized design (CRD) that determined the effect of different tending methods (simple coppicing, selective coppicing, coppice with standards and pollarding) on quantitative structures of A. Sayel stands. CRD is particularly effective in forestry experiments as it controls for environmental variability across blocks and enhances the precision of treatment effect estimates (Gomez & Gomez, 1984).

Plot Layout and Establishment

i. A total of 4 plots (A, B, C and D) of 10 m × 10 m were established using a randomized complete block design.

ii. Each block represented a homogenous site condition, and treatments were randomly assigned to plots within each block.

iii. Buffer zones (1.5m wide) were created between plots to prevent treatment interference (Husch et al., 2003).

Data Collection Techniques

Data were collected within 10 10-month period, while measuring selected quantitative stand structures and production parameters. The following standards were strictly adhered:

•Diameter at Breast Height (DBH) was measured using a diameter tape at 1.3 meters above ground (Avery & Burkhart, 2002).

• Trees' heights were determined using a Tape

• Trees' density counts of health living trees per plot was marked.

• Number of Shoots/Branches in each treatment per time was counted as shoot/branches production rate:.

• Physically observed animals (worms, insects, reptiles, mammals, butterflies, Bees, ants, etc on the trees were recorded

• Number of points of exudate (Gum Arabic) was recorded

• Crown diameter and bole height were measured to assess canopy development and form.

Data Analysis

Collected data was analyzed using mean and standard deviation to determine the differences between and among treatments. The data was processed using Statistical Package for the Social Sciences (version 25), and Microsoft Excel (2010) for graphical representation.

Validity and Reliability

To ensure validity, standardized forestry measurement protocols were followed as recommended by Avery & Burkhart (2002). Reliability was enhanced through repeated measurements and the use of calibrated instruments. A preliminary study was done by experimentation in a small field with four (4) stands before the actual experiment.

Ethical Considerations

All field activities followed standard environmental and safety guidelines of the Federal University Gashua Research Act.

Therefore, necessary permissions were obtained from the Faculty of Agriculture and the Department of Forestry and Wildlife Management of the University. The results showed that A. Sayel species were adaptable to both coppicing and pollarding based on survival rates. Specifically, based on the survival rates' means, all three (3) coppicing techniques were higher than the mean of the pollarded trees. Therefore, coppicing techniques were more positively impactful than the pollarding technique. Generally speaking, A. Sayel adapted more to different coppicing techniques regarding survival rate than the pollarding technique.

The result of Table 2 below shows the monthly mean records/counts of shootings/branching under different treatments, with simple Coppicing having the highest shoot production (59), followed by coppicing with standard (53), then selective coppicing (48), and pollard (47), while the untended had the lowest number of shoots produced (31).

Figure 1 below summarized the effects of the three (3) coppicing techniques that show they were positively more impactable than pollarding technique regarding shoot production and/or branching.

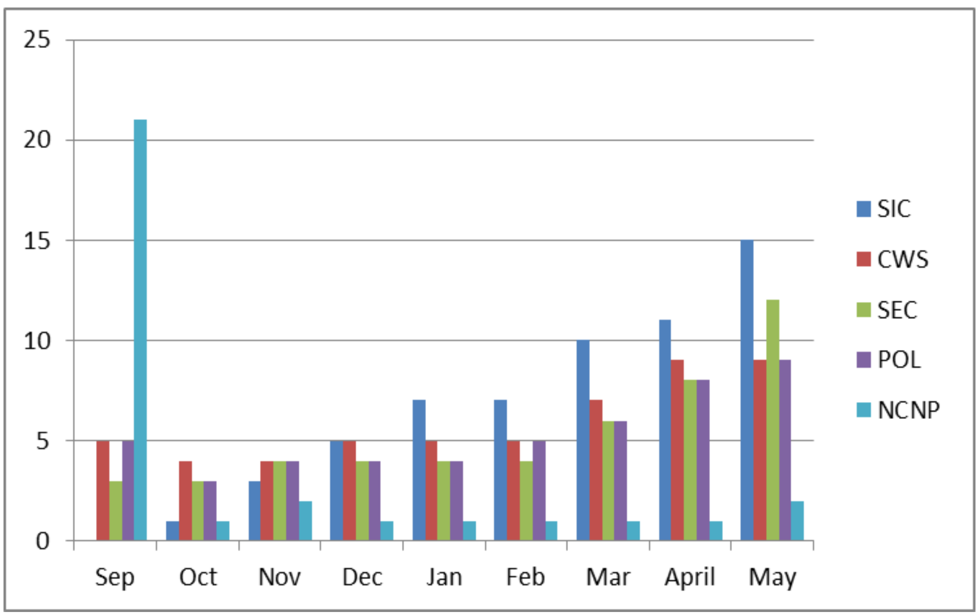

Figure 1: Mean monthly shootings of *Acacia seyel across treatments*
SIC (Simple Coppicing), CWS (Coppicing with Standard), Selective Coppicing (SEC), Pollarded (POL), Non-Coppiced and Non-Pollarded trees/untended (NCNP)

Table 3 below shows that coppicing is generally more effective and suitable for A. Sayel in terms of shoots' length compared to pollarding. Specifically, simple coppicing (SIC) had the highest effects with a mean of 79.5, followed by coppicing with standard (CWS) with a mean of 78.6, and then selective coppicing, which has a mean of 78.1. On the other hand, pollarding had the most effects in terms of Gum Arabic production, wood quality (wood diameter), as well as inhabiting biodiversity compared to all three (3) other coppicing techniques. Interestingly, the untended stands (control group) had more animals (including invertebrates and vertebrates) compared to all treatments.

The result that showed the highest shoots' length under simple coppicing treatment may be associated with the effects of pruning, thereby providing more sunlight that aided photosynthesis, in addition to reduced competition for dissolved food. The result is in line with a previous study that stated the roles of tending techniques in removing small trees and saplings to reduce competition and cause vigorous re-sprouting of multiple stems from the single cut stump (Short and Radford, 2008; Umar and Mesike, 2009). On the one hand, the bushy nature of A. Sayel stands from the outcome of pollarding observed in these results, and its characteristic ability to inhabit different animals is in line with the observation of Legess (2021), who asserted that A. Sayel tree species inhabit wildlife, especially small mammals and invertebrates. Moreover, the results concur with Elsiddig (2003), who associated the development of volume and height-diameter of a tree with tending technique adaptable by specific tree species. Finally, the observed bushy nature of A.seyal under the treatment of pollarding shows the tree species' potentiality of providing fuelwood for a population, as observed in past literature (Vink, 1990; Ali et al., 2023).

4.0 CONCLUSION

Tending practices are used to manage and improve the growth of a forest stand throughout its life cycle. Different Tending operations apply to Acacia trees during the early and late growing stages of the species. This study focused on selected tending techniques, namely coppicing and pollarding and their impact on selected quantitative structures on specific acacia species that are abundant and adapted to the area of study (A. Sayel). The research was conducted in the semi-arid region of Nigeria using established A. Sayel plantations in the Federal University Gashua. This study adopted an experimental design carried out within the period of nine (9) months in five (5) different plots, each of 50m by 50m, that inhabited ten (10) marked A. Sayel species selected based on vigour. The results showed that A. Sayel species were adaptable to both coppicing and pollarding tending techniques, with different effects in terms of wood quantity (number and height/length of shoots/branches), and wood quality (diameter), production of gum Arabic, inhabiting invertebrates and small vertebrates. It was observed that simple coppicing had the most influence on the length of shoot/branches, and coppicing with standard had the most impact on gum Arabic production, while selective coppicing was associated with the largest counts of invertebrates, and pollarded trees were associated with trees that have the largest diameter as well as the most attractants to both invertebrates and small vertebrates. The results of this can benefit seasonal farmers, agroforestry farmers, researchers, policy and decision makers on management decisions on issues of livelihood improvement, environmental protection, and biodiversity conservation. The results of the study can further add to the existing literature on silviculture, tending methods and techniques and sustainable forest and fuelwood management that often pave the way for increased source income, improve health through recreational activities in the forests, carbon sequestration and control of climate change, prevention of flooding and erosion and promoting educational activities. The study was carried out during the dry season only in a limited experimental duration of nine (9) months, which may not fully reflect long-term effects. Despite these, the design and methodology were robust enough to provide reliable insights into the impact of different tending techniques on A. Sayel.

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REFERENCES

Abdelrahaman, G.E. and Talaat. D.A. (2014). The Potential of *A. Sayel* as a Resourceful Tree for Gum Arabic in Sudan. A study Conducted at the Request of the Gum Arabic Board (Sudan)

Abdu, A., Ali, M. A., and Abdul Hamid, H. (2024). Effect of pruning intensity and picking on Acacia senegal for gum arabic yield in Northern Jigawa State, Nigeria. IOP Conference Series: Earth and Environmental Science, 1323, 012002. Retrieved from https://www.researchgate.net/publication/380337760

Ali, B., Saadun, N., Kamarudin, N., Alias, M.A., Nawi, N.M., and Azhar, B. (2023). Fuelwood Value Chain in Northern Nigeria: Economic, Environment, and Social Sustainability Concerns. *Forests*, 14, 906. https://doi.org/10.3390/ f1405090

Avery, T.E., & Burkhart, H.E. (2002). Forest Measurements (5th ed.). McGraw-Hill.

Elsiddig, E.A. (2003). Development of volume and height-diameter equations for Eucalyptus camaldulensis, *Acacia nilotica* and *A. Sayel* in the Sudan. *Sudan Silva, 9* (2), 1-13.

Gomez, K.A., and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research (2nd ed.) Wiley.

Husch, B., Beers, T.W. and Kershaw, J.A. (2003). Forest Mensuration (4th ed.). Wiley.

Kamla, R. (2009). Marketing of Acacia Species (Gum Arabic) in Borno State, Nigeria. *Journal of Human Ecology*, 28(2): 103-106

Larsen, F.W., Londoño-Murcia, M.C. and Turner, W.R. (2011). Global priorities for conservation of threatened species, carbon storage, and freshwater services: scope for synergy? Conservation Letters, 4(5): 355–363. Doi: 10.1111/j.1755 263X.2011.00183.x

Legesse N. (2021). A Selection of African Native Trees: Biology, Uses, Propagation and Restoration Techniques. ISBN 978-99944-3-086-4, 621 pages, Addis Ababa, Ethiopia

Naibbi A.I., Baily, B., Healey, R.G., and Collier, P. (2014). Changing Vegetation Patterns in Yobe State Nigeria: An Analysis of the Rates of Change, Potential Causes and the Implications for Sustainable Resource Management, .International Journal of Geosciences, 5, 50-62

National Forest (2025). Traditional woodland management techniques. Retrieved from https://www.nationalforest.org/whats-new/article/traditional-woodland-management-techniques-why-they-are-still-relevant-in-the

Obaje, D. and John, P. (2022). Pollarding and coppicing effects on fodder production in agroforestry parklands in Benue State. Nigerian Agroforestry Review, 14(2), 66–75.

Olatunji, S. and Olaniyi, K. (2023). The influence of cutting height on biomass accumulation of Azadirachta indica in Osun State. Southwest Nigerian Forestry Journal, 9(1), 51–61.

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., and Simons, A. (2009). Agroforestree. Database: A Tree Reference and Selection Guide Version 4.0. World Agroforestry Centre. Kenya. https://www.worldagroforestry.org/output/agroforestree-database accessed on 12-03-2025.

Short, I. and Radford, T. (2008). Silvicultural Guidelines for the Tending and Thinning of Broadleaves. Teagasc Forestry Development and COFORD.

Umar H.Y. and Mesike C.S. (2009). Marketing of Acacia Species (Gum Arabic) in Borno State, Nigeria. *J Hum Ecol*, 28(2): 103-106.

Vink, A.T. (1990). Growth of *A. Sayel* analysis of 1987-1990. measurements in Rawashda forest. Field Document No. 38. Fuelwood Development for Energy in Sudan, GCP/SUD/033/NET. Government of the Republic of Sudan/ Netherlands Government/FAO.

Wakawa, L., Aminu S., Yakubu, I. and Lawan, A. (2017). Tree Species Biodiversity of a Sahelian Ecosystem in North-East Nigeria. *Journal of Bartin*, 19(2):166-17

Yusuf, A. A., Sule, M.A., and Lawal, K. (2023). Coppicing potentials of selected savanna tree species in semi-arid Nigeria. Nigerian Journal of Sustainable Forestry, 8(3), 122–133.

PRESENTATION OF RESULTS

Table 1: Adaptability of different Tending Techniques on *A. Sayel*

Treatments	Survival rate of trees after Treatment	
	Mean	Std Dev
SIC	78.07	6.11
SEC	82.07	1.80
CWS	78.80	20.42
POL	75.13	5.77
NCNP (untended)	100	0.00

SIC (Simple Coppicing), Selective Coppicing (SEC), CWS (Coppicing with Standard), Pollarded (POL), Non-Coppiced and Non-Pollarded trees/untended (NCNP)

Table 2: Monthly Mean shootings /branching on *Acacia seyel* trees by treatments

	Monthly Mean record of shoot(s) under experiment									Total
Types of treatments	Sep 2024	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	April 2025	May 2025	
SIC	0	1	3	5	7	7	10	11	15	59
CWS	5	4	4	5	5	5	7	9	9	53
SEC	3	3	4	4	4	4	6	8	12	48
POL	5	3	4	4	4	5	6	8	9	47
NCNP (untended)	21	1	2	1	1	1	1	1	2	31

SIC (Simple Coppicing), Selective Coppicing (SEC), CWS (Coppicing with Standard), Pollarded (POL), Non-Coppiced and Non-Pollarded trees (NCNP)

Table 3: Effects of Tending Treatments on *Acacia seyel*

S/N	Treatment	Shoot Length (cm)		Wood diameter/quality (cm)		Mean weight (kg) ± standard deviation of Collected Gum Arabic from different Treatments		Organisms count (Biodiversity)	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
1	SIC	**79.5**	**7.3**	34.44	2.84	24	45.5 ± 6.7	2.2	0.7
2	SEC	78.1	6.4	34.44	2.84	88	39.9 ± 7.9	3.3	0.8
3	CWS	78.6	1.7	34.44	2.84	64	43.4 ± 8.2	5.6	0.6
4	POL	75.1	8.4	36.04	9.48	314	41.3 ± 8.4	9.8	0.4
5	NCNP (untended)	74.7	7.1	5.75	0.44	138	40.6 ± 8.6	**11.9**	**0.7**

SIC (Simple Coppicing), Selective Coppicing (SEC), CWS (Coppicing with Standard), Pollarding (POL), Non-Coppiced & Non-Pollarded trees/untended (NCNP)