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THE FOREST OF HOPE: PAINS AND GAINS IN TROPICAL SILVICULTURE

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THE FOREST OF HOPE: PAINS AND GAINS IN TROPICAL SILVICULTURE

The Vice Chancellor, Sir,
The Deputy Vice-Chancellor (Academic),
The Deputy Vice-Chancellor (Development),
The Registrar,
Other Principal Officers of the University,
My Lords Spiritual and Temporal
My Dean, College of Environmental Resources Management
Other Deans and Directors
My Head of Department
Other Heads of Departments
Academic and Professional Colleagues
Members of my Immediate and Extended families
Eminent Invited Guests
Distinguished Ladies and Gentlemen
Gentlemen of the Press,
Great F*UNAABITE*.

1.0 INTRODUCTION

This is the day the Lord has made; I will rejoice and be glad in it (Ps.118:24). It is with gratitude to the Almighty God, and joy unspeakable that I stand before you all to present my Inaugural Lecture titled "THE FOREST OF HOPE: PAINS

AND GAINS IN TROPICAL SILVICULTURE", the 37th in the series of inaugural lectures of this great University.

Mr. Vice Chancellor Sir, an inaugural lecture doubles as an academic tradition and celebration that represents a significant milestone in any academic's career. It is a privilege to present an overview of one's field of specialization, explain what has been done and justifies ones contributions to knowledge and its relevance to humanity. Specifically, it is an occasion to place one's contribution into general perspective. That I can live to see today and give account of over three decades of my sojourn in the University system, I give glory to God.

This Inaugural Lecture is the first to be delivered in the tenure of the current Vice Chancellor, Professor Olusola Oyewole. It is the seventh from the College of Environmental Resources Management, the fourth from the Department of Forestry and Wildlife Management and the first to be given on the subject of Silviculture – the science of tree production. During my preparation and search for a topic for this Inaugural Lecture, a recurring question on my mind was "Is there any hope for sustainable forest production in Nigeria?". This question arose because a cursory assessment of forest practice with respect to where we are versus where we are supposed to be might suggest little or no hope. I was quickly cautioned and reminded on a personal note that I am in every sense a product of hope. This is because as the first out of nine children, we lost our father 33 years ago and at that time it appeared all hope was lost. Drawing from my personal and life experiences, I received insights from my humble contributions that notwithstanding the current low level of forest productivity in Nigeria, there is hope for sustainable forest production in Nigeria. This hope was cemented by the First Forester, the Almighty God who declared in the Bible, in Job 14:7-9 that

> *"For there is a hope for a tree,*
> *If it be cut down, that it will sprout again,*
> *and that its tender branch will not cease.*
> *Though its root grow old in the earth,*
> *and it stock die in the ground*
> *Yet at the scent of water it will bud,*
> *and bring forth boughs like a plant".*

The silviculturist can see in these verses the Divine Hand commanding silvicultural tools such as coppicing, nutrient and water relation, canopy architecture and root management for sustainable forest production.

Mr. Vice Chancellor Sir, the theo centric ethics (Gen. 2:15) instruct man to work and take care of the environment. In the past 31 years I have been privileged to work in the area of silviculture identifying silvicultural tools to promote forest productivity. Consequently, against daunting challenges to tropical forest productivity, I stand before you to present my Inaugural Lecture titled:

> *THE FOREST OF HOPE: PAINS AND GAINS IN TROPICAL SILVICULTURE.*

2.0 MAN AND THE FOREST OF HOPE

In the period of natural economy, the forest was the big all - encompassing hope for man. Man lived inside the forest and was hundred percent dependent on the forest for shelter, clothing, food, medicine and aesthetic functions. The forest then provided everything man needed with little or minimal human intervention. In the modern day which has become highly monetized economy, the value and role of the forest to the survival of man has been on the increase.

Ecologically, forest trees and woodlands prevent erosion from wind, sand dune, rainfall, protect water catchments, preserve water quality, and regulate river flows. The forest is the natural home for fungi, insects, bacteria and wildlife that coexist to maintain a natural balance. The concept and implications of global warming is no longer a myth but has become a reality. The threat to our environment consequent upon global warming or greenhouse effect (Flening *et al*., 2002) has been shown to rank next only to nuclear war in its capacity to drive human civilization to extinction (Masumbuko and Robeshala, 2000). More than any other factor, measures towards establishing more carbon sinks through reforestation, afforestation and conservation of forests reduces this global challenge.

Economically, the forest remains a source of income from various products obtainable in the forests. Principally, it is the source of construction materials in form of structural wood, plywood, particle board, besides non-timber forest products such as leaves, resins and medicinal plants. It is also a source of industrial chemicals and pulp and paper products. The forest and forest products contribute to national economic growth. According to Adeyoju (1975), up to the middle of the 1970s before embargo was placed on log exportation and wood based products, forest industries earned substantial foreign exchange for the country estimated at ₦413 million annually. According to a recent estimate (F.A.O., 2010), forest related activities in Nigeria today accounts for only 2.5% of the country Gross Domestic Products. What a dismal picture!

Spiritually, forests in one form or the other either in form of groves or "sacred forest" are centres of worship in many religions and places of traditional rites. According to Christian ontology, the salvation of man could not have been completed without the forest and forest products. The betrayal and arrest of Jesus Christ took place in the garden of Gethsemane, a city forest (Matthew 26:36-48); He was crowned with thorns of *Zizyphus spinna-christii* (Matthew 27:27-29), a forest product before His crucifixion on a wooden cross of *Acacia radianna* (Mark 15:24).

Plate 1: *Zizyphus spinna- christii (*Christ thorn*)*

3.0 THE FOREST OF HOPE

In recent times, increases in population, introduction of cash economy and improvement in standards of living has placed subsequent increase on the demand for forest products and services. The attendant exploitative nature and its ecological and economic implications has generated the universal challenge to foresters to produce and maintain the forest of hope. This is the delight and ultimate objective of the forester. The forest of hope can be described as that forest where:

i. Productivity is guaranteed by increasing current and mean annual increments.
ii. Threatened or endangered species are encouraged to revegetate.
iii. Both daily domestic energy needs and export requirements are met without environmental degradation or abuse.
iv. The forest maintains its value as a source of medicinal reserves in perpetuity.
v. The structure and composition maintains a self contained and sustain yield management units.
vi. The forest responds favourably to silvicultural treatments in varied ecological challenges such as soil erosion, deforestation and desertification.
vii. A flourishing plantation of exotics of high economic value is maintained without recourse to ecological opportunity cost.

viii. The forests continue to generate employment opportunities and positively impact both local and international markets.

4.0 CHALLENGES TO THE FOREST OF HOPE

Nigeria is known to be rich in forest resources (Adeyoju, 1975). However estimates by Food and Agricultural Organisation (1995) reported that only 17% instead of 20% of total land area in Nigeria supports forests and other woodlands. While total forest areas now stand at 15,785 million hectares; total volume and number per hectare are 100m^3 and 64 respectively. With respect to demand, F.A.O. (1995) estimated that by the year 2010 consumption of industrial round wood, fuel wood and wood based panels will be 13.8, 161 and 171 million m^3 respectively. Therefore, the challenges to the forest of hope are predicated on various multifaceted and related issues. These can be grouped into two major categories, namely:

4.1 Administrative and Policy Issues

Prominent in this category are

(i) Dual and/or multiple ownership structure of forest lands.
(ii) Low level of private investment in forest enterprise.
(iii) Artificial pricing of forest products. Insufficient skilled man power.

(iv) Expired or/and contradictory forest legislation.
(v) Inefficient or poor forest management.

4.2 Biological Challenges

Mr. Vice Chancellor Sir, the silviculturist becomes relevant in forest development in the biological sector. The silviculturist is charged with the responsibility of evolving appropriate silvicultural treatments or techniques that can enhance productivity of the forest. Some of the very important silvicultural challenges in tropical silviculture include:

i) The development and improvement of appropriate silvicultural techniques or systems for specific ecological sites.
ii) Identification of seed years and quantification of germination factors in forest seeds required for rapid and even forest development.
iii) Development of appropriate and cost effective nursery technology with emphasis on moisture and nutrient requirements in tree seedlings.
iv) Diagnosis of nutrient deficiencies in tree seedlings.
v) Development and quantification of establishment techniques to reduce mortality in transplants due to physiological shock in transit.
vi) Assessment of forest soil seed bank to promote natural regeneration particularly for species that are highly sensitive to their ecological niches.

5.0 SILVICULTURE AND THE FOREST OF HOPE

Silviculture has been variously defined. A generally accepted definition is that it is the study of the life history and general characteristics of trees with particular reference to environmental factors. As stated earlier in this lecture, the challenges to the establishment and maintenance of the forest of hope are daunting. Silviculture in forest development is charged with the responsibility of evolving appropriate techniques required for the formation of new and regeneration of old forests. This ranged from choice of species, nursery technology, tending of transplants to ecologically friendly harvesting techniques.

Mr. Vice Chancellor Sir, and distinguished audience, on the basis of just one ecological factor, for instance, accessibility to water supply, three main types of tropical vegetation are recognized. These are the mangrove forest, the lowland rainforest and the dry forest or savanna. The above forest formations are present in Nigeria in addition to established plantations estimated at 213,230 hectares (Omoluabi, 1990). Appropriate silvicultural tools in Nigeria must be mindful of the divergent natural forest formations, emerging plantation management, influence of previous silvicultural practices as well as site specific challenges in national forest development. Consequently, the silviculturist in Nigeria must evolve appropriate silvicultural practices to face the challenges of erosion control in the east, reforestation in the west and desertification in the far northern part of the country.

Since foresters must produce the desired forest of hope, appropriate silvicultural practices must be employed at every stage in the life of the forest estate. These silvicultural practices are defined as scientifically devised silvicultural treatments applied singly or in combination to enhance forest productivity. The applications of these treatments vary in time and space with forest formation.

6.0 MY RESEARCH FOCUS AND CONTRIBUTIONS TO KNOWLEDGE

Mr. Vice Chancellor Sir, ladies and gentlemen, my research focus has been in the development of silvicultural treatments aimed at adding value to tropical forest nursery technology in divergent ecological context. These are in the following specific areas:

1. Quantification of germination factors in seeds of forest trees.
2. Nutrient factor in forest nursery practice.
3. Water relations in tree seedlings.
4. Mycorrhizal inoculation as a silvicultural tool.
5. Development of appropriate establishment techniques for transplant.

6. Assessment of forest productivity for natural regeneration

6.1 Quantification of germination factors in seeds of some forest trees

A major challenge to natural regeneration in most forest trees is attributable to irregular seeding of mother trees. Most forest trees do not seed yearly and when they produce, the interval is not regular. This has given rise to the concept of seed years. Seed years are the years when the mother tree produces viable seeds. The viability and germinability of these seeds are influenced by various factors such as physiological state of the seed, and in mature seeds by scarification, acid and water treatments.

Figures 1 and 2, and Table 1 showed that physiological stage of maturity is a factor that affects seed germination in forest seeds. While in some, germination decreases with age, in others germination increases with seed maturity. My findings (Aduradola, 2003, Aduradola, 2004) showed that while in seeds of *Zizyphus spinna christii,* germination decreases with age, in seeds of *Acacia nilotica* and *Piliostigma reticulatum,* germination increases with seed maturity. These findings has practical implication in forest operation with respect to appropriate timing for seed collection.

My investigation on the effects of seed scarification on germination spanning more than a decade (Table 2) showed that point of scarification significantly influenced seed germination. Result showed that while scarification around the circumference enhanced high germination in seeds of *Parkia biglobosa, Afzelia africana, Erythrophleum suaveollens,* scarification at the distal end of seed significantly influenced high germination in *Chrysophyllum albidium* seeds. This background underscores the need to identify appropriate point for scarification in forest seeds.

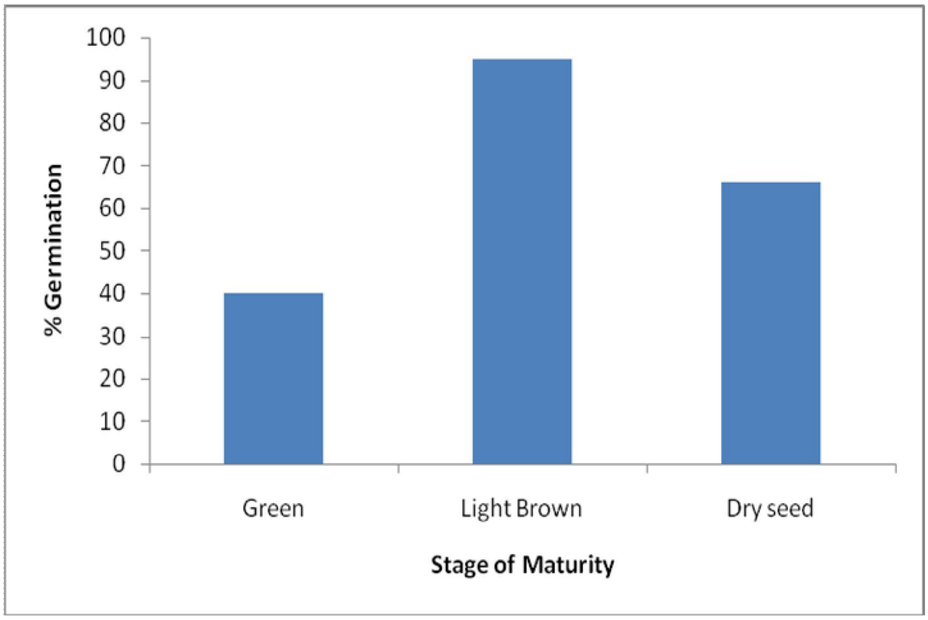


Figure 1: Effect of stage of maturity on %germination in seeds of *Acacia nilotica* Source: Aduradola, 2003

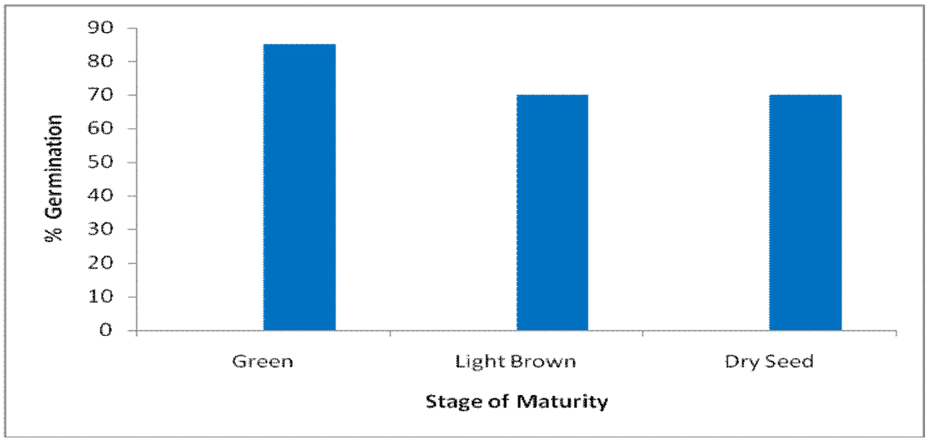


Figure 2: Effect of stage of maturity on %germination in seeds of *Ziziphus spina-christii*
Source: Aduradola, 2003

Table 1: Effect of stage of maturity on germination in seeds of *Piliostigma reticulatum*

Stage of maturity	% Germination
Fresh/Green	5
Semi-matured	23
Matured (Dry)	48
L.S.D.	3

Source: Aduradola, 2004

Table 2: Effect of point of scarification on germination in seeds of some forest trees

Point of Scarification	% Germination					
	Parkia biglobosa	Tamarindus indica	Chrysophyllum albidum	Afzelia africana	Terminalia ivorensis	Erythrephleum suaveolens
A 2mm from micropyle	65	70	40	40	30	63
B 2mm from distal end	65	80	70	60	40	70
C Around the seed circumference	95	90	10	70	40	9
L.S.D.	19.98	28.25	10.86	1.99	3.66	28.5

Source: Awodola, 1999; Aduradola and Shinkafi, 2003; Aduradola and Adejumo, 2003; Aduradola and Badru, 2004; Aduradola *et al*. (2005).

Table 3: Response of seed germination to acid concentration and treatment time in some forest seeds

Treatment Time (minute)/ Species	Percentage Germination – Acid Concentration 10				50				98			
	P.b	T. ind	C. albid	T. ivo	P.b	T. ind	C. albid	T. ivo	P.b	T. ind	C. albid	T. ivo
10	55	47.5	60	52.5	57.5	62.5	40	62.5	50	92.5	30	57
30	62.5	62.5	50	55	62.5	80	30	57.5	60	92.5	10	70
60	62.5	92.5	40	60.0	77.5	92.5	20	72.5	80	65	0	65
L.S.D.	9.7	7.6	1.7	1.05	9.7	7.6	1.7	1.05	9.7	7.6	1.7	

Source: Aduradola (1994), Awodola and Shinkafi (2003), Aduradola *et al.* (2003).

P.b - Parkia biglobosa
T. ind. - Tamarindus indica
C. albid. - Chrysophyllum albidum
T. ivo. - Terminalia ivorensis

Table 4: Effect ratio of seed hot water treatment on percentage seed germination of some forest seeds

Volume of hot water (litres) / Species	Seed weight (s)											
	10				50				98			
	P.b	T. ind	C. albid	T. ivo	P.b	T. ind	C. albid	T. ivo	P.b	T. ind	C. albid	T. ivo
1	17.5	33.75	68.6	30	18.75	37.5	66.1	37.5	20	42.5	45.3	42.5
2	17.5	48.75	86.1	37.5	18.75	61.75	67.6	50.0	22.5	65	46.3	67.5
L.S.D.	6.8	7.99	0.178	1.34	6.8	7.99	0.171	1.34	6.8	7.79	0.17	1.38

Source: Aduradola (1994), Aduradola and Badru (2004), Aduradola *et al*. (2005).

P.b - Parkia biglobosa
T. ind. - Tamarindus indica
C. albid. - Chrysophyllum albidum
T. ivo. - Terminalia ivorensis

It is generally accepted that appropriate acid treatment enhances seed germination (Table 3). However, for large scale afforestation programmes involving resource poor unskilled labour, we endeavoured to assess and identify easy to adopt options affordable by resource poor forest workers. Investigations on the use of hot water treatment (Table 4) showed that while *Parkia biglobosa* would not respond favourably to water treatment, *Chrysophyllum albidum, Tamarindus indica* and *Terminalia ivorensis* seeds responded favourably to higher ratios of seed weight to volume of hot water. We observe for example, a higher germination percentage for *Chrysophyllum albidum* (86%) using hot water treatment than highest values (60%) obtained from acid treatment. This has implication both for cost and risk management.

6.2 Nutrient factors in forest nursery practices

In 1804, De Saussure demonstrated that green plants cannot live without some carbon dioxide and that the ash ingredients of plants were not only taken from the soil but were indispensable for plant growth. Again in 1840, Leibig stated that plants live on carbonic acid, sulphuric acid, magnetia, potash and iron, thus stressing the importance of supplying the element found in ash to plants for satisfactory growth. By the year 1967, about 60 elements have been positively identified in plants (Pillai, 1967). More studies on plant nutrition have shown that only sixteen of these elements are considered essential for healthy growth of green plants in general, including forest trees (Gessel *et al*., 1960; Swan, 1965).

6.2.1 Essential nutrient elements and diagnosis of deficiency symptoms

An important input in forest nursery operation is identification of essential elements and their deficiency symptoms. Of particular interest is induced deficiencies caused not by lack of elements in the soil but lack of accessibility to root occasioned by displacements by higher elements. For example, in aluminum rich soil we have incidences of aluminum induced phosphorus deficiencies.

Conventionally, essential elements are elements with specific role to play in the metabolism of the plant, such that in their absence, complete processes of vegetative or reproductive life cycles are prevented. The specific deficiency symptoms to each of them can only be corrected by their application.

A greenhouse experiment to identify essential elements and symptoms of deficiencies in seedlings of *Parkia biglobosa* revealed some facts as listed below in Tables 5, 6 and 7 and also presented plates 2, 3 and 4 of my work (Awodola, 1991).

(a) Symptoms of deficiencies in seedlings may overlap at the level of discoloration e.g. deficiencies of N, P, K, Mg all exhibited chlorosis or yellowing of leaves.

(b) Symptoms of deficiencies can be located in same parts of the plant e.g. deficiencies in N, P, K, Mg were all manifested in the older mature leaves.

(c) Deficiency of the most limiting element may not be manifested in visual discoloration e.g. calcium deficiency in *Parkia biglobosa* seedling.

(d) The most limiting element for *P. biglobosa* seedlings is calcium.

(e) While the forest nursery worker should not equate greenness or lack of discoloration for good health, single discoloration could be a signal for multiple deficiencies of essential elements as revealed by research works.

Table 5: Macronutrient composition of the applied nutrient solution stock solution (g / litre)

Complete Nutrient Solution	KNO_3 (202)	Ca $(NO_3)_2$ (326)	$CaCl_2$ (222)	K2SO_4 (174)	$MgSO_4$ (7H2O) (184)	Na_2SO_4 $10H_2O$ (161)	$NaNO_3$ (340)	Mg $(NO_2)_2$ $6H_2O$ (340)	NaH_2PO4 $_2H_2O$ (208)
Complete	+	+			+				+
-N			+	+	+				+
-P	+	+			+	+			
-K		+				+		+	+
-Ca	+				+		+		+
-Mg	+	+				+			+
-S	+	+						+	+

Source: Awodola, 1991

Table 6: Effect of Macronutrient deficiencies on shoot growth in *P. biglobosa* seedlings

Treat-ment Solution	Height (cm)	Stem diameter (cm)	Leaf No.	Fresh Weight (g)	Total Chlorophyll (mg/g)	Leaf area (cm2)
Complete	19.1a	0.35a	27a	3.96a	7.98a	126.31b
-N	15.2b	0.29c	19c	2.7b	3.52d	43.2d
-P	11.5c	0.29c	20c	2.65b	6.23b	88.64b
-K	15.8b	0.29c	21b	2.35d	6.82b	123.42a
-Ca	9.0d	0.24c	10c	0.59c	2.9d	23.6c
-Mg	12.84c	0.27d	24b	2.49cd	5.35c	65.12c
-S	16.25b	0.31b	23b	2.41d	6.35b	122.71a
CV(%)	13.3	4.0	9.3	7.4	12.1	10.2

Source: Awodola, 1991

Table 7: Key for Deficiencies in macronutrients in *Parkia biglobosa* seedlings

Symptoms localized in older leaves	N, P, K, Mg
Uniform narginal chlorosis in a pale green ground colour with or without necrotic spot, size diminished but normal in shape	N
Uniform marginal chlorosis in a green ground colour with or without scorch	P
Chlorosis in older leaves, leaf curls and tip burn in older leaves, leaf curls and tip burn in young leaves	K
Interveinal chlorosis with or without greenish marginal band, leaves normal in size and shape	Mg
Lack of foliage decoloration, reduced leaf number and size	Ca
Incipient chlorosis localized in young leaves	S

Source: Awodola, 1991

Plate 2: Complete and Nitrogen Deficient Seedling of *Parkia biglobosa*
Source: Awodola, 1991

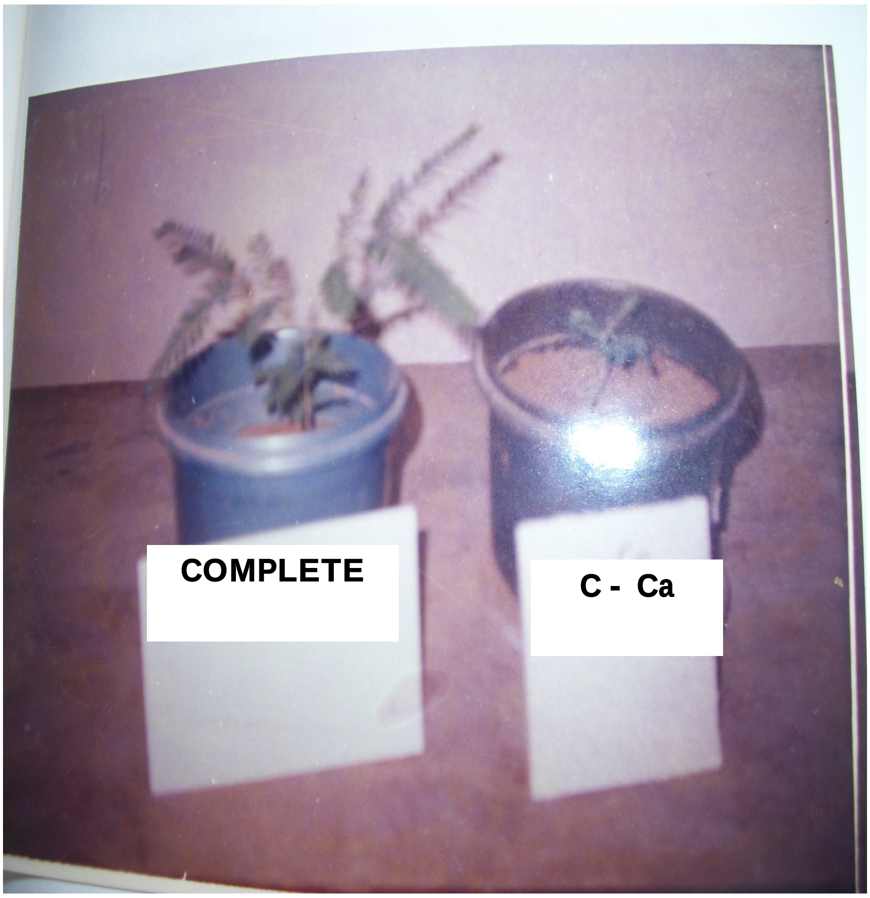


Plate 3: Complete and Calcium Deficient Seedling of *Parkia biglobosa*

Source: Awodola, 1991

Plate 4: Response of root growth to deficiencies in macronutirent elements in seedlings of *Parkia biglobosa*

Source: Awodola, 1991

6.2.2 Sourcing of nutrient from local materials for seedling growth and development

The ultimate objective of forest nursery workers is to produce seedlings of high morphological and physiological grade. The use of fertilizer and manure has long been recognized as a silvicultural tool to achieve this objective (Nwoboshi, 1969, 1982). Awodola and Abubakar (1996) assessed the effects of phosphatic fertilizers and poultry manure on the growth and foliar macronutrient distribution in seedlings of *Sclerocarya birrea* and *Acacia nilotica*. Our findings indicated that quantity of inorganic and organic manure influenced biomass production in both species and that best seedling morphological performance were recorded when 20g of poultry manure was mixed with 2kg of potted soil. (Tables 8 and 9).

A similar investigation (Aduradola, 1998) on the effects of sources of nitrogenous fertilizer and manure on *Zizyphus spina christii* and *Zizyphus mauritiana* showed (Tables 10 and 11) that better performance in the two species were recorded when 20g of air dried cowdung was mixed with 2kg of top soil in a semi arid environment. These results and earlier work by Awodola and Nwoboshi (1990) strengthen the position that scientific application of locally sourced material has favourable influence on the production of quality seedlings. This has implication for cost effectiveness in silvicultural practices.

Table 8: Effect of type and quantity of Phosphatic fertilizer on seedling height. Collar diameter, leaf number and area, fresh and total dry weights in seedlings of *S. birrea* and *A. nilotica* parameters

Type of Fertilizer	Quantity (g)	Seedling height (cm)		Collar diameter (cm)		Leaf Number		Fresh Weight (g)		Total Dry weight (g)		Leaf Area (cm2)	
		S.b	A.n	S.b	A.n	S.b	A.n	S.b	A.n	S.b	A.n	S.b	A.n
Poultry	10	24	20.3	1.9	1.7	16	74	16.1	4.08	6.79	1.57	20	20
Manure	20	21	23.9	1.6	1.5	17	87	18.3	4.24	6.83	2.49	25	25
	30	19.9	17.0	1.6	1.4	19	98	10.2	3.11	3.72	1.94	30	25
Single	10	22	13.1	1.7	1.5	16	76	15.1	3.69	3.45	1.94	15	19
Super	20	19	16.2	1.8	1.4	16	90	15.4	4.43	4.23	1.77	18	21
Phosphate	30	20	13.8	1.7	1.6	19	99	16.7	4.73	4.65	2.10	22	20
Triple	10	21	11.2	1.6	1.5	15	82	16.8	4.48	3.46	1.49	22	16
Super	20	20	13.2	1.5	1.4	16	92	18.0	4.45	3.32	1.63	24	18
Phosphate	30	21	12.7	1.5	1.6	15	99	19.6	4.73	3.31	2.10	28	20
L.S.D. (0.05)		5.42	4.83	1.32	0.39	4.31	22.7	8.78	1.19	1.55	0.56	6.29	0.57

S.b = *Sclerocarya birrea* A.n = *Acacia nilotica*

Source: Awodola and Abubakar, 1996

Table 9: Effect of type and quantity of Phosphatic fertilizer on foliar macronutrient concentration in seedlings of *S. birrea* and *A. nilotica* parameters

Type of Fertil-izer	Qua ntity (g)	Nitrogen (%)		Phosphorus (%)		Potassium (mg/100g)		Calcium (mg/100g)		Magnesium (mg/100g)	
		S.b	A.n	S.b	A.n	S.b	A.n	S.b	A.n	S.b	A.n
Poultry	10	0.020	0.018	0.016	0.016	.006	.008	0.10	0.08	0.50	1.36
Manure	20	0.012	0.017	0.028	0.032	.004	.009	0.38	0.18	0.64	1.20
	30	0.017	0.013	0.016	0.002	.019	.011	0.84	0.25	0.73	1.04
Single	10	0.001	0.018	0.018	0.007	.019	.011	0.10	0.21	0.73	0.50
Super	20	0.020	0.019	0.019	0.005	.014	.010	0.31	0.74	0.69	1.09
Phos-phate	30	0.025	0.010	0.023	0.003	.015	.008	0.38	1.30	0.52	1.31
Triple	10	0.005	0.010	0.005	0.006	.011	.014	0.38	0.20	0.50	0.60
Super	20	0.017	0.016	0.022	0.023	.010	.012	0.34	0.39	0.44	0.74
Phos-phate	30	0.020	0.019	0.025	0.025	.019	.011	0.03	0.35	0.157	0.99

Source: Awodola and Abubakar, 1996

Table 10: Effect of type and quantity of nitrogenous fertilizers on growth parameters of the seedlings of *Zizyphus spinachristii* and *Z. Mauritania*

Type of Fertilizer	Qty (g)	Seedling height (cm)		Collar diameter (cm)		Leaf area (cm2)		Leaf fresh weight(g)		Leaf dry weight(g)		Root dry weight(g)	
		ZS	ZM	ZS	ZM	ZS	ZM	ZS	ZM	ZS	ZM	ZS	ZM
NPK	10	33.3	39.9	.29	.24	28	44	9.04	6.14	4.0	4.73	0.32	0.30
	20	41.2	43.2	.33	.37	25	48	10.0	10.0	4.93	5.86	0.30	0.40
	30	31.5	41.0	.31	.37	29	66	11.2	10.0	2.96	5.53	0.4	0.40
UREA	10	45.5	33.9	.30	.30	24	47	10.0	9.0	3.96	3.64	0.45	0.20
	20	42.0	39.5	.34	.29	28	56	10.0	11.1	4.81	4.75	0.50	0.90
	30	34.5	40.2	.30	.35	25	43	13.1	12.0	3.9	4.94	0.26	1.0
COW DUNG	10	42.3	44.5	.36	.34	31	66	14.0	13.0	4.76	6.13	0.35	0.7
	20	40.7	54.7	.33	.33	34	86	12.1	12.2	5.51	13.0	0.55	1.0
	30	30.6	38.4	.33	.33	32	69	15.0	15.1	4.73	9.28	0.46	0.8
L.S.D.		28.09	11.51	.09	.09	7.73	22.97	3.25	5.16	2.28	2.58	0.12	0.5

ZS = *Zizyphus spinachristii* ZM = *Zizyphus mauritiania*
* Each value is mean of five replicates
Source: Aduradola (1998)

Table 11: Effect of type and quantity of nitrogenous fertilizers on foliar macronutrient concentration in seedlings of *Zizyphus spinachristii* and *Z. Mauritania*

Type of Fertilizer	Qty (g)	% Nitrogen		Phosphorus (PPM)		Potassium (Kg/100g)		Calcium (mg/100g)		Magnesium (mg/100g)	
		ZS	ZM	ZS	ZM	ZS	ZM	ZS	ZM	ZS	ZM
	10	.026	.057	2.0	4.3	.225	.608	.070	.304	.096	.260
NPK	20	.013	.036	2.6	6.0	.608	.230	.120	.288	.540	.240
	30	.164	.027	7.1	7.9	.705	.215	.122	.192	.540	.224
	10	.008	.023	3.0	3.4	.288	.189	.140	.272	.030	.160
UREA	20	.010	.031	4.2	3.4	.448	.230	.200	.208	.380	.336
	30	.061	.018	9.3	4.3	.512	.217	.20	.176	.320	.240
	10	.012	.015	5.3	2.5	.480	.179	.120	.224	.700	.400
COW-DUNG	20	.011	.030	6.2	7.0	.262	.266	.091	.112	.320	.240
	30	.056	.020	3.3	4.0	.448	.448	.260	.280	.580	.220

ZS = *Zizyphus spinachristii* ZM = *Zizyphus mauritiania*
* Each value is mean of five replicates
Source: Aduradola (1998)

6.3 Water relations in tree seedlings

The role of moisture in plant growth is well documented. Water constitutes over 50 percent of the fresh weight of woody plants. Almost every plant process is affected directly or indirectly by water supply (Fasheun, 1979). Reduction in water content below a critical minimum level is known to be accompanied by changes in cell structure leading to death of plants. Water economy and use in tree seedlings is of particular importance in dry environment where forest nursery operation requires a lot of water which may not readily be available particularly in the dry season. To ensure success of tree seedlings, germination bed and polypots must be kept moist since a water stress of even a day could result in heavy seedling mortality (Bharathie, 1973).

The major source of water for plant growth is soil water. The availability of soil water to plant root is however determined not by quantity of water, but by the potential of soil water in the boundary layer surrounding the roots. This is because liquid water moves from soil into the root along a gradient of decreasing water potential. This is in response to the soil-plant-atmosphere continuum. While the total soil water potential has other components such as the matrix potential, pressure potential, gravitational and osmotic potential; the matrix potential has been identified as a factor influencing plant growth (Okali and Dodoo, 1973). The leaf water potential derived from the soil matric potential is the driving force for the movement of water in plant.

$$Y_w = Y_m + Y_{os} + Y_p + Y_g,$$

Where

Y_w = Total water potential
Y_m = Matrix potential
Y_{os} = Osmotic potential
Y_p = Pressure potential
Y_g = Gravitational potential.

Awodola (1987) assessed the effect of soil matric potential on leaf water potential, relative turgidity, chlorophyll content and morphological parameters in seedlings of *E. camaldulensis* and *Eucalyptus torreliana*. Findings showed that leaf water potential decreased with moisture stress and was lower in seedlings of *Eucalyptus torelliana*. Relative turgidities were also lower in *E. torelliana* seedlings. *E. camaldulensis* with higher biomass and relative turgidities on moisture stressed soils was recommended to be better adapted for growth in xeric habitat (Table 12).

In a similar study, (Awodola, 1989) showed among other findings that *Mimosa pigra* seedlings had highest Net Assimilation rate (81.43 x 10^{-3}) on moisture stressed soil (0.8MPa) than *Combretum micranthum* seedlings (14.0 x 10^{-3}) (Table 13).

Results of the effect of soil matric potential on seedling morphological and physiological parameters of *Acacia albida* and *Acacia seyal* indicated that leaf water potential decreased with increased moisture stress, but that morphological parameters were enhanced at soil moisture of 0.2MPa (Awodola, 1991).

Mr. Vice Chancellor Sir, while the assessment of leaf water potential could be an instrument to determine the level of adaptation of a tree species with respect to moisture requirement, the frequency and quantity of watering to field capacity needed for roots to initiate sustenance of young seedlings is a practical requirement in forest nursery water economy.

Awodola and Nwoboshi (1993), Awodola (1995), Aduradola (2001) demonstrated that irrespective of source of nutrient, frequency of moisture application significantly influenced biomass production and macronutrient uptake in seedlings of *Parkia biglobosa*. Specifically, results showed that moisture application at a frequency of not more than 4 days interval to pot capacity enhanced satisfactory seedling production (Table 14). This has implication for water economy because seedlings treated to daily moisture supply did not exhibit better performance. Frequency and quantity of moisture supplied was shown to significantly influence morphological characters in seedlings of *Albizia lebbeck, Azadirachta indica* and *Acacia nilotica* (Awodola and Soje, 1992; Aduradola, 2004).

In order to promote quality seedling production, and water economy in the nursery, specific moisture requirement must be ascertained.

Table 12: Effect of soil moisture regime on *Eucalyptus camaldulensis* and *E. torelliana*

Soil matric potential	Plant species	Cumulative height (cm)	Leaf number	Total dry weight (g)	Relative turgidity (%)	Leaf water potential (%)	Total chlorophyll mg/glcal
0.0 x 105	E. camaldulensis	120.50	43.00	13.35	69.56	05.00	05.68
Pa	E. torelliana	059.87	21.00	11.67	96.00	16.05	08.25
0.0 to	E. camaldulensis	105.08	40.00	14.86	89.07	08.00	10.80
-0.2 bar	E. torelliana	049.50	19.00	10.14	62.77	18.00	08.37
0.0 to	E. camaldulensis	079.72	35.00	05.31	76.42	17.00	07.21
-0.7 bar	E. torelliana	048.00	12.00	05.38	37.43	18.05	09.19

Source: Awodola, 1987

Table 13: Effect of soil moisture regime on net assimilation, relative growth and absolute growth rates in seedlings of *Combretum micranthum* and *Mimosa pigra*

Species	Growth Parameters	Soil Moisture Regime OMPa	2MPa	8MPa
	NAR(g/cm2/we)	96.23 x 10-5	35.57 x 10-5	19.58 x 10-5
C. micranthum	RGR(g/wk)	17.06 x 10-2	10.44 x 10-2	32.67 x 10-2
	AGR(g/wk)	31.43 x 10-3	17.14 x 10-3	14.0 x 10-3
	*NAR	23.87 x 10-4	12.92 x 10-4	12.28 x 10-4
M. pigra	*RGR	45.07 x 10-2	19.44 x 10-2	22.06 x 10-2
	*AGR	98.71 x 10-3	87.14 x 10-3	81.43 x 10-3

* NAR = Assimilation Rates   * RGR = Relative Growth Rates
* AGR = Absolute Growth Rates
Source: Awodola, 1989a

Table 14: Effect of frequency of watering on some morphological parameters independent of sources of nitrogen on seedlings of *P. biglobosa*

Morphological parameter	Frequency of watering F1	F2	F3	F4
Leaf number	12a	13a	12b	11b
Seedling height (cm)	13.65a	13.55a	12.54b	11.83b
Collar diameter (cm)	0.238a	0.229a	0.234a	0.223a
Root length (cm)	17.94bc	19.38ab	20.33a	16.33c
Shoot to root ratio	0.848a	0.732b	0.65b	0.759ab
Total fresh weight (g)	2.178a	2.13a	1.818a	1.046b
Total dry weight (g)	0.522ab	0.621a	0.477b	0.477b
Root weight (g)	0.219a	0.263a	0.20a	0.178a
Shoot weight (g)	0.188a	0.128a	0.112b	0.11b
Leaf weight (g)	0.129a	0.204a	0.164a	0.157a
Leaf area	60.01a	62.27a	45.26b	38.57b
Relative turgidity	72.42ab	69.429b	75.674a	41.5c
Relative water content	1.656a	1.66a	1.599b	.599b

Note: Same letter(s) along a row indicate non-significance at 5% probability level.
Source: Awodola, 1995

6.4 Mycorrhizal inoculation as a silvicultural tool

The symbiotic association of specific fungus and plant root known as mycorrhizal association is a silvicultural tool that is gaining prominence in tropical tree crop production (Skujins and Allen, 1986). Both ectomycorrhizal and vesicular arbuscular mycorrhizal fungi are known to increase nutrient uptake particularly in low phosphorus soils (Ekwebelam and Reid, 1983; Nelson and Safir, 1982). Mycorrhizal fungi can also increase drought tolerance of host plant (Levy and Krikun, 1980; Osonubi, 1989) owing to increased stomatal conductance (Allen and Brosalin, 1983).

In Nigeria, mycorrhizal inoculation has the potential of increasing productivity of both plantation and natural forests. More specifically this practice can expand the ecological range of some economic tree species to include semi-arid zone and increase the productivity of otherwise marginal lands. Okon and Osonubi (1988) reported increased drought tolerance in *Gmelina arborea* seedlings consequent upon inoculation with an indigenous ectomycorrhizal.

In the semi-arid zone of Nigeria, Shinkafi and Aduradola (2001) observed significant differences in xylem pressure potential of *Faidherbia albida* (Table 15) between inoculated and non inoculated seedlings. Results indicated that inoculated seedlings with ectomycorrhizal had highest stomatal conductance. The higher stomatal closure with corresponding high xylem potential in moisture stressed plant suggest an adaptive strategy to conserve water by preventing water losses (Table 16).

In the humid zone of Nigeria, our findings (Table 17) suggest that irrespective of watering regime, mycorrhizal inoculation enhanced morphological characters in seedling of *Jatropha carcass* and *Ricinus communis* (Ologun, 2012).

Table 15: Diurnal variations in xylem pressure potential after twelve drought cycles in *Faidherbia albida* seedlings

Treatment	Xylem Pressure Potential at different times of the day (Mpa)		
	06:00hr	12:00hr	18:00hr
NMW_1	1.50[a]	2.79[a]	1.40[a]
NMW_2	1.00[c]	2.00[b]	1.40[c]
NMW_3	0.20[f]	1.02[f]	0.30[a]
$ENMW_1$	1.02[c]	1.28[c]	0.80[d]
$ENMW_2$	0.70[b]	0.50[h]	0.40[d]
$ENMW_3$	0.10[g]	0.40[c]	0.20[h]
$ECMW_1$	1.30[b]	1.80[c]	1.00[b]
$ECMW_2$	0.90[d]	1.50[d]	0.70[c]
$ECMW_3$	0.20[f]	0.90[g]	0.20[h]

Means along the same row with the same superscripts are not significantly different ($P > 0.05$) DMRT.
Source: Shinkafi and Aduradola (2003)

Table 16: Diurnal variations in stomata conductance after twelve drought cycles in *Faidherbia albida* seedlings

Treatment	Stomata Conductance at different times of the day (Mpa)		
	06:00hr	12:00hr	18:00hr
NMW_1	11.40^c	40.00^h	20.00^h
NMW_2	20.00^c	80.00^f	40.00^f
NMW_3	30.00^a	120.00^c	20.00^c
$ENMW_1$	20.00^c	90.00^c	60.00^d
$ENMW_2$	25.00^b	100.20^d	60.00^d
$ENMW_3$	30.20^d	140.00^a	90.00^h
$ECMW_1$	15.20^d	600.00^g	30.60^g
$ECMW_2$	20.40^c	90.00^c	50.80^c
$ECMW_3$	20.20^a	130.00^b	80.00^b

Means along the same row with the same superscripts are not significantly different ($P > 0.05$) DMRT.
Source: Shinkafi and Aduradola (2003)

Table 17: Effect of mycorrhizal inoculation on morphological parameters in seedlings of *Jatropha curcas* and *Ricinus communis*

Species	My-corrhizal	Collar Diameter (cm)	Leaf No.	Height (cm)	Leaf area (cm2)
Jatropha curcas	M0	1.80	5.73	15.93	73.80
	M1	2.02	7.33	20.19	108.27
Ricinus communis	M0	0.89	5.20	29.59	
	M1	0.97	5.13	39.80	

Source: Ologun 2010

6.5 Assessment of Forest Productivity

Quantitative assessment of the forest estate is a necessary requirement for understanding ecological dynamics needed for holistic forest management.

Mr. Vice Chancellor, between 1991 and 1996, I was privileged to lead the vegetation study team of the European Economic Community (EEC) Commissioned study of the Zamfara Reserve in the present Zamfara State. In our attempt to quantify potential productivity of the reserve, our activities centred on:

(a) Assessment of the vegetation status of the Reserve for pastoralism.
(b) Biological control of *Cassia tora,* a predominant weed of insignificant nutritive value.
(c) Assessment of drought tolerance of some multipurpose plants in the reserve.

6.5.1 Assessment of the vegetation of Zamfara Reserve for pastoralism

Using the point-centred quadrat method (Mneller and Ellenberg, 1974), the floristic composition of Zamfara forest was assessed. Our result indicated that the plant cover of Zamfara Reserve was poor, due to over exploitation of the flora. Specifically only 22 species belonging to 12 families were encountered in the study area. Absolute density of the woody plants in the 1.6 hectare sample plot was found to be 178.31 (Table 18). *Piliostigma reticulatum* with a density of 48.88 per hectare has the highest absolute density in the reserve.

The dominance value of each family are presented in Table 19. *Caesalpinaceae* family recorded the highest dominance value of $18.41m^2$/ha. Field observation revealed that in the month of March, there was total lack of foliage in the northern part of the reserve in areas above latitude 13^0N. In these areas, only *Diospyras mespiliformis* along river coasts were with foliage. The implication is increased feeding pressure during the dry season feeding gap. Drought resistant species such as *Zizyphus mauritania, Balanites aegyptiaca* and *Piliostigma reticulatum* were recommended to reduce the dry season feeding gap.

Table 18: Density of woody species in Zamfara Forest Reserve

Species	Density (No. ha)	Density Rank	Relative Density (%)
Piliostigma reticulatum	48.88	1	24.41
Eucalyptus doka	2.88	13	1.61
Afzelia africana	11.50	3	6.45
Tamarindus indica	5.75	7	3.22
Parkia biglobosa	2.88	13	1.61
Lannea kerstingii	8.63	5	4.84
Anogeissus leiocarpus	25.88	2	14.51
Balanites wilsoniana	11.50	3	6.45
Prosopis africana	8.63	5	4.85
Terminalia nigricans	2.88	13	1.61
Cassia siamea	5.75	7	3.22
Ficus sycomorus	5.75	7	3.22
Sclerocarya birrea	5.75	7	3.22
Vitex doniana	2.88	13	1.61
Combretum nigricans	2.88	13	1.61
Adansonia digitata	5.75	7	3.22
Terminalia avicennioides	5.75	7	3.22
Rogeria adenophylla	5.75	7	3.22
Ximenia americana	2.88	13	1.61
Ziziphus spinachristi	2.88	13	1.61
Isoberlinia doka	2.88	13	1.61
Ziziphus mauritiana	2.88	13	1.61

Source: (Awodola *et al.*, 1998)

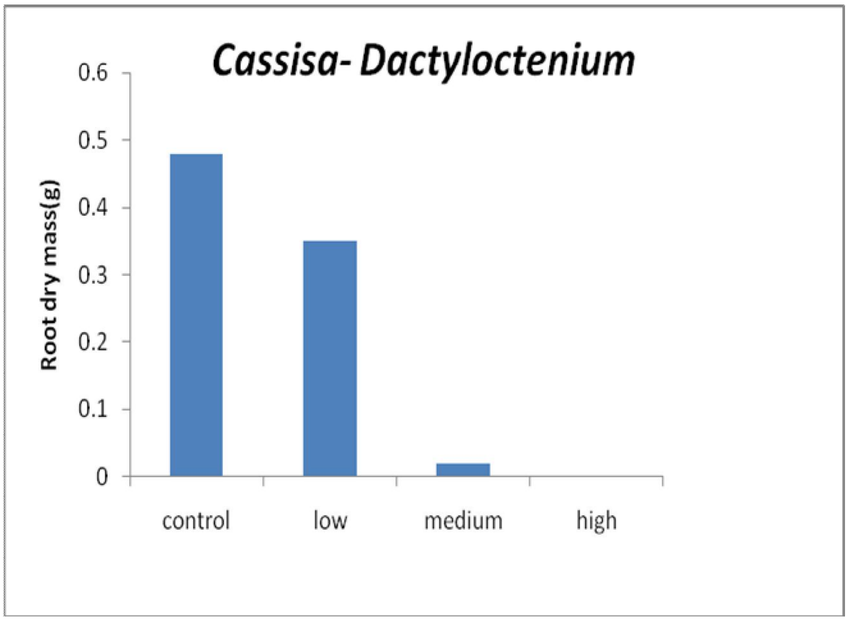
Table 19: Family dominance among the woody plants in Zamfara Forest Reserve

Family	No. of Species	Family Dominance (M2)	Dominance Rank	Relative Dominance (%)
Caesalpinaceae	5	18.41	1	28.70
Combrataceae	1	12.82	2	20.06
Anacardiaceae	2	2.13	8	3.33
Mimosaceae	2	4.00	6	6.25
Moraceae	1	1.15	10	1.80
Myrtaceae	1	0.20	12	0.31
Verbernaceae	1	1.44	9	2.25
Balanitaceae	1	7.91	4	12.37
Bombacaceae	1	10.18	3	15.92
Pedaliaceae	1	4.54	5	7.10
Oliaceae	1	0.58	11	0.90
Rhamnaceae	1	2.28	7	3.56

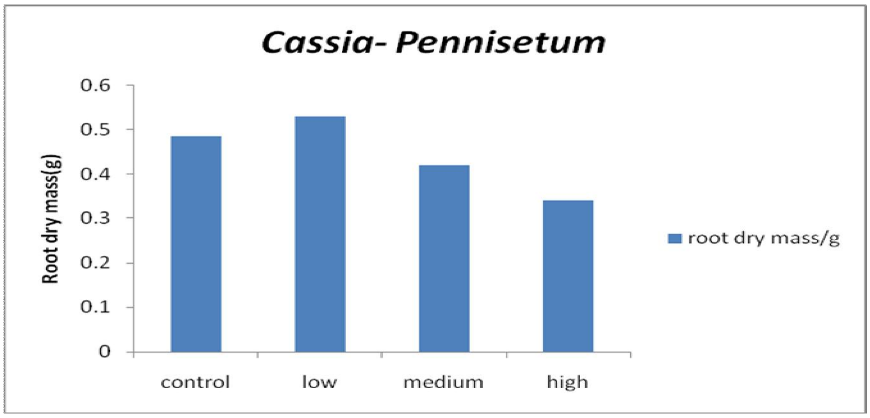
Source: (Awodola *et al.*, 1998)

6.5.2 Biological control of *Cassia tora*

In the 1970s and 1980s, *Cassia tora,* an indigenous weed, successfully invaded vast areas of the Zamfara Forest Reserve. Biological control is rooted in the understanding of growth patterns and inter-specific competition among plants. We assessed the effect of three levels of interspecific competition between *Cassia tora* and two economic species namely: *Dactyloctenium aegyptium* and *Pennisetum pedicellatum* at four different soil depths on root biomass. Our findings (Figures 3 and 4) suggest that *Cassia tora* can be successfully controlled by *Dactyloctonium aegyptium* suppressing root of *Cassia tora* at ratio of 1:4.



a



b

Figure 3 a and b: Root dry mass of *Cassia tora* in the three density treat ments with grass species in comparison to the control
Source: Koukora *et al.*(1998)

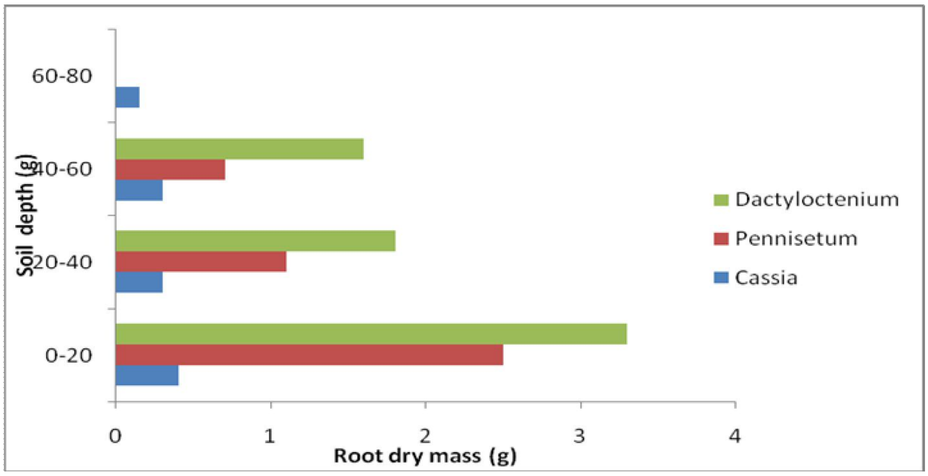


Figure 4: Root dry mass in the control treatment of the various species in the end of the growing season Source: Koukora *et al.* (1998)

6.5.3 Assessment of drought tolerance of some multi purpose plants in Zamfara Reserve

In 1994, between the months of August and November, we assessed the diurnal leaf water potential and stomatal resistance of three herbaceous plants namely; *Dactyloctenium aegytiaca, Cassia tora, Zornia glochidiata* and five tree species namely: *Piliostigma reticulatum, Anogeisus leiocarpus, Guieria senegalensis, Balanites aegyptiaca* and *Zizyphus mauritiana*. Results presented in Tables 20 and 21 suggest the following:

a) In all species, maximum stomata opening was at middays.
b) With respects to temporal variation, predawn values of leaf water potential (LWP) increased from August to October.
c) Among the herbs, *Zornia glodichidiata* had highest value (12 bar) of midday leaf water potential at peak of rainy season.
d) Between August and September, *Piliostigma reticulatum* has significantly higher stomatal resistance and lower leaf water potential.
e) With respect to periodicity of foliage, *Z. mauritania* retained green and fresh foliage throughout the study period, while by November all the herbs were dried and not available for measurement. Consequently, the order for drought tolerance among the studied species is
f) Herbaceous species: *Cassia tora* > *Zornia glochidrata* > *Dactyloctenium acyptum*.
g) Woody species: *Z. Mauritiania* > *P. reticulatum* > *B. aegyptiaca* > *G. senegalensis* > *A. leiocarpus.*

Table 20: Diurnal and temporal variation in leaf water potential chart of some multipurpose plant species in Zamfara Reserve

Month	August			September			October			November		
Time (hrs.)	06:00	12:00	16:00	06:00	12:00	16:00	06:00	12:00	16:00	06:00	12:00	16:00
D. aegyptium	12	35	10	24	25	18	3	19	16			
C. tora	10	15	9	10	18	14	3	13	14			
Z. glochidiata	17	12	12	6	12	12	8	9	10			
P. reticulatum	55	50	60	9	66	20	7	29	20	23	35	27
A. leiocarpus	20	28	30	30	29	30	8	17	13	21	40	39
G. senegalensis	15	35	25	10	35	20	2	12	10	14	30	22
B. aegyphaca	46	60	40	15	45	30	20	24	20	33	40	36
Z. mauritiana	20	45	30	12	35	25	24	23	21	40	35	37
S.E.	2.08	2.07	2.17	1.03	1.90	0.84	1.03	9.81	0.86	2.05	0.84	25

Source Awodola *et al.* (1998)

Table 21: Diurnal and temporal variation in stomatal resistance (S/cm) of some multipurpose plant species in Zamfara Reserve

Month	August			September			October			November		
Time (hrs.)	06:00	12:00	16:00	06:00	12:00	16:00	06:00	12:00	16:00	06:00	12:00	16:00
D. aegyptium	9.60	1.50	6.90	0.80	4.70	10.40	2.08	0.60	5.10			
C. tora	8.00	1.38	4.90	0.89	3.70	1.29	0.34	2.02	3.60			
Z. glochidiata	0.90	2.24	4.60	3.75	2.80	3.35	0.57	2.30	3.20			
P. reticulatum	7.50	9.50	9.00	0.20	11.20	4.80	0.18	0.66	4.10	0.99	0.25	0.23
A. leiocarpus	5.20	4.50	5.20	0.66	5.80	4.13	1.02	0.68	1.30	0.88	0.88	5.00
G. senegalen-sis	2.70	8.90	4.20	2.18	4.40	5.20	0.44	0.65	2.30	1.34	0.69	2.30
B. aegyphaca	6.30	0.60	6.50	1.87	0.94	5.40	1.04	2.01	4.20	3.00	1.70	0.23
Z. mauritiana	9.00	1.00	2.00	1.78	1.20	4.90	3.70	1.00	4.60	3.55	9.50	4.80
S.E.	0.38	0.44	0.26	0.14	0.41	0.32	0.14	0.09	0.16	0.25	0.78	0.46

Source Awodola *et al.*, (1998)

7.0 CONCLUSION

Mr. Vice Chancellor Sir, I wish to conclude that the forest of hope is that forest that provides in perpetuity, forest products and services to man is not a myth but a reality.

This reality will become more apparent as we discover and apply the silvicultural treatments that will propel sustainability of quality forest productivity in our country.

Consequently, against apparent challenges to forest production through abuses, and or misuse, I will like to conclude that with a conscious adoption of scientific approach and necessary political will, there is a hope for our forest.

8. 0 RECOMMENDATIONS

1. Capacity Building (Training and Research)

Qualitative manpower training remains a challenge in contemporary educational system in Nigeria. Our curricula must be periodically reviewed to make our product relevant in an increasingly competitive global market. The quantum and quality of research should be positively correlated to the rate of development. Functional problem oriented research should be encouraged in our universities and research institutes. While academics must publish research findings, the syndrome of publish or perish should be revisited to focus more on the quality and resultant impact indices, rather than numbers. Collaboration and networking should be promoted to benefit from technology transfers and advanced laboratories to enhance capacity building.

2. Promotion of Attractive Forest Enterprise

A revolutionary policy should be put in place to make the forestry business attractive. This should range from abolition of old and ineffective forest laws, enactment of new forest legislation to the promotion of appropriate pricing of forest products and services.

3. Establishment of more Forestry related Research Institutes

To date, for over 50 years, we have in Nigeria only one Forestry Research Institute. Ironically, in the Agricultural sector, we have commodity-based research institutes, such as Cocoa Research Institute, Rubber Research Institute, e.t.c.

I wish to recommend the creation of more forestry related research institutes from the available one, Forest Research Institute of Nigeria. I suggest we have:

(a) Institute for Tropical Silviculture and Forest Ecology
(b) Institute for Wood Products and Utilization
(c) Institute for Forest Inventory and Forest Management.

These establishments will increase the speed of functional problem-oriented research and provide employment for forestry graduates.

To meet the FAO requirement that 25 percent of our land area should support forest estate, I wish to recommend a legislation that will enforce tree planting of at least ten hectares annually in every local government of Nigeria. The local government budget can afford this project.

9.0 APPRECIATION

Mr. Vice Chancellor Sir, my first appreciation goes to the Almighty God for the gift of Salvation through the blood of Jesus and who against hope gave me hope to be what I am today. I must in specific term thank God for protection. Twice, I survived stray bullets at Sokoto and Akwanga respectively. I thank God for His mercies and the numerous people He used to sustain and make me see this glorious day.

It is practically impossible to thank all the people that contributed in one form or the other to the career of an academic. I will endeavour to mention a few of them.

First, I am eternally grateful to my parents – my father, Late Pa. Julius Sunday Olatunji Awodola, I remember you today with mixed feelings. You struggled to give your children the best, but could not wait to see a day like this. May your gentle and caring soul rest in perfect peace until we meet on the Resurrection morning. I salute and appreciate my mother, Mrs. Mary Moyoade Awodola, who despite the demise of our father 33 years ago, revived hope in us and continued with the struggle to train us. Mama I am happy you can see today. You will see more glorious days. Amen.

I appreciate members of my extended family in particular, Chief (Deacon) S.A. Sayomi, former Deputy Governor of Kwara State, Mr. F.O. Awodola (retired Justice), Mrs. Margaret Oyebimpe Aroyehun, Late Mr. J.S Fajinmi, and Mr. and Mrs. Moses. A Fajinmi.

I am blessed with a wonderful father-in-law, Late Apostle Gabriel. Kayode Daramola. He taught me some lessons that I continue to cherish. I appreciate my mother-in-law, Mrs. Deborah Daramola who is alive to witness this occasion. Members of Daramola family present are duly appreciated.

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Mr. Vice Chancellor Sir, I started my academic career in the then University of Sokoto now Usmanu Danfodiyo University in 1981, Late Professors Abubakar Gwandu and Chinwere Ikoku interviewed me for the post of Graduate Assistant. To both of you I say a big post humous thank you. I am grateful to all the foundation members of the Department of Forestry and Fisheries; Usman Danfodiyo University, Sokoto, Prof. Tore Arnborg, Dr. Abdul Malik, Dr. S.P.A. Okoro, Dr. (Mrs.) E.G. Oboho and Prof. J.K. Ipinjolu, my beloved friend. I appreciate Mr. Olatunde Adeniran, Mr. Lanre Amao and Mr. Moses Dare my friend and in-law.

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I was not here during the tenure of the first Vice Chancellor of this great University of Agriculture, Abeokuta, Prof. N.O. Adedipe. Unknown to him his excellent handling of AGB 110 and AGB 112 during the 1977/78 session at the University of Ibadan deposited in me a seed of interest in plant physiology. Prof. Yemi Akegbejo-Samsons representing my first degree set is a good witness. Prof. J.A. Okojie was the Vice Chancellor of this great University when I relocated, I appreciate him very sincerely. It was during Prof. I.F. Adu's tenure that I was promoted a Reader. Prof. Adamson as Acting Vice Chancellor announced my elevation to the Professorial position and appointed me Director, FMNEV-UNAAB Linkage Centre. The immediate past Vice Chancellor, Prof. O.O. Balogun, appointed me Chairman of FUNIS Board. I thank them all for their contributions to my academic career.

I am grateful to the Italian Government who granted me a full scholarship for a study in Agroforestry techniques. I appreciate the European Economic Community who sponsored a 5-year research on the vegetation of Zamfara Forest Reserve.

I appreciate all my students past and current for a fruitful team work. Permit me to recognize my first PhD Student, Prof. M.A. Shinkafi, currently a commissioner in Zamfara

State.

Mr. Vice Chancellor, it is a common saying that those who have fathers will move further while those who have mothers will matter. Permit me to appreciate and recognize my fathers and mothers in the Lord.

I appreciate the General Overseer and Mother-in-Israel of The Redeemed Christian Church of God, Pastor and Pastor (Mrs.) E.A. Adeboye. I cannot thank you enough for your outstanding spiritual leadership, exemplary lifestyle, prayers and care. Pastor and Pastor (Mrs.) D.A. Ilori, Assistant to the General Overseer, Pastor and Pastor (Mrs.) I.O. Abatan, Director, Directorate of Christian Education, RCCG. Pastors J.O. Odeyemi , J.F. Odesola, Olu Obanure, J.O. Obayemi, W. Haastrup, Remi Akintunde, Special Assistants to the General Overseer, I salute you for your unfailing fatherly roles.

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Mr. Vice Chancellor Sir, before I conclude this Lecture, permit me to appreciate my nuclear family.

Wives are in categories, some remain as conventional wives, others degenerate to become sources of pains, while others graduate to become mothers to their husbands. Pastor (Dr.) (Mrs.) Oluwaremilekun Ajoke Aduradola has graduated to become a mother and a special delight and part of me. I make bold to say my wife is a virtuous woman. On this occasion I publicly salute your unfailing love, unquantifiable sacrifices and hope against hope in moments of challenges. I thank and appreciate you for your unwavering love, transparency, care and sustaining prayers.

Special appreciation goes to my biological children. They are loving and understanding heritage of God; Toluwaleke Aduradola (Accountant), Oluwatomi Aduradola (Economist) and Oluwatobi Aduradola (an emerging Computer Scientist). I also express gratitude to all our adopted children who have stayed with us for mentoring.

I thank you all for listening and before closing join me as I sing this song:

Baba nigbati mori be se to 3ce
Mo wa so pe ope loye Baba.

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