

Environmental Conditions Prevailing in Habitat Affect Seedlings Growth (*khaya Senegalensis*)

Fatima Algunaid Hassan*, Mai Mamoun Ali**

Assistance Professor, Field: Natural Resources, Environmental Science Faculty of Agriculture and Natural Resources, Forestry and Range Sciences Department, University of Bakht Er-Ruda Ministry of Higher Education and Scientific Research, White Nile state (AD Duwem) Sudan ** Assistance Professor, Forestry Research Centre ,P.O.Box1339, Soba, Khartoum Sudan

Abstract- Survival of seedlings in arid and semi-arid zones plantation is strongly affect by localities requirements (soil ,moisture and climate) Many tree species are able to adapt themselves in response to these factors. Seeds from sand, clay and mixture soil (according to the main classification of soil in Sudan) which representing by sinnar, Kordofan and Southern Darfur States used for propagation of *khaya Senegalensis* for three months. The experiment was conducted at the nursery and was laid out in randomized block design with 8 replicates and the growth characteristics were measured on monthly bases The aim of this study was to evaluate the effect of localities requirements in seedlings growth characteristics of *khaya Senegalensis*. The results show significant variation in growth and productivity, which found directly correlated to environmental conditions prevailing in each geographical area. It recommended that care should made not to transfer seed from one locality to another because each plant is adapted to its own specific climate condition and a wrong seed transfer may lead to serious losses of plant martial which may fail to grow successfully away from their natural habitats

Index Terms- *Khaya senegalensis*, seedling, localities, nursery.growth.

I. INTRODUCTION

The importance of forests and natural resources is indisputable, when considering the developing countries especially areas situated in the arid and semi-arid climatic zones. The woody species provide the main parts of the population with firewood and charcoal (Plaza and Chang, 2008). In the mid-fifties, forests in Sudan constituted about 36% of the total area (Harrison and Jackson, 1958). Sudan is classified as a moderately forested country with about 28% (67 million ha) forest and woodlands cover (FRA, 2005).The scarcity of forest resources in Sudan is further aggravated by a high deforestation rate.

FAO (2005) ranked Sudan as the third country following Brazil and Indonesia in terms of net forest loss per year between 2000 and 2005. Many factors attributed to the deforestation in Sudan such as agricultural expansion, fires, overgrazing and illicit felling of trees for fuel wood. Sudan's forests provide a variety of goods including timber in the round and sawn forms arboreal biomass for domestic energy supplies and building material and a large number of non-wood forest products (NWFPs) National energy surveys indicated that forests70.8% of the country national energy balance (4.01 million tons of oil

equivalents) (FAO, 2003). Sudan forests also contribute 33% of the total feed requirement of the national herds. In addition, forestry activities provide significant opportunities for employment and income generation in almost all rural areas of Sudan. It was estimated that one out of seven of the population is engaged in forest related activities (Ballal, 2002).Salih (2000) reported that the forest and woodland area in Sudan amount to 68.90 million ha, which is continuously being encroached upon by agriculture and urbanization or otherwise degraded by uncontrolled felling. Tropical forests are important to rural people in developing countries as they provide them with fuel and other essential goods and services, with food and benefit environment (Badi, 1989).

Khaya senegalensis (Desr) A. juss, locally known as Mahogany, is one of the most economically important forest tree species. The tree is very popular, used for high-class furniture, joinery, building and construction purposes, and recommended for utilization purposes for which surface quality is of high importance .The species has also high traditional medicinal values and used as an ornamental tree for gardens and avenues. Despite its importance the species is only limited incorporated in a forestation programmers. This is mainly because, like most tropical forest tree species, studies on silviculture of the species are incomplete Mahgoub (2002).

Our objectives assess the performance of the species at localities levels at early seedling stage. The importance of this study lies in the fact that knowledge in variation within the species performance at early juvenile stage is particularly important as they determine success of species in establishing themselves under unstable climatic conditions and in their natural and artificial habitats.

II. MATERIAL AND METHOD

Seed materials used in the study collected from three provenances. .Southern Kordafan(Um Abdalla (U) 11° 45' N, 30° 55' E Annual rainfall 700 mm) , Sinnar (Sinnar (S) 13° 75' N33° 75' E Annual rainfall 600)mm and Southern Darfur States(Zalinge (Z) 13°00' N23°50' N Annual rainfall 800mm); with the help of the National .Tree Seed Center of the Forestry Research Centre, Agricultural research Corporation. The experiment conducted to assess Provenance variation of Mahogany at early stage of growth. The experiment conducted in the nursery of the Forests National Corporation at Ad Duwem), White Nile state, following the ordinary nursery practice for raising forest tree seedlings. The seedlings grow in polythene

bags of 25 cm width by 30 cm length when flat. The soil used Isis river silt. No fertilizers used and three seeds grow in each bag. The seedling watered every three days through flood irrigation which is the common practice with sunken nursery bed. The seedling placed in beds under the shade ;in randomized block design with 8 replicates were adopted. For each provenance, 480 seedlings raised i.e. 60 seedlings per plot. The seedling growth parameter measured then the seedling dried at 80°C till a constant weight obtained and the following assessments made. Total dry weight (g) shoot dry weight (g) and root dry weight (g). Results statistically analyzed using the JMP advanced statistical. Means compared using Tukey – Kramer method.

III. RESULTS AND DISCUSSION

Tables (1, 2, 3) and figures (1, 2, 3) show mean seedling characteristic by provenances for Mahogany in second month of growth. Seedling growth evaluated in term of assessment of nine growth parameters. The results showed significant differences for all growth characteristics of the three provenances. From the result obtained it is apparent that shoot in both Zalinge and Sinnar grow faster in length. The maximum root length attained by Um Abdalla, provenance Sinnar and Zalinge provenance are less than that in the shoot.

This explained in the light of the findings obtained by Ahmed (in Ibrahim 1988) for Acacia subspecies, that root length is critical importance at early stage, as deeper primary root system provides access to more reliable source of water in short time than available to shallow root system. However, under difficult conditions, particularly low soil moisture, the ratio of root length to shoot length considered as an important factor.

In survival of plants, the ratio believed to be large for species grow in dry region. Jacobs (1955), as quoted by Abbott (1984) Ahmed (1982) claimed that seedling of arid land tree species are characterized by that their roots grow taller than shoots even if they are watered, yet dry matter production from shoot of all provenance was much superior to the root dry matter production. The provenances Zalinge and Um Abdalla produced relatively higher number of leaves per seedling this is an indication of adaptation of Sinnar provenance to drier condition compared to the other two provenances. Variation in growth in the localities is of special interest to the tree breeder as it makes selection among localities or within species. As far as the three localities investigated in the study is concerned Sinnar and Zalinge and Um Abdalla did not differ significantly from each other. Zalinge showed good growth for three months. Sinnar showed better growth in the first month and lowest growth the third month. When using shoot height as only criteria for evaluating growth performance and productivity; early height growth determining the success of seedling establishment. Seedling that will grow rapidly could have practical advantages, damage from animal for instance lessened because the terminal part of the tree would sooner be inaccessible to browsing. Fast growing seedling can compete better with other vegetation Demister (1972) argued that outstanding seedling can maintain superior growth, rates for considerable periods. Root growth among the three localities found significant during initial two months while these difference evened down for three localities by the third month

IV. CONCLUSION AND RECOMMENDATION

The conclusion from this study is growth of Zalinge state was faster and better than other two states. The result indicates that variation in growth and productivity within the species under investigation is significant at the initial three months.

V. RECOMMENDATION

Since there are significant differences of seedling growth characteristics at juvenile growth performances between the three states, which found directly correlated within environmental conditions prevailing in each geographical area. We recommended that caution should be made, when transfer seed from one locality to another because each plant is adapted to its own specific climate condition and a wrong seed transfer may lead to serious losses of plant material which may fail to grow successfully away from their natural habitats

REFERENCES

- [1] Abbott, I (1984): Emergence early survival and growth of Seedling of six tree species in Mediterranean forest of Western Australia Forest Ecology and management 9:51-66.
- [2] Ahmed, E.A (1982): The Autecology of Acacia tortillas (Forks) Hayne. Ph.D. Thesis University of Khartoum – Sudan.
- [3] Badi, K. H. (1989.) The natural forests. In: The forest of the Sudan, Khartoum, Sudan.
- [4] Ballal, M. E.(2002.) Yield trends of gum arabic from *Acacia senegal* as related to some environmental and managerial factors. *PhD Thesis*, University of Khartoum, Sudan.
- [5] Demister, W. R. (1972): The Influence of the Environment During seed Development and germination and the growth of pinups *Sylvetrisl*. PhD Thesis.
- [6] FAO, 2003. State of the world's forests, Rome, Italy.
- [7] FAO, 2005. Global forest resources assessment, forestry paper 147, Rome, Italy, 320.
- [8] FRA, 2005. Global Forest Resources Assessment. Country report 212: Sudan, Forestry Department, FAO, Rome.
- [9] Harrison, M. N. and Jackson, J. K. 1958. Ecological classification of vegetation of the Sudan. *Forestry Bulletin* No. 2.
- [10] Kramer, P.J, and Kozlowski, T(1960) *physiology of Trees* Mc Grow – Hill Book company, London
- [11] Ibrahim, A.M (1988): Juvenile development of some important Arid land tree species with particular reference to salt tolerance M.Sc .Thesis, Department of Forestry, Faculty of Agriculture, University of Khartoum.
- [12] Mahhoub, S. (2002): Studies of physiological, Environmental and of Some forest tree species. Ph.D. Thesis, U. of K.
- [13] Plaza, A. and Chang, C. 2008. High performance computing in remote sensing. Chapman and Hall/CRC, Taylor and Francis Group, LLC.
- [14] Salih, A. A. M.(2000). Forestry outlook study for Africa, Sudan Forest National Corporation. Khartoum, Sudan.

AUTHORS

First Author – Fatima Algunaid Hassan, Assistance Professor, Field: Natural Resources, Environmental Science Faculty of Agriculture and Natural Resources, Forestry and Range Sciences Department, University of Bakht Er-Ruda, Ministry of Higher Education and Scientific Research, White Nile state (AD Duwem) Sudan, Cell phone 00249911633434

Second Author – Assistance Professor, Forestry Research Centre, P.O.Box 1339 ITel. 0912630309, 0122547928, Soba, Khartoum Sudan., Email mamamoun2@gmail.com

Table (1) Growth characteristics of 3-month old *Khaya senegalensis* seedlings of the three provenances

| Growth characteristics | Provenance Um Abdalla | Sinnar | Zalinge |
|---------------------------|--------------------------|----------|----------|
| Shoot length (cm) | 14.36 c* | 16.34 b* | 17.33 a* |
| Root length (cm) | 14.61 a | 12.256 b | 14.61 a |
| Total length (cm) | 29.45 b | 28.60 b | 31.94 a |
| Growth at root color (cm) | 12.26 a | 12.4 a | 11.8 a |
| No. of leaves/seedling | 10.40 a | 9.6 b | 10.2 a |
| Soot dry weight (gm) | 0.68 a | 0.67 a | 0.66 a |
| Root dry weight (gm) | 0.21 a | 0.25 a | 0.2 ab |
| Total dry weight (gm) | 0.9 a | 0.93 a | 0.9a |
| Root/shoot Ratio | 0.75 b | 1.0129 a | 0.842 b |

Similar letters in the same row are not significantly different using Turkey-kramer test

Table (2) Shoot growth rate of the three provenances under investigation at the first three months in the nursery:-

| Provenance | Month 1 st | 2 nd | 3 rd |
|------------|--------------------------|-----------------|-----------------|
| Sinnar | 7.475 a* | 16.34b* | 20.89c* |
| Um Abdalla | 6.165b | 14.63c | 22.95b |
| Zalinge | 1.65 a | 17.335a | 25.62a |

* Similar letters in the same column are not significantly different using kramer- Tukey –test.

Table (3) Root growth rate of the three provenances under investigation at the first three months in the nursery:-

| Provenance | Month 1 st | 2 nd | 3 rd |
|------------|--------------------------|-----------------|-----------------|
| Sinnar | 10.23 b* | 12.265 b* | 12.175 b* |
| Um Abdalla | 10.815 b | 14.82 a | 15.495 a |
| Zalinge | 11.635 a | 14.615 a | 15.955 a |

* Similar letters in the same column are not significantly different using Tukey –

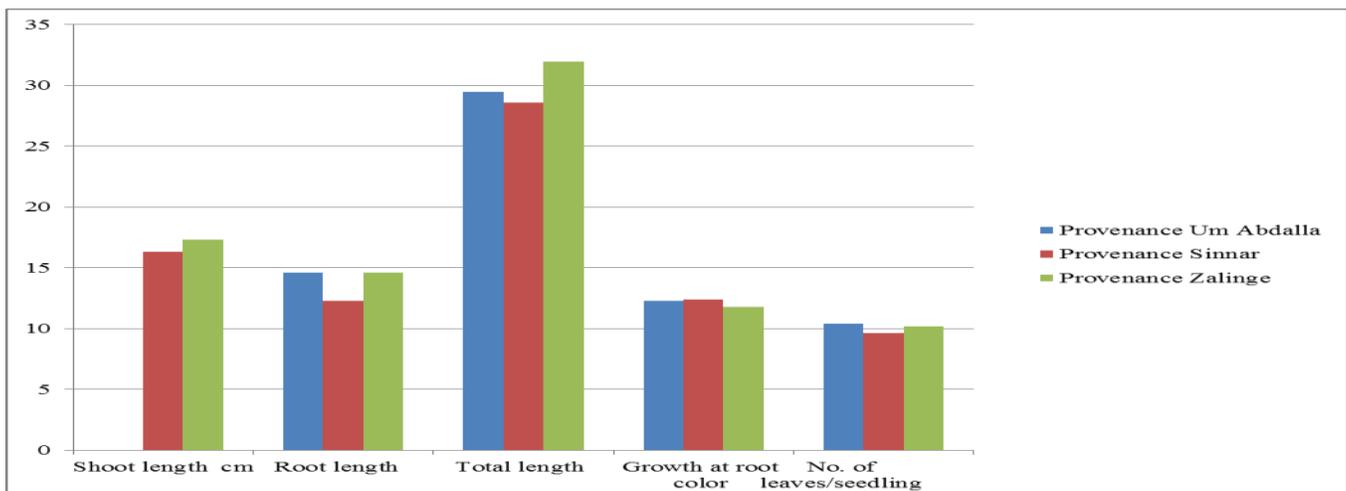


Figure (1) Growth characteristics of-3month old *Khaya senegalensis* seedlings of the three provenances at nursery growth

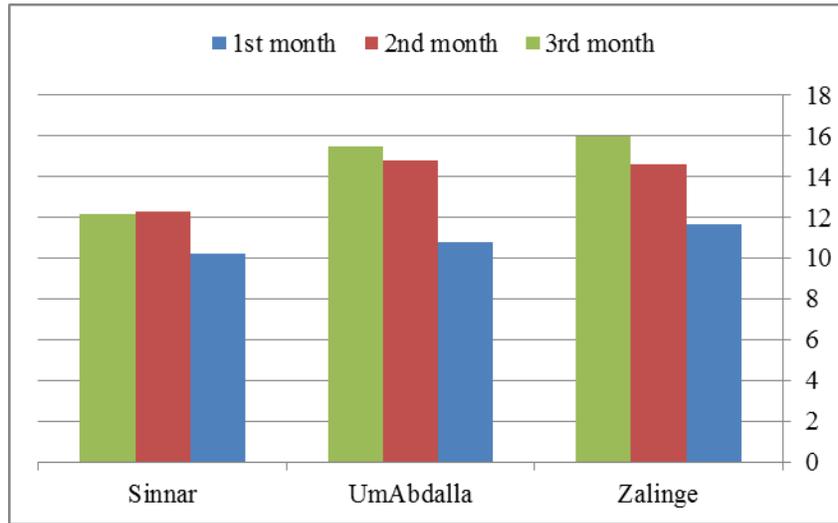


Fig (2): Shoot growth rate of the three provenances under investigation at the first three months of nursery growth

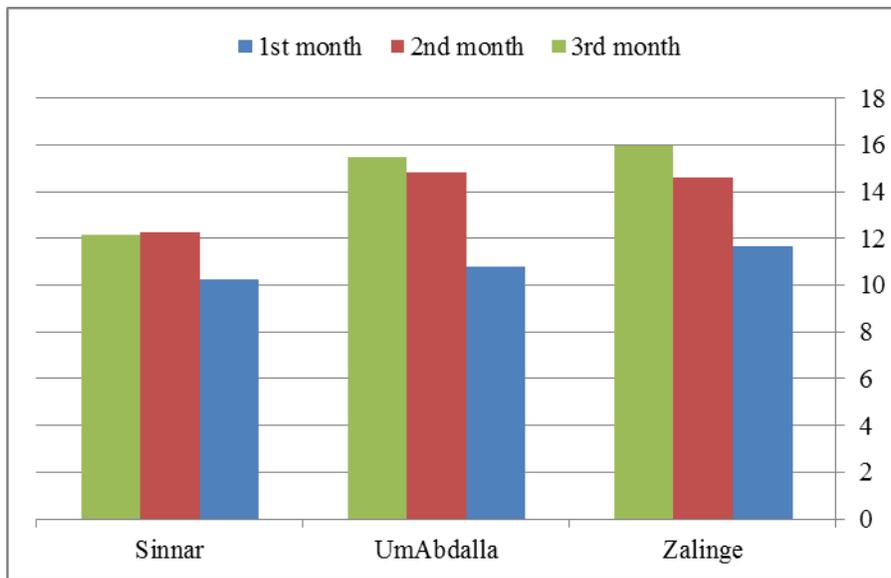


Fig (3): Root growth rate of the three provenances under investigation at the first three months in the nursery:-