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KOGI STATE UNIVERSITY

ANYIGBA, NIGERIA

INAUGURAL LECTURE

TITLED:

SCIENCTIFIC ELEGANCE AND POLITICAL NAIVETY OF FOOD AND WOOD SUFFICIENCY IN NIGERIA: THE TAKE OF AN AGROFORESTER

Delivered by

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Scientific Elegance and Political Naivety of Food and Wood Sufficiency in Nigeria: The Take of an Agroforester

By

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Professor of Agroforestry

Being the text of the 5th
INAUGURAL LECTURE

Delivered

@

Kogi State University, Anyigba, Nigeria.

Dedicated To

All who love to produce and consume sustainably.

National Anthem
Arise, O compatriots
Nigeria's call obey
To serve our fatherland
With love and strength and faith
The labour of our heroes' past
Shall never be in vain
To serve with heart and might
One nation bound in freedom
Peace and unity

O God of creation
Direct our noble cause
Guide thou our leaders right
Help our youths the truth to know
In love and honesty to grow
And living just and true
Great lofty heights attain
To build a nation where peace
And justice shall reign

KOGI STATE UNIVERSITY, ANYIGBA ANTHEM

Kogi State University, you stand in strength and pride

Showing the way for all who yearn

Standing firm in wisdom and truth

In unity we grow

Committed in imparting knowledge, skill and learning

To all who long for excellence

Kogi State University, the pride of the world

We honour your virtues

The Vice-Chancellor, Deputy Vice-Chancellor (Administration), Deputy Vice-Chancellor (Academic), the Registrar and other Principal Officers, Provost of the College of Health Sciences, the Dean of the Faculty of Agriculture, the Dean of School of Postgraduate Studies and other Deans, Professors and other Academic Colleagues and Students, the Congregation and other staff, my Lord Spiritual and Temporal, Friends and well-wishers, Gentlemen of the Press, Ladies and Gentlemen.

Introduction

I give this fifth inaugural lecture to the glory of God. This lecture was ready in 2016, when the Senate of this University re-established the Department of Forestry and Wildlife; hitherto, I was in the Department of Animal Production. Also in 2016 I turned ten years as a Professor. As the saying goes – man proposes but God disposes. The journey started precisely on a Monday December, 17 of 1984 at the University of Ilorin, Ilorin, Nigeria, when the then Acting Head of Crop Production Department, Dr. A.A Adesiyun warmly welcome me and took me to Dr. J.A Ogunwale. As soon as I was introduced to Dr. Ogunwale he stood up from his chair and said 'welcome on board Prof. Fagbemi' and I opened my mouth not knowing what response to give. Dr. Ogunwale then asked me to claim the title since that ought to be the ultimate aim of any academic. That wish for me by Prof. J.A Ogunwale, one time Vice-Chancellor of Oduduwa University, Ile – Ife came to fruition on the 1st of September 2006 when the Governing Council of the Kogi State University, Anyigba pronounced me a Professor. It is this making of the Lord that has qualified me to stand before you today to profess agroforestry.

I had earlier confided in a colleague that I was not prepared to give an inaugural lecture while still in "academic Siberia". I was recruited to the Department of Forestry and Wildlife in September 2006 by this University but the Department was yet to take –off when I reported. The then Dean sent me to the Department of Animal Production promising that as soon as the Faculty was through with the accreditation exercise for B. Agriculture programme being prepared for, Forestry and Wildlife would come on board. This take-off of the Department was not to be for ten years and that was how I got stranded in Babylon. So asking me to deliver an inaugural lecture with the presenttitle while still in the Department of Animal Productionwould be demanding that I sing the Lord's song in a strange land. Indeed the forest should provide the habitat for the animal.

In the course of time we did a review of the Forestry and Wildlife programme document to include Fisheries with two programmes in the Department of Forestry, Wildlife and Fisheries. However, by the time the document for the re- establishment of the Department would come up on the floor of the Senate after it had gone through the Curriculum Development Committee, the name had changed to "Fisheries, Forestry and Wildlife. I argued against the nomenclature but the Senate would not listen to me being the only Forester I was a minority. This abracadabra is what my brothers and sisters in Ebiraland will describe as "arekuku ka kukuku", in Igalaland 'Ifiam ifiam' and Okuns will say 'aranbada'. Then I remembered that a tree could not make a forest and that the Senate of Kogi State University was not *doli incapax***.**

In 2012, the NUC sent a team for the verification exercise of new programmes without a Forester as Forestry and Wildlife programme was omitted from the list sent to the NUC. When I met the then Vice Chancellor he claimed not to have known what led to the omission but I had my suspicion. Till date I see the whole matter as being profoundly paradoxical. Mr. Vice-Chancellor Sir, is it not historical that the Department of Forestry and Wildlife was re-established by the same Senate during your tenure? Permit me to briefly review the state of the Nigerian University System today.

State of the Nigerian University System.

The University System in a country should ideally be the pathfinder for the nationals. The urge to make the gown to meet the town should be encouraged but a situation whereby the town is allowed to swallow the gown is detestable. Unfortunately the rot in the larger society has crept into the Nigerian University System to the extent that we can no longer resist asking the question: who will rescue the Nigerian University System?The situation with the University System in Nigeria can be likened to the story told by Dr. D.K. Olukoya the General Overseer of Mountain of Fire and Miracles Ministries (MFM) Worldwide. He had narrated how a Professor that had a particular 'serious' trouble decided to seek for solution from an 'illiterate' Babalawo. The witchdoctor had prepared some solution that could cure the Professor and had requested his apprentice to deliver the green bottle to the Professor; unfortunately, he delivered to him the black bottle containing the urine of the Babalawo. What a shame!

Most Universities in Nigeria are not well funded and are therefore poorly equipped. State Universities are worse of in that most of their Visitors do not even understand the essence of a University. A system that compromises on quality in managing quantity will be dominated by

mediocrity. I recall a former lecturer of mine at the University of Ibadan telling us that a time was when a certain white Professor that taught his set said he literally had to put a student's script under the microscope to see how to move a 39.5 % to 40%. I have since come across where, if a student earns 39 in a course and a Lecturer returns same for her/him, it was regarded as a form of computational *harakiri.*

What motivation exists for undergraduates to excel in Nigeria of today? Students know when they are admitted but are not sure when they will graduate. Strike in Universities should end and ASUU should lead in a national talk shop to end strike in the University System. How many Nigerian Universities can provide enough space, the required equipment and chemicals to support the needed practical demonstrations that students admitted each year for science based courses are required to carry out? Thank God for TETFund that supports public Universities today, it could have been worse.

Today, undergraduates remain on their various courses for many years beyond the period prescribed for the different disciplines since leaving the University for the larger society is like leaving frying pan to fire. No thanks to our past leaders who had failed to plan for the future of our children. In 1982, I had a job offer from the Civil Service Commission of old Kwara State but I turned down the offer to pursue a postgraduate programme that prepared me for the job that I am doing today. Employment for graduates has now become a big issue. When we fail to attend to small issue it becomes a big issue (Fagbemi, 2003).The conditions under which academics carry out research in most Nigerian Universities are less than ideal. I imagine what Mr. Vice-Chancellor goes through having to worry on cost of fuel to power the numerous generating sets on campus. Meanwhile as late as 1998, then President Jerry Rawlings had instructed the electricity company in Ghana to place all their Universities on the same line that supplied the Presidential Villa in Ghana

The quality of the mind of the Chief Executive Offer in a University who is usually a Vice-Chancellor has a lot to do with the growth and development of such institution. If a Professor with a puny mind is appointed a Vice-Chancellor, he will in all probability reduce the University to her/his puny self. Attainment of the rank of professorship should notbe the most important factor that qualifies an academic to be appointed as a Vice-Chancellor but character and integrity. It was Drucker (2004) in his book 'Management: Tasks, Responsibilities, Practices' who said 'A man might know too little, perform poorly, lack judgment and ability

and yet not do damage as a manager. But if he lacks character and integrity, no matter how brilliant, how successful – he destroys. He destroys people the most valuable resource of the enterprise. He destroys spirit. And he destroys performance.'

Nigerian Universities should strive to distinguish themselves in such a way that they would be repositories of intellectual troubleshooters, where the larger society would look up for solutions to societal troubles. They should be populated with academics that desire to tell the truth based on facts, a condition that is a crucial factor for being an intellectual. Intellectuals in the University System should be encouraged by their first among equals (usually the Vice-Chancellor) to carry on rational inquiry to wherever it may lead. The state of affairs in the Nigerian University System that appears to make the System comfortable being led by the larger society cannot lead to the development of the country. The political elite should be made to understand that once the Universities fail to lead the nation, the country will simply be writing its own suicide note well in advance. Having established that a University should be led by a Professor with character and integrity, we may now want to know who a Professor is

Who is a Professor?

Nigeria is a huge joke. Universities all over the world have criteria for promoting an academic to occupy the chair. One criterion is the assessment of the scholarly publications of the one to be so promoted usually by internal and external assessors. When a minimum of two external assessors return positive verdict on the one being assessed, the Council may go ahead to confer the title of professorship in a specific area in a given discipline. It will be wrong of me to introduce myself as: my name is Professor Oluwagbemi, Tai. An error most colleagues make. My correct introduction is: My name is Oluwagbemi, Tai, a Professor of Agroforestry! It is also wrong to address a female academic as Professor Mrs… for scholarship is gender neutral.

When a Professor is retiring and she/he is convinced that she/he has so distinguished herself/himself, she/he could submit herself/himself for further assessment to the membership of that noble club of emeriti. Once an academic has been pronounced Emeritus Professor she/he can wear that title for life. Point of further clarification, if an academic who becomes a Professor without attaining the emeritus status leaves the University for whatever **Reason**; she/he ceases to occupy a chair. I wish to humbly appeal to all those so called 'Professors' in government either in elective or appointive positions to stop engaging in intellectual hypoventilation by dropping their professorial titles and revert to their former titles. They

should stop this macabre dance of intellectual "talala ntololo, tololo ntalala" when they parade themselves with the title. Shall we now go to the subjects of food and wood?

Food and Wood Sufficiency

Generally speaking, man is a creation of God. In verses 15-17 of Chapter 2 of Genesis, "The Lord God took the man and put him in the Garden of Eden to work it and take care of it. And the Lord God commanded the man, 'you are free to eat from any tree in the garden, but you must not eat from the tree of knowledge of the good and evil, for when you eat of it you will surely die' (TPDB, 2007). One can easily deduce that the earliest man was a caretaker of the garden which is what a forester is. He was also a vegetarian! The evolution of cultigens that gave rise to agriculture might have been as a result of man's sin of disobedience. His eating the forbidden fruit led to his inability to gather sufficiently from the garden. Food in its simplest definition is any substance that plant or animal can take into its body to maintain its life. The question may be asked as to why a forester is addressing the issue of food instead of wood only! We are all involved.

This inaugural Lecturer likes to eat good food. At the age of two years when his twin sister and himself were about to be weaned, he attempted to pick fried cake (akara) from a frying pan. He got his left arm burnt in the process when hot oil poured on him. This little accident made his mother to resume breast feeding him for an extra six months to the envy of his twin sister! Little wonder that when he found himself having to study forestry, he decided to pitch his tent in that tripartite marriage involving agronomy, forestry and animal husbandry. The courtship for these relationships between arable and tree crops started on the day of the introduction in Burma around 1861. The couple is known as *taungya.* According to Nwoboshi (1982*) taungya* system may be defined as a plantation establishment technique in which forest crops are raised in combination with temporary cultivation of arable crops.

In the early seventies (Anon, 1973) the Department of Forestry at the University of Ibadan, proposed a variation of the *taungya* system to be practised outside forest reserves. This variation in accord with Nwoboshi (1982) could be termed *agri-silviculture* which envisages multiple land-use involving arable and tree crops, in which case the arable crop is better favoured. This is what IITA Ibadan calls alley cropping (Kang and Wilson, 1987) whereas World Agroforestry Centre in Nairobi refers to it as hedgerow intercropping, which is in a sense agroforestry or alley farming (Reynolds and Adediran, 1987). Agroforestry is a land-use

system in which agricultural, silvicultural and livestock–raising activities are assembled into various combinations for the production of food, timber, fuel, fibre, forage, green manure and animal products simultaneously or sequentially in a given area. Ngambeki (1985) had demonstrated its economic viability.

I am more comfortable addressing the issue of food sufficiency in Nigeria rather than food self-sufficiency. How many of the crops produced in temperate countries can Nigeria produce in sufficient quantity and quality sustainably? In the eighties, the drive to produce sufficient wheat in Nigeria led to the ban on wheat importation in 1987. However, a comparative study by Omotesho (1998) on the profitability of wheat and tomato production for the Kano irrigation project showed that tomato production led to more profitable use of land, irrigation water and labour than wheat production. The study justified the lifting of ban on wheat importation in 1992. Today, research has now led to the development of varieties that yield six tonnes per hectare as opposed to a little above one tonne in the eighties. Well, the current Federal Government of Nigeria has informed Nigerians that by 2018 cereal importation will cease.

Certain challenges are confronting food (Orebiyi, 2016) and wood (Oluwagbemi, 2012) production in sufficient quantity in Nigeria. However, these challenges can be tackled at two fronts. Demonstration of correct political will and progressive research can help to codify research results that will lead to sustainable food and wood production in a dynamic environment such as Nigeria. But do we have such political platform in place to formulate and implement correct people-centred policies?

Back to the issue of wheat, the bulk of the wheat consumed in Nigeria today is imported. Luckily research findings have supported the fact that Nigeria can have 20:80 percent cassava-wheat flour for the production of all confectioneries (FIIRO, 1985, 2014). Chief Olusegun Obasanjo while in office had given approval to the policy of 10 percent cassava flour inclusion in bread baking and had challenged flour millers and bread bakers to cue into this correct policy. But then, the move did not lead to any desirable result before he left office. Dr. Akinwumi Adesina who served as the Minister of Agriculture under Dr. Jonathan presidency did canvass for a 40 percent cassava flour input in bread baking. If this policy had taken root faithfully, it would have saved the country huge foreign exchange normally expended on wheat importation. The art of 20:80 cassava-wheat was yet to be perfected when the Government of the day then announced 40:60 cassava-wheat bread!

The past governmental approach to cassava-wheat substitution was an embarrassing gargantuan failure. Presidents Obasanjo and Jonathan during their tenures showed on the NTA an attractive loaf of bread purportedly baked from cassava-wheat flour. I do not know of any household in Nigeria today where 40:60 cassava-wheat bread is eaten as breakfast. May be Mr. Vice-Chancellor may know since by virtue of his office he has access to more information than myself. Access to food should be a fundamental human right. Nevertheless we need to clear the political space of democratic pretenders and capitalist bagasse in Nigeria to make food available and affordable to all Nigerians. Nigeria is not food sufficient today and that is why the country expends so much on food imports as could be seen in Table 1.

Mr. Vice-Chancellor Sir, let me call our attention to a fundamental error in our attempts at making food sufficient in Nigeria. This obstacle is constitutional. The Constitution of Nigeria 1999 as amended under the Fifth Schedule Part 1- Code of Conduct for public officers trivializes the farming profession, yet we want to attain food sufficiency. I do not know any developed country that has attained food sufficiency sustainably in this manner.

In what are we sufficient if I may ask? As a little boy at Ekinrin-Adde, I recall that the Public Works Department at Kabba dug a well around my grandfather's house in 1965 which does not go dry! Can we be a bit historical? During this period that wells were provided for us, Kabba Province was under the Northern Regional Government. The present nineteen (19) States in the northern part of Nigeria were all one region under the premiership of the Sardauna of Sokoto. The import of the present balkanization of the old Northern Region into 19 States is that there are now 19 Sardaunas in Nigeria. Unfortunately the collective vision of the 19 little Sardaunas is less than that of the old Sardauna.

The new little Sardaunas that have governed Kogi State have tried to provide us with water. But then, all the hand-operated boreholes that had been provided for Ekinrin are today without water. My desire to benefit from the public water supplies in Lokoja took me to the State Water Board in 2014. The management of the Board informed me that to convey water from the main pipe that runs by the NITEL office at Lokoja to my house would cost me #475,000.00 naira only. This was at a time that I was paying yearly #788,096.04 as tax to the Government of Kogi State. Raising the amount needed was not the serious challenge that I had but how to police the pipe that will bring water from NITEL building to my house. That was how I gave up. And so till date the public water supplies have failed to supply water to my house.In those days, the

business of ‘mairuwa’ was limited to supply of water to ‘maisha’. Today, we have graduated to embracing the culture of sachet water and ‘mairuwa’. Can we in all honesty claim to be sufficient in potable water supply in Nigeria today? Is the inability of our governments to provide adequate potable water to the citizenry a colonial burden that we need to unburden? I do not think so. What we need to unburden is the poverty of the mind!

Table 1. Nigeria’s Imports from European Union

Imports SITC Rev. 3 Product Groups	Value Mio €	% Total	% Extra-EU	% Growth*
Total	18,364	100.00	1.1	-34.7
Primary products	18,106	98.6	3.3	-35.0
Agricultural Products	552	3.0	0.4	-31.6
Food	475	2.6	0.4	-12.3
Fish	48	0.3	0.2	21.4
Raw materials	77	0.4	0.3	-9.4
Fuels and mining products	17,554	95.6	4.5	-35.6
Ores and other minerals	83	0.5	0.3	-7.7
Fuels	17,470	95.1	5.3	-35.7
Of which petroleum & petroleum prod.	16,283	88.7	6.7	-37.2
Non ferrous metals	1	0.0	0.0	-11.9
Manufactures	247	1.4	0.0	3.0
Iron and steel	0	0.0	0.0	-91.1
Chemicals	11	0.1	0.0	36.7
Of which Pharmaceuticals	0	0.0	0.0	-70.8
Other semi-manufactures	159	0.9	0.2	-0.5
Machinery and transport equipment	64	0.4	0.0	27.0
Office and telecommunication equipment	12	0.1	0.0	54.7
Electronic data processing & office equipment	3	0.0	0.0	46.3
Telecommunications equipment	9	0.1	0.0	58.6
Integrated circuits and electric components	0	0.0	0.0	-5.2
Transport equipment	16	0.1	0.0	164.1
Of which automotive products	1	0.0	0.0	181.5
Other machinery	36	0.2	0.0	-9.5
Power generating machinery	15	0.1	0.0	-37.2
Non electric machinery	11	0.1	0.0	-0.4
Electrical machinery	10	0.1	0.0	131.3
Textiles	4	0.0	0.0	-10.4
Clothing	0	0.0	0.0	181.7
Other manufactures	8	0.1	0.0	-9.7
Of which scientific & controlling instruments	6	0.0	0.0	-14.4
Other products	10	0.1	0. 1	-24.8
Others	1	0.0	n.a.	n.a.

*% Growth relative variation between current and previous period
% Total: Share in Total: Total defined as all products
% Extra-EU: imports/exports as % of all EU partners i.e. excluding trade between EU Member States.
Source: Eurostat Comext (2015).

My humble contributions to research in agroforestry:

In the earlier part of this lecture, I have shown that we need a correct polity to ensure that we have sufficient food and wood in Nigeria. Lucas (2007) submitted that we have had enough food for thought and that we should begin to have enough food on the table. Scientists in Nigeria and elsewhere have elegantly demonstrated through research that indeed, Nigeria can have sufficient food and wood to feed her citizens and to process for export to earn foreign exchange. My baptism of academic research started at the University of Jos, when Khan, Fagbemi and Ejike (1983) monitored the diurnal rhythm of planktonic organisms in relation to various physico-chemical variables during dry, hot and rainy seasons of Lamigo water reservoir on the Jos Plateau. My contributions to research as a sole researcher or with others have centred on exploring the integration of savanna tree species into arable cropping/animal husbandry of the peasantry.

In a review Fagbemi (1989a) had examined the potential impact of agroforestry in resolving the Nigerian food crisis when he identified bad political leadership as a major constraint to the full manifestation of agroforestry and suggested progressive political governance as the turning point in economic uplift. Fagbemi and Nwoboshi (1991a) had advocated the integration of agroforestry systems into food production programme in the savanna zone of Nigeria as a rescue to food insecurity. In the eighties the bulk of the research on the potentialities of agroforestry in Nigeria was in the rainforest zone yet agro-forestry systems are location specific. It was this realization that made Fagbemi (1989a) to draw attention to the need for the introduction of modern agroforestry farming systems in the savanna zone which represents about 86 percent of Nigeria's arable land. Agroforestry, though scientifically elegant at supporting sustainable food and wood production will fail to make any meaningful impact under a politically naïve leadership. If we fail to shape up politically, Nigeria will continue to be unsafe even at zero speed. A regime that finds it convenient to marginalize the people to satisfy the wants of few greedy elite would make the adoption of agroforestry very difficult.

The present Federal Government rode on the change mantra to power. Change can be phototropic, geotropic, 'horizontropic' or 'cyclotropic' in direction. When a change is likely to short change a nation in search of change then it is appropriate to immediately commence the interrogation of such change. This is important so that the country will not end up going through a geotropic or 'cyclotropic' change. If I may ask - what has changed? The Federal

Government now has in place what it calls the Green Alternative containing its policies and strategies for food sufficiency. Let us hope that the alternative will not change dark sufficiency to dim sufficiency in food production.

On the whole my take is that Nigeria needs to have a well-defined national goal that all Nigerians can aspire to achieve without allowing any ethnic, regional or religious colouration to becloud its glory. This is achievable if we are determined. Why must I care where the President of this country comes from if she/he will be willing to be just and fair and be determined to operate above all vices to make life more abundant for the greatest majority of Nigerians? The followers must also be ready to imbibe the culture of change for good. The mind boggling revelations of how the wealth of this country had been shared by a few individuals has not struck the right chord in the minds of Nigerians for them to begin to sing a new and inspiring song of change.

What do we have instead? Ethnic defence of perfidy, cultural rationalization of abomination and elite conspiratorial silence are what I am seeing in the air. Yet we must be individually convinced to be able to collectively fight corruption in Nigeria. Are you ready to be that agent that can bring about an egalitarian society in Nigeria where food and wood will be sufficient for all and the environment will be safe enough for us and the coming generations? It is certain that the present uneven and ungodly distribution of wealth in Nigeria cannot create the environment that will support sustainable food fibre and wood production for all Nigerians.

If I were not today deeply rooted in Christ, I would have been prepared to join any group of persons that can work toward a bloody revolution to bring about the desired change in this country. Anytime I think about this country, how much wealth (human and materials) that God has endowed her with and how perfidious our rulers have mismanaged our affairs, I always thank God for preventing our rulers from making some of us go *ga ga*. I still hold strongly that there is this bloody revolution that we should still all pray for and work assiduously to bring about. This is that revolution of the heart to remove the filthy layer of pericardium of greed surrounding our heart. Until we do this, those who labour will continue to labour in vain.

While maintaining an acceptable level of sanity under a politically terrorizing military and pseudo democratic dispensations, I have continued to carry out research in an unusual aspect of agroforestry. Most research findings reported on *agri-silviculture*/alley cropping/hedgerow intercropping centre on exploring the desirable attributes of a single tree species (mostly

leguminous species) in enhancing arable crop production. The idea of integrating mixed-silviculture into arable production was not common. How *Leucaena leucocephala, Parkia biglolsosa, Prosopis africana, Moringa oleifera, Gmelina arborea etc.*can be individually or in different combinations simultaneously or sequentially made to yield wood and improve the productivity of maize, sorghum and African dwarf goat in the guinea savanna zone of Nigeriahas occupied my attention these past thirty two (32) years.

King (1968) had already identified the existence of an excellent prospect of introducing agroforestry in the southwestern region of Nigeria. Fagbemi (1998a&b) emphasized the attraction of ensuring that agroforestry systems take firm roots in the Nigerian Savanna Zone. Fagbemi and Idoko (1991) were of the view that in Nigeria then, the existing extension packages on farming systems contained little agroforestry message. In the process of developing a farming system, it is necessary to find out how much the farmers know about such a system and also the direction along which the adoption would more fast. This is pertinent as it would afford the Agroforester a timely re-adjustment in emphasis that could lead to the development of a socio-culturally acceptable system. Fagbemi and Idoko (1991) found out that farmers in Malete and Shao-two communities in Kwara State were already familiar with locust bean tree and were prepared to learn more about how gmelina and leucaena would perform on their farm lands. The need for adequate training for the extension agents that were expected to introduce agroforestry systems to the peasantry was stressed by Fagbemi and Idoko (1991).

The ability of leucaena to fix atmospheric nitrogen through root nodulation with rhizobia has made it a popular soil fertility restorative tree species (NAS, 1984). Several volunteer leucaena seedlings were examined (Fagbemi and Nwoboshi, 1991b) for root nodules, but none were found on a two-year old agroforestry plot at Ilorin in the Southern Guinea Savanna zone of Nigeria in 1988. However, a similar examination at the International Institute for Tropical Agriculture (IITA) Ibadan 1982 agroforestry plot revealed an average of four nodules per seedling. This observation made Fagbemi and Nwoboshi (1991b) to explore the nodulating behaviour of *Leucaena leucocephala* (Lam.) de wit var. K28 in soils of the Southern Guinea Savanna Zone of Nigeria. Fagbemi and Nwoboshi (1991b) reported that leucaena began nodulating within the first 30 days in the IITA and Okene soils but nodulation was not initiated until after the first three months in the University of Ilorin and Odogun soils. This difference in behaviour might have been due to the earlier existence of leucaena stands on IITA and Okene

soils, whereas leucaena was new to Ilorin and Odogun soils, with the initial presence of few leucaena rhizobia (Sanginga *et al*., 1988). The findings of Fagbemi and Nwoboshi (1991b) are further attestation to site specificity of agroforestry systems.

The paucity of information on the silvicultural characteristics of locust bean tree made Fagbemi (1989b) to draw attention to aspects that could improve its agroforestry potential in the Savanna Zone of Nigeria. Lepidoptera from five families were reported to attack leaves of this tree (Roberts, 1969). However, no member of the family Pieridae was mentioned. Raising seedlings of Parkia and Leucaena in the Southern Guinea Savanna Zone of Nigeria (Fagbemi, 1989b) observed whitish speck-like eggs laid on pinules of both legumes. Whereas eggs on Parkia developed to larvae those on Leucaena failed to develop. When the larvae collected from seedlings of Parkia were cultured, they turned out to be sulphur-butterfly identified as *Eurema hecabe* Linn. (family: Pieridae). Mr. Vice-Chancellor Sir, that was the first time that this insect would be reported as a pest of Parkia in Nigeria.

Throughout my primary and secondary education acquisition at Ekinrin-Adde and Titcombe College Egbe, I never came first in my class. I recall placing second on a number of occasions. At a time, I reasoned that my inability to come top in my class could be connected to the circumstance of my birth. When I was coming to the world, I did not come alone. Indeed, I came in a pair. I have come to accept that there is something unique in the figure 2. In fact, in my denomination, wherever congregants struggle to be the first to be blessed by the Angels of God, I will simply settle for the second position for Angels of blessings to easily locate me and this has really been spiritually rewarding. Knowing full well that two is greater than one, I have decided to import this belief in my research of integrating trees into the agro-ecosystem of the Nigerian Guinea Savanna Zone.

Agroforestry research on alley cropping has mainly emphasized the use of a singletree species on the hedgerow (Kang *et al*., 1984, 1985, Kang and Wilson, 1987). However, mixed silviculture reduces risk levels (Aiyer, 1949). Combining two or more tree species on the hedgerows also enhances the productivity of alley cropping (Maclean *et al.*, 1992). A combination of either Leucaena or Parkia and Gmelina on the hedgerow could increase or decrease the productivity of alley cropping but this system was yet to be evaluated in the Southern Guinea Savanna Zone of Nigeria.

To evaluate the growth and development of Parkia and Leucaena in mixed silviculture with Gmelina in the Nigerian Southern Guinea Savanna Zone (Fagbemi, 1994a) embarked on these investigations spanning three years. Fagbemi (1994a) reported that the presence of Gmelina enhanced the survival of both Parkia and Leucaena at the seedling and sapling stages (Table 2a). However, the canopy of Gmelina adversely affected height, diameter at breast height (DBH), crown diameter, volume and dry matter production of Parkia, but not that of Leucaena which was a better competitor with Gmelina than Parkia (Table 2b). Hence Fagbemi (1994a) submitted that the integration of Leucaena and Gmelina mixed silviculture into the Nigerian Southern Guinea Zone agro-ecosystems looks more promising than Parkia with Gmelina (Fagbemi, 1994b, 1997).

Leucaena is an exotic tree species in Nigeria whose ability to fix atmospheric nitrogen (N) through root nodulation with the appropriate Rhizobium strain has been attested to (NRC, 1984, Sanginga *et al.*, 1989a&b). Apart from Leucaena's capacity for rapid N fixation, the nutrient contribution from its prunings would be more beneficial to a companion arable crop in alley or hedgerow intercropping (Kang *et al*., 1984, 1985). However, when any arable crop is intercropped with a tree species, optimal planting densities are adjusted. For instance, Ngambeki (1985) reported Leucaena occupying about 20 percent of the surface area when alley cropped with maize. Leucaena population density in agri-silvicultural farming system could be further reduced if there is an interest in its bole formation. Such a reduction in leucaena density could lead to a low yield of prunings. To make up for this loss in prunings, a woody tree species like Gmelina could occur in mixed-silviculture with Leucaena on the same hedgerow.

To find out how these combinations involving Leucaena will perform in the Nigerian Guinea Savanna Zone led Fagbemi (1995,1996a) to probe the growth and development of Leucaena in mixed-silviculture with Gmelina having maize or sorghum alley cropped in the inter and intra-spaces simultaneously or sequentially along the Leucaena-Gmelina hedgerows on a plinthustalf soil of Ilorin. The presence of Gmelina did not significantly affect the number of Leucaena seedlings or saplings that survived at the end of the first, second and third years (Table 3).

Arable crops (maize and sorghum) did not differ in their effects on the percentage survival of Leucaena. Planting sequence significantly affected the number of seedlings that survived the first year, thereafter; its effect was not significant. Sole cropping resulted in 93.3 percent survival of Leucaena at the end of the first year. During the second and third years, the

percentage survival rate of Leucaena that was simultaneously cropped with maize was significantly lower than when grown as a sole crop. The adverse effect of simultaneous cropping of sorghum or maize on Leucaena during the first year was probably due to the shading effect of the arable crops on the vulnerable seedlings coupled with low soil nutrient status (Table7). By the end of the second year, the effect of planting sequence had weaned since the seedlings had been able to get better established.

Observation of the height growth of Leucaena on a bi-annual basis indicated that Gmelina and arable crops did not produce a significant effect but planting sequence did with sequential planting being superior to simultaneous. However, this was only during the first 18 months. At 30 months of growth, Leucaena had recovered from the earlier negative effect due to simultaneous cropping with either maize or sorghum or Gmelina in combination with either maize or sorghum. The greatest detrimental effect on Leucaena height growth was from simultaneous cropping involving sorghum. The highest growth of 7.8m over three years seem poor compared with 5.0m recorded for Leucaena in one year in Kevela, South India, 5.5m in 9 months in Reduit, Mauritius, and 8.0m in 18 months in east Java, Indonesia (NRC, 1984).

Comparing 2.56m mean annual height growth of Leucaena obtained by Fagbemi (1996a) on plinthustalf soil of Ilorin with the 2.74m obtained for Gmelina (Fagbemi, 1994a) on the same soil type; one could conclude that Leucaena is less adapted to the Nigerian Southern Guinea Savanna zone than Gmelina. But since the interaction effect of Gmelina by arable by time did not go beyond the first 18 months, it would appear that the legume could be established under any of the cropping systems in the Southern Guinea Savanna Zone of Nigeria.

Gmelina and cereal crops did not significantly affect Leucaena volume increment but planting sequence did. Whereas, Leucaena that was simultaneously cropped recorded 2.6, 4.2 and 5.6 m^3ha^{-1} of bole volume, sequential cropping resulted in 11.4, 15.2 and 21.0 m^3ha^{-1} during 24, 30 and 36 months of growth (Table 4).

Table 2a. Effect of Gmelina on survival of Leucaena and Parkia at Ilorin, Nigeria.

Legume	Factor	Percentage Survival.		
		Year 1	Year 2	Year 3
Leucaena	Gmelina			
Present		82.75	75.92	75.92
Absent		71.58	59.75	59.75
	LSD (0.05)	n.s	n.s	n.s
Parkia	Gmelina			
Present		97.33	95.25	95.25
Absent		93.75	88.83	88.83
	LSD (0.05)	n.s	n.s	n.s

n.s = not significant.

b. Effect of Gmelina on height, diameter at breast height (DBH) and crown diameter of Leucaena and Parkia at Ilorin, Nigeria.

Legume	Factor	Present / Absent	Stage of growth (months).							
			6	12	18	24	30	36	36	6	36
				Mean height (cm)					DBH (cm)	Crown dia	
Leucaena	Gmelina	+	139	246	421	531	636	696	5.42	77	289
		-	127	242	422	524	610	690	5.91	87	302
Parkia	Gmelina	+	58	93b	111b	150b	164b	193b	1.40b	51	131b
		-	65	114a	145a	216a	243a	271a	2.40a	58	192a
LSD (0.05)			n.s	16	14	24	21	22	0.38	n.s	12

Column means with different letters differ significantly at 5% level of probability.

n.s = not significant; +: Presence of Gmelina; - : Absence of Gmelina.

Source: Fagbemi (1994a).

Table 3: Effect of different crop combinations and planting sequence on percentage survival of Leucaena in Ilorin, Nigeria.

Factor	Percentage Survival		
	Year 1	**Year 2**	**Year 3**
Gmelina:			
Present	82.8	75.9	75.9
Absent	71.6	69.8	69.8
LSD (0.05)	n.s	n.s	n.s
Arable Crop:			
Maize	76.5	66.1	66.1
Sorghum	77.9	69.6	69.6
LSD (0.05)	n.s	n.s	n.s
Planting Sequence:			
Simultaneous	67.4	57.0	57.0
Sequential	96.9	78.7	78.7
LSD (0.05)	14.5	n.s	n.s
Sole Leucaena	93.3a	90.0a	90.0a
Leucaena + maize simultaneously	61.3c	36.0b	36.0b
Leucaena + sorghum simultaneously	55.3c	52.7ab	52.7ab
Leucaena + maize sequentially	80.0ab	72.3ab	72.3ab
Leucaena + sorghum sequentially	89.0ab	78.0ab	78.0ab
Leucaena + Gmelina	80.0ab	68.3ab	68.3ab
Leucaena + Gmelina+ maize simultaneously	75.0abc	67.7ab	67.7ab
Leucaena +Gmelina + sorghum simultaneously	78.0abc	69.7ab	69.7ab
Leucaena + Gmelina + maize sequentially	89.0ab	86.3a	86.3a
Leucaena + Gmelina + sorghum sequentially	89.0ab	78.0a	78.0a
LSD (0.05)	31.4	40.3	40.3

Means within columns followed by the same letter do not differ significantly at the 5% level of probability.
n.s = not significant.
Source: Fagbemi (1996a)

Table 4: Effect of different crop combinations and planting sequence on bole volume increment (m^3ha^{-1}) of Leucaena at Ilorin, Nigeria.

Factor	Volume (m^3ha^{-1})		
	24 Mths	**30 Mths**	**36 Mths**
Gmelina :			
Present	6.9	9.3	13.2
Absent	7.1	10.1	13.2
LSD (0.05)	n.s	n.s	n.s
Arable Crop:			
Maize	7.9	10.8	14.8
Sorghum	6.1	8.6	11.9
LSD (0.05)	n.s	n.s	n.s
Planting Sequence:			
Simultaneous	2.6b	4.2b	5.7b
Sequential	11.4b	15.2a	21.0a
LSD (0.05)	4.4	5.6	7.5
Sole Leucaena	11.0a	18.1a	22.6a
Leucaena + maize simultaneously	1.6b	2.4b	3.7c
Leucaena + sorghum simultaneously	1.7b	2.7b	4.4ab
Leucaena + maize sequentially	13.2a	17.4a	24.3a
Leucaena + sorghum sequentially	11.0a	14.7ab	20.3ab
Leucaena + Gmelina	5.1ab	8.1ab	11.0abc
Leucaena + Gmelina + maize simultaneously	5.6ab	8.9ab	11.3abc
Leucaena + Gmelina + sorghum simultaneously	1.6b	2.8b	3.6c
Leucaena + Gmelina + maize sequentially	11.1a	14.6ab	20.1abc
Leucaena + Gmelina + sorghum sequentially	10.1ab	14.1ab	19.1abc
LSD (0.05)	9.0	12.5	16.6

Means within columns followed by the same letter do not differ significantly at5% level of probability.
n.s = not significant.
Source: Fagbemi (1996a).

The effect of Gmelina, cereal crops and planting sequence on above ground biomass partitioning on Leucaena was similar to that on bole volume. A total of 5.5 and 6.4t ha^{-1} were obtained from the prunings (leaf + branch) of 2 - year old Leucaena cropped with sorghum and maize respectively at Ilorin, Nigeria (Table 5). Yield of Leucaena prunings in the order of 7t ha^{-1}has been reported (Kang *et al.*, 1985). The low biomass production from Leucaena simultaneously cropped with either cereal led to a reduction in the quantity of prunings used to mulch the soil. However, the inclusion of Gmelina as a component of the Leucaena hedgerow

could raise the total quantity of prunings produced (Maclean *et al.,* 1992). Here lies the beauty of the combination that takes advantage of combining differing attributes of the species in a complementary manner. The results obtained from the investigations by Fagbemi (1996a) have shown that Leucaena could be integrated into the agro ecosystems of the Southern Guinea Savanna Zone of Nigeria.

Gmelina (*Gmelina arborea* Roxb) is an important exotic tree species in Nigeria re-afforestation programme. It is more often raised as a sole crop in plantation. At best, it may be tended under the *taungya* system which involves the inclusion of an arable crop at the early stage of tree crop plantation establishment. However, as soon as the tree crop closes canopy the intercropping of the arable crop ceases. Research efforts at developing appropriate agro-forestry systems (Kang *et al.,* 1984, 1985) are tilted towards nitrogen–fixing trees as hedgerow inter crops. These leguminous tree crops are rarely ever included in alley cropping or hedgerow intercropping with the aim of raising them to timber size. To find out how Gmelina would behave when subjected to co-habiting with other desirable crops over a longer period than hitherto investigated made Fagbemi (1994a) to carry out further research on it. Fagbemi (1994a) conducted studies on the growth and development of Gmelina that was mixed–intercropped with Leucaena, Parkia, sorghum and maize on plinthustalf soil in the Nigerian Southern Guinea Savanna Zone over four cropping seasons.

The result of analysis of variance on the effects of legume, arable and planting sequence on Gmelina percentage survival is shown in Table 6. Legume and the two cereal crops (maize and sorghum) had no significant effect on the number of trees surviving throughout. However, sequential planting (98.78, 98.17, and 98.17%) involving the cereals was significantly higher ($P < 0.05$) than simultaneous method (88.67, 83.11 and 83.11%) at the end of the first, second and third years respectively.

The effect of the different crop combinations on height growth of Gmelina has been reported by Fagbemi (1994a). From the first 6 months to the age of 36 months, Gmelina grew tallest when combined with Leucaena. Gmelina's height growth when in mixed silviculture with Leucaena was significantly higher than when combined with Parkia. The ranking follows: Gmelina + Leucaena (739.58cm) › Sole Gmelina (695.00cm) › Gmelina + Parkia (641.17cm) in three years of growth. The enhanced growth in height of Gmelina when it was in mixed silviculture with Leucaena was attributed to healthy competition for space that existed between

Table 5: Effect of Gmelina, arable, planting sequence and crop combinations on biomass partitioning (t ha^{-1}) of Leucaena at Ilorin, Nigeria.

Factor	24 Months		26 Months		
	Leaf	**Branch**	**Leaf**	**Branch**	Bole
Gmelina:					
Present	1.7	4.7	1.7	4.5	7.6
Absent	1.4	4.2	1.7	3.9	7.1
LSD (0.05)	n.s	n.s	n.s	n.s	n.s
Arable Crop:					
Maize	1.7	4.7	1.7	4.5	8.1
Sorghum	1.4	4.1	1.5	3.8	6.6
LSD (0.05)	n.s	n.s	n.s	n.s	n.s
Planting Sequence:					
Simultaneous	1.2b	2.9b	1.1b	2.6b	3.6b
Sequential	1.9a	6.0a	2.1a	5.8a	11.1a
LSD (0.05)	0.4	1.2	0.4	1.3	3.3
Sole Leucaena	2.0a	5.9a	2.1a	5.8a	12.3a
Leucaena + maize simultaneously	0.8c	2.5c	0.8b	1.8b	2.3b
Leucaena + sorghum simultaneously	0.9bc	2.0c	0.9b	2.1b	2.5b
Leucaena + maize sequentially	1.9ab	6.0a	2.1a	5.7a	12.5a
Leucaena + sorghum sequentially	1.9a	6.1a	2.1a	5.9a	11.0a
Leucaena + Gmelina + maize simultaneously	1.9ab	4.1abc	1.8a	4.5ab	6.7ab
Leucaena + Gmelina + sorghum simultaneously	1.0bc	2.9bc	1.1ab	2.0b	2.9b
Leucaena + Gmelina + maize sequentially	2.0a	6.2a	2.0a	6.1a	10.9a
Leucaena + Gmelina + sorghum sequentially	1.9ab	5.5ab	2.0a	5.8a	10.0a
LSD (0.05)	1.0	3.0	1.0	3.4	8.1

Means within columns by the same letter do not differ significantly at the 5% level of probability.
n.s = not significant.
Source: Fagbemi (1996a).

the two species since both are known to be fast growing (NRC, 1984, Dommergues, 1987). This development is desirable when viewed against the background that Gmelina's diameter at breast height (DBH) was not significantly compromised as a result of the competition. Leucaena being a nitrogen fixer could have contributed positively towards the growth of Gmelina (Van Noordwijk and Dommergues, 1990), whereas Parkia might not since it does not fix atmospheric nitrogen (Dommergues, 1984; Fagbemi, 1989b, IFS, 1989).

Table 6: Effect of different crop combinations and planting sequence on percentage survival of Gmelina at Ilorin, Nigeria.

Factor	Percentage Survival		
	Year 1	**Year 2**	**Year 3**
Legume:			
None	95.83	93.08	93.08
Parkia	91.75	86.17	86.17
LSD (0.05)	n.s	n.s	n.s
Arable:			
Maize	95.72	94.50	94.50
Sorghum	91.72	86.78	86.78
LSD (0.05)	n.s	n.s	n.s
Planting Order:			
Simultaneous	88.67b	83.11b	83.11b
Sequential	98.78a	98.17a	98.17a
LSD (0.05)	4.17	8.35	8.35
Sole Gmelina	93.33a	88.33ab	88.33ab
Gmelina + maize simultaneously	100.00a	100.00a	100.00a
Gmelina + sorghum simultaneously	83.33b	72.33b	72.33b
Gmelina + maize sequentially	100.00a	110.00a	100.00a
Gmelina + sorghum sequentially	100.00a	100.00a	100.00a
LSD (0.05)	9.30	16.65	16.65
Gmelina + Leucaena	85.00b	85.00ab	85.00ab
Gmelina + Leucaena + maize simultaneously	85.33b	78.00b	78.00b
Gmelina + Leucaena + sorghum simultaneously	85.33b	74.00b	74.00b
Gmelina + Leucaena + maize sequentially	100.00a	96.33a	96.33a
Gmelina + Leucaena + sorghum sequentially	96.33ab	92.67ab	92.67ab
LSD (0.05)	14.00	18.80	18.80
Gmelina + Parkia	88.67	88.67	88.67
Gmelina + Parkia + maize simultaneously	89.00	89.00	89.00
Gmelina + Parkia + Sorghum simultaneously	89.00	85.33	85.33
Gmelina + Parkia + maize sequentially	100.00	100.00	100.00
Gmelina + Parkia + sorghum sequentially	96.33	96.33	96.33
LSD (0.05)	n.s	n.s	n.s

Column means with the same letter do not differ significantly at 5% level of probability.
Source: Fagbemi (1994a).

The cereal crops did not differ significantly in their effects on Gmelina's height, diameter at breast height (DBH) and crown spread development. Maize grew with Gmelina for 90 days while sorghum took up to 180 days to complete its development. Research data indicate that the N rate required for optimum sorghum yield is 25 to 30% less than the optimum rate for maize (Touchton, 1982). This behaviour by the two cereal crops could probably nullify the difference in the effect that the longer maturation period encountered with sorghum could have had on Gmelina's performance.

Simultaneous planting involving either maize or sorghum significantly depressed Gmelina's height, DBH and crown diameter than sequential. This is contrary to the observation of Agbede and Ojo (1980) that intercropping of Gmelina with maize in the humid rain forest zone of Nigeria was beneficial to Gmelina's height growth. The crop population density and arrangement could have brought about this difference. In the study carried out at Ilorin, apart from growing the cereal crops on the alleys, spaces along the tree crop hedgerow were also planted. This might have created nutrient stress especially in the Southern Guinea Savanna Zone where the soil is inherently deficient in certain nutrient elements. This could also have accounted for the higher number of Gmelina stands that survived with sequential than with simultaneous planting method. The findings reported by Fagbemi (1994a, 1996a) on the three tree species he studied support their establishment in the Southern Guinea Savanna Zone of Nigeria under the appropriate silvicultural techniques. What should be the next concern to us will be to find out how the two most common cereal in the middle belt of Nigeria would perform as companion crops to these tree species.

In comparison with maize, sorghum is a poor yielder grain however; it is very effective in utilizing residual nitrogen (Touchton, 1982). The application of some fertilizers is desirable for obtaining a high sorghum yield on a sustainable basis. Felker (1978) gave an account of the leaf litter of *Faidherbia albida* as providing nitrogen for the growth of sorghum, millet and groundnut in drier regions and providing shade for livestock during the hot weather. There are reports that different varieties of sorghum perform well when they occur around some tree species that peasants are known to retain in the Guinea Savanna Zone of Nigeria. Fagbemi (1995) reported the failure of any serious attempts on the part of the peasants to cultivate these tree species as being due to lack of adequate knowledge of the tree species.

In consonance with efforts being made in the nineties towards the development of suitable agro forestry farming techniques relevant to the different agro-ecosystems in the tropics (Fagbemi, 1995) subjected sorghum to grow and develop with different tree crops. He examined effects of Parkia, Leucaena and Gmelina on sorghum dry matter production and grain yield in mixed – intercropping on plinthustalf soil in the Southern Guinea Savanna Zone of Nigeria over four cropping seasons without fertilizers inputs. The results of the physico-chemical properties determination of the soil of the experimental plot just before the first year of planting is presented in Table 7. The percentage sand decreased while silt increased down the soil depth. The soil has been described as plinthustalf in the order of Alfisol in accord with the USDA taxonomy (Ogunwale, personal communications).

Table 7: Physico-chemical properties of plinthustalf soil of Ilorin.

Depth (cm)	%				%		Meg/100g of Soil						PPM		
	Sand	**Clay**	**Silt**	**pH**	**OM**	**N**	**K**	**Ca**	**Mg**	**Na**	**Ea**	**ECEC**	**P**	**Mn**	**Zn**
0-15	73.01a	10.64	16.15b	5.96a	1.76a	0.99a	0.25a	4.64a	1.30a	0.038	0.04	6.27a	3.30a	25.55	2.14a
15-30	68.63b	10.61	19.26a	5.73b	1.26b	0.65b	0.20b	3.27b	0.89b	0.049	0.04	4.45b	1.42b	25.53	1.67b
LSD (0.05)	2.094	n.s	2.024	0.061	0.255	0.0097	0.41	0.553	0.058	n.s	n.s	1.21	0.23	n.s	0.44

The figures above represent mean values.
Column means with the same letter do not differ significantly at 5% level of probability.
Source: Fagbemi (1995).

Observations made on the growth of sorghum at Ilorin during the period of study showed that the height performance was best in year 1. Sorghum probably took advantage of the initial nutrient status of the soil. Within that period also shading was minimal. Below and above ground competition between sorghum and Gmelina especially could probably have affected sorghum height growth beyond the first cropping season.

The upsurge in dry matter production from the second month to the third could be related to the addition of stem component which was lacking during the first month. The fact that there was no significant difference in sorghum total biomass production between 150 and 180 days after sowing (DAS) could mean that essentially the bulk of both vegetative and reproductive growth took place within 150 DAS. The presence of Gmelina significantly depressed dry matter production of sorghum in year II. This was attributed to shading effect as some Gmelina stands in some plots almost closed canopy within the first 18 months of growth.

Study on root competition between sorghum and Gmelina was carried out on the same plot. Trenching along an unthinned Gmelina stand and a stump in October of year IV when sorghum

was 120 DAS, revealed that root of sorghum plant growing closer to the unthinned stand could not penetrate beyond 7cm soil depth. Roots of sorghum at the middle of the plot where samples were collected for biomass assessment were observed at 15cm depth.

This tells us that the closer the sorghum plant is to the Gmelina stand the less would be its ability to develop roots which will affect its overall performance significantly. Verinumbe and Okali (1985) had earlier observed appreciable reduction ($P< 0.01$) in the biomass production of maize in South Western Nigeria due to the combined effects of shade and living roots of teak.

On the whole, an average of 10,230 kg/ha of sorghum total biomass was obtained in no legume, 9,040 kg/ha from Leucaena and 10,110 kg/ha from Parkia blocks in the first year of cropping (Table 8). These values are low when viewed against the result of Kassam and Stockinger (1973) of 17,630 kg/ha. In year II, it was reduced to 6,120 kg/ha in no legume, 5,130 kg/ha and 7.380 kg/ha in Leucaena and Parkia blocks respectively. The total biomass production in year III was 1,850 kg/ha for no legume, 2,330 kg/ha in Leucaena and 2,340 kg/ha in Parkia blocks. Sequential intercropping seemed to have been better with sorghum than simultaneous intercropping at the fourth cropping season.

Effects of legume, time of sampling and Gmelina on sorghum total biomass production at Ilorin over four-year duration are presented in Table 8 below.

Table 8: Effects of Legume, time of sampling Gmelina and planting sequences on sorghum total biomass production at Ilorin.

Treatment		Dry matter (t/ha)			
		Year I	**Year II**	**Year III**	**Year IV**
Legume					
	None	10.23a	6.21b	1.85b	1.79b
	Leucaena	9.04b	5.13b	2.33a	2.51a
	Parkia	10.11a	7.38a	2.34a	1.08c
	LSD (0.05)	0.651	0.842	0.183	0.169
Time of sampling					
	30 days	0.18c	0.10c	0.05e	0.05e
	60 days	1.37d	0.91c	0.40d	0.38d
	90 days	10.06c	4.89b	1.28c	1.30c
	120 days	12.23b	10.25a	3.33b	2.77b
	150 days	17.43a	10.67a	4.03a	3.17a
	180 days	17.49a	10.65a	3.94a	3.10a
	LSD (0.05)	0.930	1.190	0.259	0.239
Gmelina:					
	Present	9.03b	5.93b	1.85b	2.44a
	Absent	10.56a	7.99a	3.06a	1.78b
	LSD (0.05)	0.531	0.687	0.149	0.161
Planting Sequence:					
	Simultaneous			2.52	2.04b
	Sequential			2.38	2.32a
	LSD (0.05)			n.s	0.161

Column means with the same letter do not differ significantly at 5% level of probability.
Source: Fagbemi (1995).

The result of sorghum grain yield as demonstrated by Fagbemi (1997) indicates that there was a decrease in sorghum grain yield from year 1 to year IV in both no legume and Parkia blocks. Within Leucaena block, sorghum grain decreased from year I - III and then increased in year IV. The best yield of 1,780kg/ha obtained by Fagbemi (1997) in year I was much lower than 2,845kg/ha reported by Kassam and Stocinger (1973). While it has been reported by Fagbemi (1997) that maize (Fig.1) did not produce grain in sole plot after four seasons of repeated

cropping at Ilorin, sorghum did (Fig.2) confirming that sorghum may be a better cereal in terms of its ability to use residual soil nutrient (Touchton, 1982). Kowal and Andrews (1973) and Fawusi and Agboola (1980) have reported that the fact that sorghum performed well at low soil moisture regime partly explains its ability to survive and thrive in dry ecological zones.

Comparing the first year's highest sorghum grain yield (1600 kg/ha) obtained by Fagbemi (1995) at Ilorin with 2,845 kg/ha reported by Kassam and Stockinger (1973) one may be tempted to conclude that the yield at Ilorin was low. However, the study by Kassam and Stockinger (1973) involved the use of compound (21:14:14) fertilizer at the rate of 132 kg/ha of nitrogen of which one-third was applied at emergence. In the investigation by Fagbemi (1995) the main sources of nutrients were the minerals inherent in the soil and nutrients released from the decomposition of the prunings from the integrated trees.

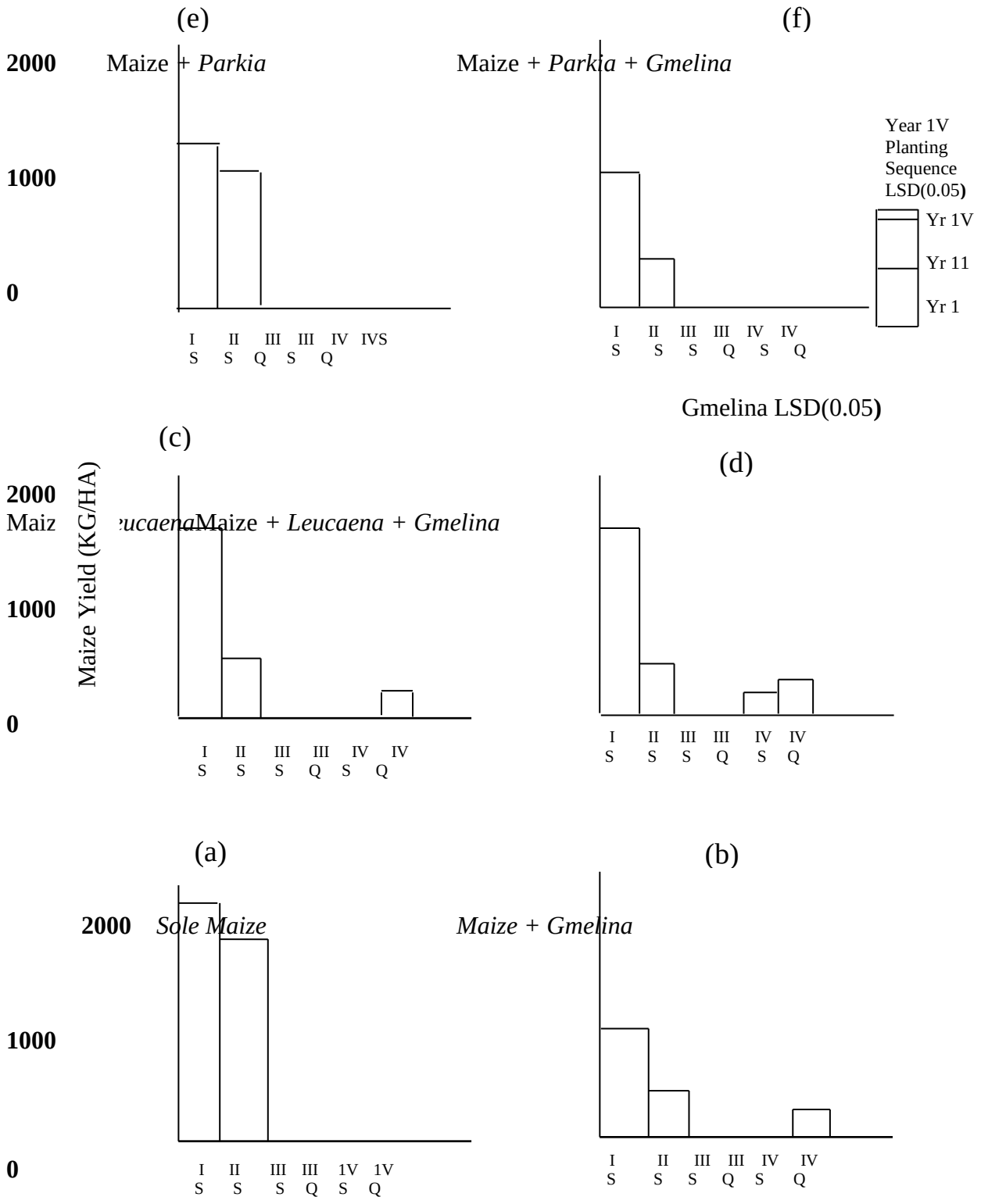

Fig.1 Grain yield of maize from Year 1 to Year 1V in different crop combinations at Ilorin, Nigeria. S= Simultaneous planting order of maize: Q= Sequential planting order of maize.
(Source: Fagbemi, 1997).

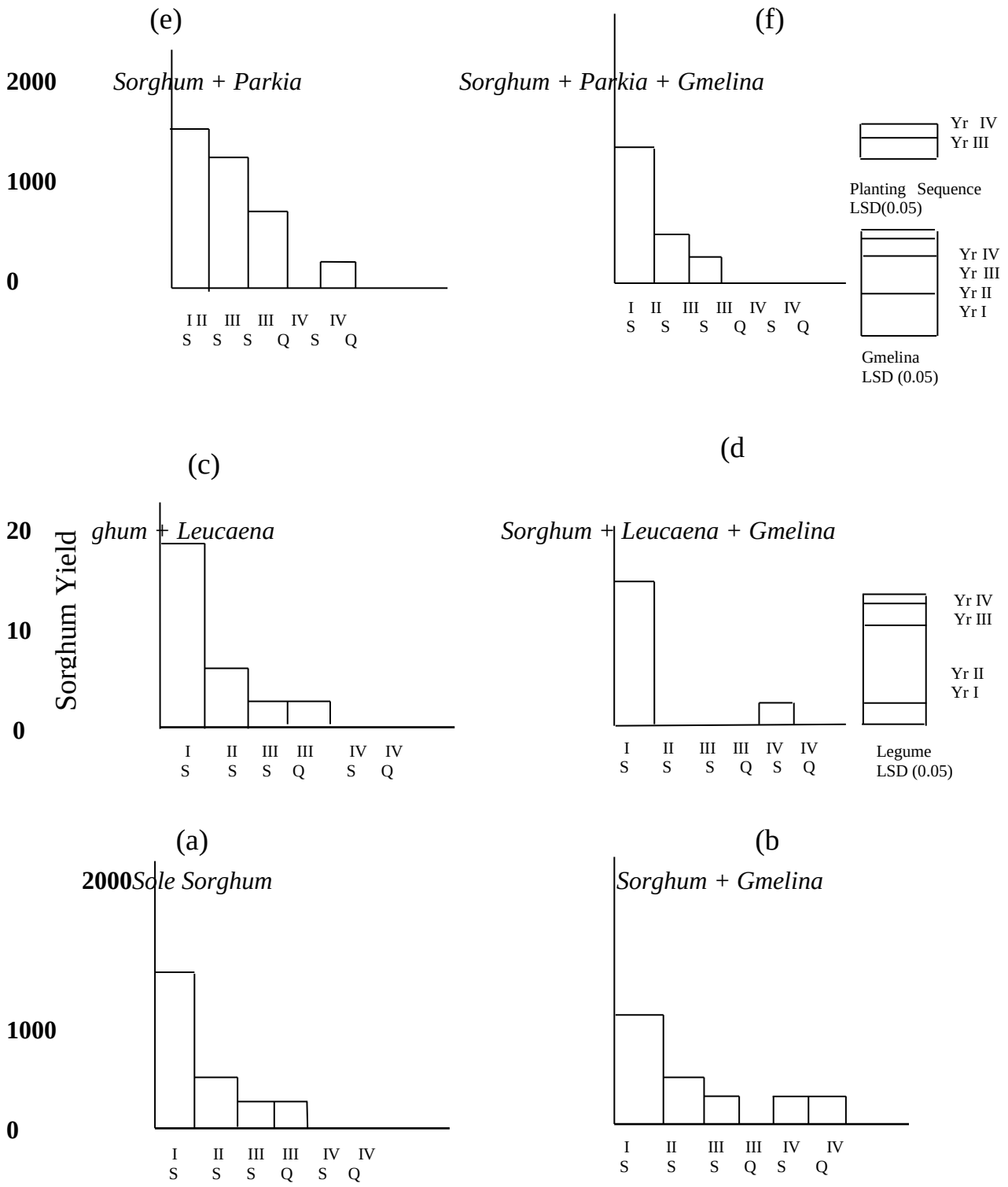

Fig. 2 Yields of Sorghum from Year I to Year IV under different treatments at Ilorin, Nigeria. S= Simultaneous Planting Order of Sorghum: Q= Sequential planting order of Sorghum. (Source: Fagbemi, 1997).

The results obtained by Fagbemi (1995) demonstrated the desirability of integrating tree species into sorghum ecosystem in the Southern Guinea Savanna Zone of Nigeria. Fagbemi (1994a) had observed that the prunings from Gmelina could be of high mulching quality. Spencer and Mulongoy (1989) have reported a number of leguminous tree species as providing prunings high in nutrients especially nitrogen that can support cereal growth. The conclusion arrived at by Fagbemi (1995) from his research involving sorghum as a companion crop to Parkia, Leucaena and Gmelina in the Nigerian Southern Guinea Savanna Zone point to the fact that with appropriate thinning and pruning regimes of the tree species, sorghum's performance could be enhanced. However, some form of inorganic fertilizer- use could not be ruled out. Fagbemi (1995) recommended Leucaena and Parkia as hedgerow crops with sorghum while Gmelina could serve as boundary crop with special silvicultural treatment.

To find out if soil that supported various crop combinations in the Southern Guinea Savanna Zone of Nigeria will require additional inorganic fertilizer to enhance the performance of cereal crops led Fagbemi (1996b) to carry out a pot culture study. Much of the past increase in maize yields had been mainly due to plant breeders' success in eliminating crop defects, for instance, susceptibility to many diseases, insects, pathogens and lodging (Schrader, 1980), and improved cultural practices. More often than not, these improved varieties do need high inorganic fertilizer inputs to be able to manifest their high yield potentialities.

Kassam *et al.* (1975) were of the opinion that high yields of maize were possible only with good levels of fertilizer. Agboola (1972) reported that some maize varieties had highest yield when 90 kg N ha^{-1} was applied with a basal dressing of 20 kgPha^{-1} and 56 Kg K ha^{-1} and with 30 kg K ha^{-1}, about 40 kg P ha^{-1} was considered optimum for maize on Alagba and Itagunmodi soils, 20 kg P ha^{-1} was more than adequate on Apomu soil, Nigeria (Osiname, 1979). Kayode and Agboola (1981) obtained 6057, 6425, 6132 and 6183 kg ha^{-1} for maize at Ibadan (Forest Transition Zone) and 2197, 3607, 3771 and 3710 kg ha^{-1} at Mokwa (Guinea Savanna Zone of Nigeria) at the rate of 0,50, 75 and 100 kg N ha^{-1}. Obigbesan and Agboola (1974) showed that nitrogen was the most important nutrient limiting the yield of maize in Nigeria. The inclusion of nitrogen-fixing tress and/or the decomposition of the prunings from other woody species would be expected to supply the arable components with some nutrients in an agroforestry system. This way it may lead to the production of moderately good crops at minimum cost

rather than increasing costs and going for the highest possible yield (Vose, 1981) which may be difficult to sustain.

After three years of intercropping Leucaena, Parkia, Gmelina, Leucaena + Gmelina and Parkia + Gmelina at Ilorin in Nigeria with maize without the addition of any inorganic fertilizers, maize crop performance was found to decline. This made Fagbemi (1996b) to investigate the effect of the addition of urea and single superphosphate to soils of varying history using maize as a test crop at Ilorin, Nigeria. Table 9 below shows the soil analytical results for the maize fertilizer experiment.

Table 9: Soil analytical results for potted Maize fertilizer experiment.

Cultivation History	Avail. P	Meq 100g of Soil					
	P^H	**%OM**	**%N**	**PP^M**	**Ca**	**K**	**Mg**
1	5.80	1.31	0.05	1.92	4.49	0.14	0.51
2	5.80	1.32	0.0049	1.92	3.28	0.12	0.58
3	5.90	1.73	0.091	2.69	3.93	0.26	0.92
4	5.70	1.14	0.060	1.81	3.42	0.15	0.50
5	5.83	1.41.	0.061	2.24	4.14	0.17	0.50
6	5.73	1.34	0.074	2.04	3.41	0.20	0.58
7	5.83	1.37.	0.070	1.91	3.12	0.21	0.54
8	5.73	1.01	0.063	1.63	2.36	0.12	0.52
9	5.73	1.27	0.064	2.32	2.86	0.14	0.70
LSD(0.05)	0.11	0.09	0.007	0.17	0.58	0.05	0.12

The nine treatments were as follows:

1. Soil from control plot where no crop was grown throughout on the field
2. Sol from plot that supported sole maize crop for 4 seasons
3. Soil from sole Luecaena plot
4. Soil from sole Parkia plot
5. Soil from sole Gmelina plot
6. Soil from plot that supported Leucaena + Maize simultaneously for 4 cropping seasons
7. Soil from plot that had supported Leucaena + Gmelina + Maize simultaneously for 4 cropping seasons
8. Soil from plot that had carried Parkia + Maize simultaneously for 4 cropping seasons
9. Soil from plot that had carried Parkia + Gmelina + Maize simultaneously for 4 cropping seasons.

   Source: Fagbemi (1996b).

Soil from sole Leucaena plot recorded the highest organic content, percentage nitrogen and available P of 1.73%, 0.91% and 2.69 ppm respectively. The highest K and Mg values of 0.26 and 0.92 meq $100g^{-1}$ of soil respectively were obtained from Leucaena soil, whereas, the highest calcium of a mean value of 4.49 meq 100^{-1} of soil was obtained from the control plot. The chemical variation in the soils of different cultivation history reported was probably due to

the effects that the different crop combinations had had on them. The high %OM and %N in soil from the plot that had supported Leucaena for four cropping seasons might be due to the rapid nutrient release from the litter fall, prunings and its nitrogen-fixing ability (Kang *et al*, 1985, Fagbemi and Nwoboshi, 1991b)

Despite the fact that soil from the plot had carried Leucaena that was fertilized supported the highest maize height (Table 10) and leaf area (Table 11) soil from Parkia + Gmelina + Maize plot had the highest total dry matter production and grain yield (Table 12). Fertilized soil from either sole Gmelina or sole Parkia plot had less compared with sole Leucaena. There was an indication that the addition of the mixture of 90 Kg Nha^{-1} to the mixed silviculture of Parkia + Gmelina soil would lead to a more balanced nutrient status for the growth and development of maize at Ilorin (Osiname, 1979, Fagbemi, 1996b). Perhaps the nitrogen content of soil from Leucaena plot was adequate to balance the K, whereas the soil from the Parkia + Gmelina + Maize plot required additional external input (Kayode and Agboola, 1983, Fagbemi, 1996b).

Table 10: Effect of cultivation and fertilizers on potted maize bi-monthly mean height growth (cm).

Cultivation Days						
History[1]	**14**	**28**	**42**	**56**	**70**	**84**
1	23.3	51.1	86.8	108.3	134.1	169.8
2	23.4	51.1	85.1	108.3	132.3	162.9
3	32.3	72.8	113.2	131.9	158.0	188.1
4	24.4	53.2	85.7	108.4	132.4	157.7
5	22.8	59.9	102.8	119.9	137.7	153.5
6	28.0	62.0	101.6	131.6	151.6	179.5
7	26.5	65.2	107.4	130.5	154.7	172.1
8	21.2	53.2	89.2	111.0	130.1	169.6
9	23.0	54.8	96.1	117.4	138.5	166.4
LSD(0.05)	3.11	9.73	10.65	9.97	11.66	14.22
Fertilizers:						
Present	25.3	62.3	111.1	143.6	181.5	208.1
Absent	24.9	53.7	79.7	93.6	100.6	129.6
LSD 0.05)	n.s	2.06	3.06	3.53	5.18	8.05

[1] see Table 9.
n.s = not significant
Source: 1996b.

Parkia at seedling/sapling stage as a single hedgerow tree species may not be recommended for alley cropping involving maize based on the outcome of the study by Fagbemi (1996b, 1997), but it could consume less water. Therefore, its mixed silvicultural integration with

Gmelina may provide a combination that enhances maize growth and development owing to the provision of prunings from Gmelina, which could be used to mulch the soil for water conservation and whose decomposition might lead to better soil nutrient status (Fagbemi, 1994b).

Table 11: Effect of Cultivation and fertilizers on potted maize bi-monthly mean green leaf area in cm^2

Cultivation	Days					
History[1]	**14**	**28**	**42**	**56**	**70**	**84**
1	105	463	982	2373	3977	3298
2	92	503	1286	2190	3636	3249
3	148	1134	2375	3499	5917	3767
4	109	531	1240	2172	3871	2399
5	90	526	1784	3048	4241	3313
6	124	642	1742	3153	4537	3231
7	134	773	2559	3955	6173	3987
8	90	713	1474	2571	4226	3347
9	96	520	1696	2805	4332	3394
LSD(0.05)	22	253.90	498.10	403.68	511.29	755.40
Fertilizers:						
Present	110	726	2181	4150	6941	4863
Absent	111	564	1184	1575	2151	1779
LSD(0.05)	n.s	93.57	116.72	288.99	281.69	337.82

[1] See Table 9
n.s = not significant
Source: 1996a

Maize is a nitrophilic crop, therefore it would benefit from mixed tree species hedgerow intercropping involving tree crops that can enhance the soil nitrogen status. The various mixed tree species hedgerow combinations investigated by Fagbemi (1996b) at Ilorin led to early initiation of tasselling and silking (Table 12) which could reduce the risk of drought, especially during the second late maize cropping (Maclean *et al.*, 1992). This signifies that maize would benefit more from an agroforestry system that leads to early completion of the maize growth cycle in the light of Leyton's (1983) observation that maize is critically affected by moisture stress during tasselling and silking and during early grain formation (Kowal and Andrews, 1973).

The summary of the findings of Fagbemi (1996b) is the desirability of the various mixed tree species in hedgerow intercropping in terms of soil nutrient enhancement. The inclusion of these tree species in maize cropping systems is advocated. However, some form of fertilizer input

would still be required just as the appropriate silvicultural technique that would reduce the effects of shade from these trees on maize is a necessity to enhance maize production in the Southern Guinea Savanna Zone of Nigeria.

Table 12: Effect of cultivation, urea + SSP on maize dry matter yield at harvest and days after sowing to Tasselling and Silking in potted maize.

Cultivation	Mean dry weight (g)					Mean no. of days		
History[1]	**Root**	**Stem**	**Leaf**	**Cob**	**Total**	**Grain**	**Tasselling**	**Silking**
1	11	103	14	44	174	24	72	81
2	12	91	17	33	154	17	73	83
3	18	121	29	47	219	23	70	78
4	12	83	21	34	152	16	73	85
5	14	97	25	42	186	23	68	80
6	14	103	25	48	191	24	73	84
7	13	89	25	41	170	21	69	78
8	11	76	19	25	133	12	74	84
9	14	116	35	50	218	27	73	83
LSD(0.05)	2.3	1.8	4.4	6.7	20.1	4.1	2.8	2.8
Fertilizers:								
Present	20	169	33	65	290	42	68	77
Absent	7	26	14	17	66	0	76	86
LSD(0.05)	0.9	2.7	1.2	2.8	6.5	1.9	1.5	1.4

[1] See Table 9.

Source: Fagbemi (1996b).

When the knowledge of the ethno botanical importance of *Moringa oleitera* was still low among Nigerians (Fagbemi, 1996c) investigated its growth performance under greenhouse conditions. Olayemi and Alabi (1994) studied the water purification properties, especially for rural dwellers while von Maydell (1986) had earlier reported on the nutritional value of the leaves in diets of local populations. In spite of the economic importance of this plant, peasants in Nigeria were not known to actively cultivate Moringa either as sole crop or as an inter-crop in the 90s.

The development of agroforestry systems offers an opportunity for the intercropping of Moringa with arable crops. However, the integration of any tree species into any agroforestry system requires adequate silvicultural investigation. This led Fagbemi (1996c) to evaluate the growth performance of *Moringa oleifera* in combination with *Leucaena leucocephala, Albizia lebbeck, Zea mays* and *Sorghum bicolor* under greenhouse conditions. The result of the statistical analysis of the plant height of Moringa in the various treatments is presented in Table 13 below.

Table 13: Height of *Moringa oleifera* intercropped with different Crops in Ilorin (cm)

	Time (Weeks) after Sowing								
Treatment	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**
Sole Moringa	9.5	20.2	24.3	42.0a	63.2a	73.2a	89.0a	99.2a	115.6a
M. + Maize	9.5	20.0	24.5	32.2b	40.0c	42.4c	45.4c	59.4b	72.2b
M. + Sorghum	9.2	20.0	24.5	35.0b	42.2c	42.4c	45.0c	51.2b	54.0c
M. + Leucaena	10.0	21.0	25.0	42.2a	63.2a	69.0a	89.0a	103.5a	118.0a
M. + Albizia	9.5	18.5	23.2	31.4b	48.0b	60.0b	78.0b	91.0a	106.2a

Column means with a.b.c superscripts are significantly different
Source: Fagbemi (1996c).

There was no significant difference at 5% level of probability in the height of Moringa among the five (5) treatments within the first six (6) weeks. However, from the eighth (8^{th}) to the 14^{th} weeks, the height of sole Moringa and Moringa inter planted with Leucaena was evidently superior to the other three (3) treatments. At 18 weeks after sowing, the tallest height for Moringa (118.0cm) was recorded when it was grown with Leucaena in the same pot while the lowest height (54.0 cm) was obtained from the pot containing Moringa and Sorghum (Table 13)

Biomass portioning shows leaf dry matter weight of 5.18g was highest in sole Moringa and lowest (1.70g) in Moringa intercropped with Maize. The highest stem dry weights (8.02 and 8.40g) were observed in sole Moringa and Moringa inter planted with Leucaena respectively. Stem dry weight was least when Moringa was planted with either Sorghum or Maize. Albizia and Leucaena significantly ($P < 0.05$) enhanced root production more than the other three (3) treatments. From the findings by Fagbemi (1996c) it would appear that Moringa can perform better with either Leucaena or Albizia than with either Maize or Sorghum in the Nigerian Guinea Savanna. Leucaena and Albizia are two promising tree-legume crops for alley cropping (Kang & Wilson, 1987; IFS, 1989). The enhanced growth of Moringa while in combination with either Leucaena or Albizia might have been due to the beneficial effect of the legumes' nitrogen contribution to the system. Van Noordwijk & Dommergues (1990) had proposed a hypothesis that roots of nitrogen fixing trees have more nodules, where nitrogen fixation takes place when they are in close contact with roots of non-nitrogen-fixing plants. This increased nodulation may lead to the direct transfer of nitrogen to the non-nodulating crop. The occurrence of Moringa with either Leucaena or Albizia may be a viable combination.

Leguminous trees are commonly used as hedgerow species in agroforestry systems in the tropics. Felker and Clark (1980) asserted that *Prosopis tamarugo, P. glauducosa, P. juliflora*

and*Leucaena leucocephala* (Felker and Clark, 1980) are major fodder producing trees for livestock in the tropics. Fagbemi and Nwoboshi (1991b) have reported nodulation in *L. leucocephala* on a plinthustalf of pH 6.5 in the Southern Guinea Savanna Zone of Nigeria. Balasundaran and Mohammed Ali (1988) found out that at pH 6 – 7.8, germination and survival of *L. leucocephala* seedlings were normal and the seedling nodulated freely, while in pH outside this range, there was no nodulation and where the nodules were formed, they were negligible. Leucaena also grew poorly on soils with a pH less than 5.5 because such soils had high exchangeable Al and low Ca which restrict root growth (Hutton, 1983). Almost all tree species react to soil pH at extremities which is usually manifested in the growth pattern of leaves or even biomass production. Nodulation was noted in slightly acidic soils for all the 12 species of *Prosopis* that were tested by Felker and Clark (1980).

The fermented product of *Prosopis africana* seeds, known as "okpehe" serves as substitute for animal protein among poor rural dwellers especially in Guinea Savanna Zone of Nigeria. In spite of its economic importance, the information on the silviculture of *P.africana* was scanty. This made Fagbemi and Isaac (1999-2001) to compare the performance of *P.africana* with .*L leucocephala* in soils of varying pH values in a greenhouse experiment. By so doing they were able to determine their soil pH tolerance in the Nigerian Southern Guinea Savanna Zone. The range of percentage Leucaena seedling emergence (81.3, 72.5 and 57.7) in soils with pH 6.0, 6.9 and 8.0 respectively was wider than from 57.5% for soils with pH 4.0 and 8.0 to 63.8% on soil of pH 6.0 for Prosopis. The findings of Fagbemi and Isaac (1999-2001) on the height growth of Leucaena and *Prosopis* revealed that *Prosopis* may be able to adapt better to acidic soil than Leucaena even though it is a slower growing legume. They then concluded that *P*rosopis would appear to be a potential species as an alternate or in mixed silviculture with Leucaena on acidic soils of the Nigerian Southern Guinea Savanna since both of them can freely *nodulate*.

In pulp and paper industries globally, pulp produced from soft wood such as *Pinus* species serves as the major source of pulp for paper making (Olatunde, 1990). This has been attributed to the fact that fibres from soft-wood were found to be of superior dimensions, suitable for high quality paper (Uju and Ugwuke, 1977). In Nigeria, however, a fast growing hardwood species – *Gmelin*a *arborea* has been identified and used as a prime substitute and a local source of good pulp for paper making (Ademiluyi and Okeke, 1979). The ever-increasing demand for pulp and

paper products consequent upon the growing human population supports the need to widen the base of plants that can help meet this demand.

Kenaf (*Hibiscus cannabinus L*) – a bast fibre plant known for its importance in making cordage, fishing nets and as jute substitute in the world commerce was identified (Anon, 1978) as a source of pulp and paper. Ogundele (1990) reported an average fibre length of 1.5mm for Kenaf planted as mono crop while pulp yield per plant was 38%. WHEN (1998) reported that the pulping processes for kenaf fibre consume less energy and generate less pollution thus making the use of kenaf fibre an environmentally friendly alternative. Adekola and Fagbemi (2001) observed that while kenaf growing was not new in Nigeria, its cultivation was less lucrative to farmers, in spite of the interest that government was showing in the plant as a possible local source of raw material for pulping.

Intercropping kenaf with traditionally grown short cycled cereals like maize or sorghum could offer some motivation for farmers. In view of the fact that little or no information was available on the effect of sorghum/kenaf intercropping on the quality of kenaf fibre made Adekola and Fagbemi (2001) to examine the effect of intercropping sorghum with kenaf on the dimensional characteristics of kenaf fibre and its suitability for pulp and paper making.

The mean value for fibre length reported by Adekola and Fagbemi (2001) ranged between 0.99mm and 1.56mm (Table 14). Kenaf that was intercropped with six stands of sorghum (KS6) had the longest length (1.56mm). The fibre from kenaf investigated by Adekola and Fagbemi (2001) has been grouped in the class of short fibred crops in accord with Metcalfe and Chalk (1983) that plants with fibre length above 1.6mm could be said to belong to long fibre class.

Table 14: Dimensional Characteristics of Kenaf fibre in Sorghum/Kenaf Intercropping System at Ilorin, Nigeria.

Treatments	Mean Fibre Length (mm)	Mean Cell Diameter (μm)	Mean Lumen Diameter (μm)	Mean Cell wall Thickness (μm)
KS**	1.17b*	73.3a	52.2a	21.2
KS1	0.99c	56.0a	37.3b	17.7
KS2	1.04bc	67.0a	50.0a	17.0
KS4	1.19b	58.5ab	4.5ab	17.0
KS6	1.56a	60.8ab	42.5ab	18.3
				n.s
S.E	0.07	6.63	4.92	2.19
LSD	0.173	15.3	11.35	5.05

* Means followed by different letters are significantly different at 5% level of probability.
** KS = sole Kenaf
KS1 = Kenaf intercropped with one stand of sorghum
KS2 = Kenaf intercropped with two stands of sorghum
KS4 = Kenaf intercropped with four stands of sorghum
KS6 = Kenaf intercropped with six stands of sorghum
Source: Adekola and Fagbemi (2001).

The mean runkel ratio obtained by Adekola and Fagbemi (2001) for Kenaf ranged between 0.68 and 0.88 (Table 15). Mean squares from their Analysis of Variance showed no significant variation among the treatment means at 5% level of probability. They concluded that the general mean runkel ratio for Kenaf fibre from all the treatments being 0.81 could be considered as suitable for pulp and paper making (Kpikpi and Olatunji, 1990).

Table 15: Derived Values of Relative Fibre Length (RFL), Co-efficient of Flexibility (CF) and Runkel Ratio for Kenaf Fibre.

Treatments[1]	Relative Fibre Length (RFL)	Co-efficient of Flexibility (CF)	Runkel Ratio (RR)
KS	22.5b*	0.71ab	0.84b
KS1	24.0b	0.66c	0.83b
KS2	20.7b	0.74a	0.68b
KS4	32.3a	0.71ab	0.82b
KS6	39.6a	0.70bc	0.88a
S.E	3.17	0.02	0.08
LSD	7.31	0.046	0.19

**(See Table 14).* Means followed by different letters are significantly different at P ‹ 0.05.
Source: Adekola and Fagbemi (2001).

The cost and timeous availability of inorganic fertilizers have been serious challenges to the peasantry in the Southern Guinea Savanna Zone of Nigeria. Even then the ecological

implication of using urea fertilizers consistently in a given farm over a long period of time has been of concern to researchers. To cut down on the rate of inorganic fertilizer input without compromising optimal arable crop production has made the integration of organic agriculture in savanna farming attractive. The development of appropriate agroforestry systems that will make the tree components yield the right quantity and quality of prunings to boost the soil nutrient status in the Savanna cannot be over stated.

Leaf-shed or litter from prunings are the major constituents in nutrient re-cycling in the agro ecosystems of the Savanna Zone of Nigeria. The rate of decomposition and mineralization of leaves of tropical trees depends to a large extent on the chemical composition of the material (Swift *et al.*, 1979). The influence of the quality of tree litter on the rate of decomposition and its subsequent impact on soil fertility has been recognized in tropical agriculture (Oyun *et al.*, 2006). The C:N ratio or Nitrogen content has been reported to be the most important index in determining the rate of mineralization (Mafongoya *et al.*, 1998). Some other authors have again noted that high concentration of lignin and polyphenols are usually accompanied with slow rate of decomposition and low level of mineralization of plant nitrogen (Palm and Sanchez, 1991: Hertemink and O'Sullivan, 2001: Kayuki and Watman, 2001. TSBF-CIAT, 2003).

In order to be able to pronounce on the litter quality and mineralization potential of certain multipurpose trees in the Southern Guinea Savanna Zone of Nigeria, Fagbemi *et al.* (2008) analyzed the chemical composition of leaves of eight common tropical savanna species. The tree species considered were *Gmelina arborea, Vitellaria paradoxa, Tectona grandis, Entada africana, Prosopis africana, Parkia biglobosa, Leucaena leucocephala* and *Gliricidia sepium.*

Results of proximate analysis of leaves from the eight tree species are summarized on Table 16.

Table 16: Proximate Analyses of some Multipurpose Tree leaves.

	N	P	K	Ash	OM	OC	Lignin	Tannin
Tree SPP	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(PP^M)**
***Parkiabiglobosa* (Pb)**	2.0	0.55	0.28	6.3	91.32	52.97	38.08	83.52
***Entada africana* (Ea)**	2.63	0.34	0.27	8.3	94.17	54.62	25.52	84.79
***Proposis grenada* (Pa)**	2.17	0.30	0.82	9.5	95.36	55.31	10.94	82.55
***Tectona grandis* (Tg)**	2.21	0.60	0.80	10.3	90.27	52.36	41.11	71.37
***Gmelina arborea* (Ga)**	2.84	0.045	0.29	4.7	92.20	53.48	34.49	80.67
***Gliricidia sepium* (Gs)**	2.93	0.11	1.01	7.0	93.77	54.39	13.35	62.91
***Vitellaria paradoxa* (Vp)**	1.79	0.50	1.00	5.0	93.63	54.31	35.38	84.57
***Leucaena leucocephala* (Ll)**	4.01	0.45	0.33	2.7	88.14	51.13	17.81	82.00
LSD	0.12	0.02	0.03	0.34	4.62	2.68	1.36	3.95

OM = Organic Matter, OC = organic carbon.
Source: Fagbemi *et al.*(2008).

Results of their investigations have shown that the level of decomposition and mineralization of leaves of the tree species vary significantly. *L. leucocephala* had the highest degree of mineralization while *V. paradoxa* was least (Table 16). Substituting chemical fertilizer with leaf litters from the selected tree species has the potential of enhancing soil fertility for the purpose of growing food crops. Consequently, *L. leucocephala, G. sepium* and *G. arborea* appear to possess good litter quality which makes them suitable for use as substitutes or supplements for synthetic chemical fertilizers known to be hazardous to the environment when applied continuously over a long period of time. These identified tree species are mostly fast growing capable of providing adequate leaf litter and prunings that can sustain or support plant growth especially those that retain their foliage during the dry season. This is desirable from the point of view of sustainable development concept in the tropics where most of the soils are not only fragile but nutritionally deficient.

To be able to wear the title of a Professor of Agroforestry, there was the need to break out of the bracket of agri-silviculture. It was this need that pushed me to join colleagues who are involved in research in animal production. *Entanda africana,* a lesser known leguminous tree species can grow to the height of between 7 and 12m (Arbonnier, 2004) could be found in parkland in the Savanna. It is one of the Malian medicinal plants used for the treatment of various illnesses. The bark has been reported capable to cause abortion in animals, but a decoction prepared from the root acts as a stimulant and tonic (Arbonnier, 2004).

Research has also demonstrated that the plant can be used as an antidote against various toxic agents because of its emetic properties. Beverages prepared from the leaves, bark, roots and shoots are used for healing various ailments and reducing fever (Arbonnier, 2004). The leaves are used for preventing suppuration and also to provide an effective dressing for wounds (Wickens, 1996). However, in the Nigerian context, the nutritional evaluation of the seed as novel for livestock was lacking and this made Belewu *et al*. (2007) to study this plant in order to evaluate its efficacy regarding the use of the seed meal in the diet of WAD goats.

Fifteen West African Dwarf goats (Buck) were used for the experiment. The seeds of *E. africana* and soybean used in the three (3) different diets were toasted (60^{o}C) to eliminate or reduce the presence of some anti-nutritional factors (tannins, spawning) and to increase their

acceptability by the goats. The *Entanda* seeds were used to replace 50 and 100% of the soybean meal in diets B and C respectively whereas diet A was the control (Table 17).

Table 17: Ingredients and Chemical Composition of Diets (g/kg DM).

Ingredients	Diets		
	A	**B**	**C**
Cassava waste	530.00	530.00	530.00
Soybean meal	150.00	75.00	-
***Entanda Africana* seed meal**	-	75.00	150.00
Rice husk	200.00	200.00	200.00
Palm Kernel cake	100.00	100.00	100.00
Vitamin – Mineral Premix	10.0	10.0	10.0
Salt	10.0	10.0	10.0
Total	1000.00	1000.00	1000.00
Chemical Composition			
Dry matter	904.80	888.20	906.60
Crude protein	199.00	162.00	133.40
Ether extract	90.0	80.0	90.0
Lignin	69.30	91.20	91.00
Neutral Detergent Fibre (NDF)	686.20	653.00	577.50
Acid Detergent Fibre (ADF)	272.10	237.00	209.40

Source: Belewu, *et al.* (2007).

The nitrogen concentration of diet A (Control, i.e. Soybean meal based diets) was considered higher than those in diets B and C (50 and 100%, *E. africana* seed meal respectively) (Table 17). Belewu *et al.* (2007) reported that neither dry matter intake, ether extract intake nor daily weight gain was affected (P › 0.05) by the inclusion of *Entanda* seed meal in the ration (Table 18). This made us to suggest that seeds of *Entanda* could be used to replace soybean meal without any detrimental effect on the performance of West African Dwarf (WAD) goats. Belewu *et al*. (2010) have increased the number of desirable tree species in the Savanna of Nigeria that can be so explored for similar result.

Table 18: Feed intake, apparent Digestibility Co-efficient and Weight gain of the Experimental Animals.

Ingredients	Diets			
	A	**B**	**C**	**±SEM**
Dry matter intake (g/d)	1540.00	1630.00	1560.00	0.05 NS
Dry matter digestibility (g/kg DM)	707.8	674.20	670.90	3.70 NS
Crude protein intake	306.46	264.06	208.10	0.01 NS
Crude protein digestibility (g/kg DM)	722.90^{a}	657.50^{b}	660.90^{b}	2.38*
Crude fibre intake (g/d)	96.25^{bc}	92.91^{b}	131.04^{a}	3.84*
Crude fibre digestibility (g/kg DM)	751.10	738.90	716.70	2.05 NS
Ether extract intake (g/d)	138.60	140.40	140.40	0.05 NS
Ether extract digestibility (g/kg DM)	951.50	835.80	869.20	9.57*
Hemicellulose intake (g/d)	637.72^{b}	678.08^{a}	574.24	0.03*
Hemicelllulose digestibility (g/kg DM)	679.00^{c}	778.60^{b}	951.90^{a}	3.53*
Lignin intake (g/d)	106.72^{c}	116.06^{b}	141.96^{a}	0.0*
Lignin digestibility (g/kg DM)	750.70^{a}	683.00^{b}	673.90^{c}	1.03*
NDF intake (g/d)	1056.75^{b}	1064.39^{a}	900.90^{c}	0.04
NDF digestibility (g/kg DM)	729.60	700.90	684.90	1.84 NS
ADF intake (g/d)	419.03	386.31	3226.66	0.08 NS
ADF digestibility (g/kg DM)	689.30	668.60	649.60	2.10 NS
Weight gain (g/d)	62.00	61.00	60.00	0.10 NS

Means along rows with similar superscripts are not significantly different (P › 0.05)* P › 0.05; NS = not significantly different (P › 0.05).
Source: Belewu *et al*. (2007).

No doubt, agriculture has played a major role in kick-starting economic growth and development and in reducing poverty and hunger in many developing countries. No wonder that many of the developing countries like Nigeria that have failed to successfully launch an agricultural revolution remain ensnared in poverty, hunger and economic drifting (Hazell, 2006). The situation in Nigeria is compounded by lack or insufficient availability of feedstuff for livestock, mostly during the dry season. This has led to migratory movement by herdsmen and this has been resulting in avoidable conflicts between these herdsmen and peasants all over the country. The battle for food and feed between man and animal has been raging over the consumption of arable crops. Added to this is the fact that recently, some developed countries like USA, China and Brazil etc. are getting worried over the use of maize in the production of biofuel ethanol.

Reynolds and Ekurukwe (1998) posited that protein rich supplement improves nutrition of sheep in small holder grass-based system and that it also increases resistance to disease such as trypanosomes. The raising of ruminant animals under traditional and subsistence agricultural

systems make good use of low quality feed in sustaining the animals. However, poor performance of these animals do occur as a result of the use of cheaper and lesser known and unconventional feed supplements which also represent low–cost towards improving animal performance. To reduce the pressure placed on arable as a result of their use as feedstuff has led to attempts that have been made to evaluable the chemical composition and nutritional potentialities of some legumes and browse species as feed supplements (Morton, 1987, Balogun and Fetuga, 1989). Even at that, there are still a number of leguminous and tree seeds needing to be evaluated for their nutritional qualities in livestock feed in the Southern Guinea, Savanna Zone of Nigeria. This made Belewu *et al.* (2008) to undertake this task involving *Blighia sapida, Leucaena leucocephala, Mucuna preta, Entanda africana, Adansonia digitata and Voandzeia subterranean.*

The results of the proximate composition along with the fibre fractions are shown in Table 19. These findings revealed that all the seeds are potential good sources of dietary energy, protein and minerals for ruminant animals. The anti–nutritional factors detected in the seeds are heat liable hence; they can be eliminated easily by different processing methods (cooking, heating etc.) Due to the overall nutritional qualities of these investigated seeds, their inclusion as alternative cheap sources of protein and energy in livestock diets by economically challenged peasants mostly in the developing countries could be encouraged. This way we could make the peasantry to be in good standing (Omotesho, 2015).

Table 19**. Proximate composition, fibre fractions, minerals, quantitative andevaluation of lesser known seeds in guinea savanna zone of Nigeria.**

Components (A)	Entanda africana	Leuceana leococephala	Voandzeia subterranean	Adansonia digitata	Bilighia sapida	Mucuna preta	SEM
Dry Matter (%)	80.00	81.00	83.00	92.00	85.00	90.00	4.45^{NS}
Crude protein (%)	39.81^{a}	41.34^{a}	23.41^{c}	37.63^{b}	10.50^{d}	38.50^{a}	3.15*
Crude fibre (%)	15.50^{c}	19.50^{a}	17.00^{b}	16.50^{b}	17.00^{b}	18.50^{a}	2.02*
Ether extract (%)	17.50^{b}	12.50^{c}	12.50^{c}	22.50^{a}	17.50^{b}	7.50^{d}	2.13*
Metabolizable energy (kcal kg^{-1})	4.88^{b}	4.58^{c}	4.38^{c}	5.46^{a}	4.48^{c}	4.62^{b}	1.45*
Acid detergent fibre(%)	39.00	24.00^{c}	18.00^{d}	17.00^{b}	36.00^{b}	35.00^{b}	3.76*
Neutral detergent fibre (%)	53.00^{c}	53.00^{c}	47.00^{d}	84.00^{a}	41.15^{c}	65.30^{b}	3.89*

Row means with same superscript are not significantly from each other (P> 0.05).

Component (B)							
Sodium (%)	0.20^{b}	0.10^{c}	0.30^{a}	0.10^{c}	0.10^{c}	0.20^{b}	0.05*
Calcium (%)	7.60^{b}	5.77^{b}	3.72^{c}	15.50^{a}	5.46^{b}	1.98^{c}	0.98*
Magnesium (%)	45.42^{a}	42.21	42.31	46.11^{a}	43.47^{b}	39.54^{c}	3.67*
Potassium (%)	44.92^{a}	46.15^{a}	45.65^{a}	45.38^{a}	8.98^{b}	45.96^{a}	3.45*
Iron (%)	0.17^{b}	0.17^{b}	0.26^{a}	0.17^{b}	0.17^{b}	0.95^{c}	0.08*

Row means with same superscript are not significantly different from each other (P> 0.05).

Components (C)						
Saponin	+ + +	+ +	+	+	. . .. . .	
Tannin	C	H	. . .	. . .	. . .	C
Saponin (%)	6.00	5.00	3.60	3.00	1.00	3.50
Tannin (%)	0.17	0.29	. . .	. . .	0.12	0.23

- Mean of 10 determinations; +++ High concentration, ++ Medium Concentration, + low concentration, C: condensed tannin, H: hydrolysed tannin, ... Nil, NS: Not significant

Source: Belewu *et al*. (2008)

When I took up an appointment with the Kogi State University in 2006, I was keen in monitoring the involvement of peasants in afforestation and agroforestry activities. The consequences of extensive deforestation have been environmental degradation and accelerated wind and water erosion of the fertile land leaving Nigerian soil too poor to sustain productive agricultural production. Imbibing the culture of tree planting is critical in advocating the integration of trees into the agro– ecosystem which agroforestry systems involve.

Kogi State Government received financial support from the World Bank between 1978 and 1984. Through the funds an afforestation project was established. The project established government afforestation plots, prepared nurseries for improved tree seedlings which were sold to farmers. The project also diffused and educated farmers on tree planting. Having rested the project for some years, *Saliu et al*. (2010) set out to describe the socio – economic characteristics of the farmers, identify the various types of participatory methods used by the afforestation agency, assess the level of adoption of tree – planting technologies by the farmers involved in Kogi State and to find out if there was any difference in income generated from different afforestation technologies.

Saliu *et al*. (2010) found out that a very high percentage of the farmers were still passively involved in afforestation exercise and this may not effectuate sustained participation and farmers may even refuse to adopt or discontinue the adoption of afforestation technology. In view of this finding (Saliu *et al*., 2010) proposed more pragmatic and dynamic participation methods such as interactive and self–mobilization to be initiated and adopted by the afforestation implementation agencies if environmental degradation and desertification must give way for sustained green cover of Kogi State in particular and Nigeria in general.

Fagbemi and Idoko (1991) had reported the interest of peasants in Kwara State in integrating multipurpose trees into their farming system. Having participated in the Kwara and Kogi States' monthly technology review meetings for many years (Saliu *et al*., 2015) decided to investigate the challenges that farmers in the North Central Zone of Nigeria were facing in agroforestry systems' adoption of the peasantry of agroforestry technologies, identify the adoption level and ascertain if they had discontinued agroforestry adoption. Data were collected from 722 agroforestry farmers out of 782 sets of questionnaire that were distributed.

Adoption of agroforestry technologies increased between 2008 and 2010 but decreased as it approached 2013. Saliu *et al*. (2015) further reported that inadequate knowledge of agroforestry with mean score of 3.71 and lack of market (mean score: 3.55) made many farmers to discontinue adoption. This made us to advocate use of fruits from the trees planted as raw materials to attract better market and scale up adoption of more fruit trees planting among the peasantry of the study area.

Agroforester as Political Activist.

What business has an Agroforester with political activism? The political landscape should be able to support researchers to engage in productive research. When the socio-economic order is such that concentrates so much wealth in the hands of few at the expense of the majority there will be a dislocation in the distribution chain. This will lead to pressure on the poor majority in the developing world who will resort to eking out a living from the land. But when the researcher is made to suffer from poor funding, and she or he is psychologically oppressed by primitive accumulation of wealth by greedy charlatan, then there is cause to worry a tropical Agroforester. We need to have an ecologically compatible policy to regulate our population. If the political frame work is porous, no matter how hard an Agroforester may try, her/his effort will continue to filter through the basket of collection. Adequate food and wood leading to sufficiency is scientifically elegant and is possible in Nigeria arising from the findings so accumulated over the years but will be ineffectual under a politically corrupt system that is dysfunctional.

When I talk of corruption, I am mindful that this is not limited to mere cornering of our common patrimony to self but also poverty of the mind (Fagbemi, 1989a). I submit that any Nigerian who has above two billion naira should be counseled on the need to pay 98% tax on her/his wealth in excess of two billion naira. No matter how sound the findings of an Agroforester in enhancing food and wood may be, if the wealth distribution in Nigeria is not addressed, food and wood may not be readily available and affordable to all. For us to be sufficient in food and wood in Nigeria the researcher must be well funded and she/he must remain focused. The political class must govern well and must view governance as an opportunity to serve others and not self. The political class must know and believe that research is the precursor of development. We all must imbibe the culture of sustainable use of our resources and jettison our present attitude of the prodigal son.

Our consumption pattern is not sustainable. My take is that Nigeria is one of the countries seriously working against the realization of the Sustainable Development Goals. It is a reproach to humanity for there to be so much poverty in a country like Nigeria that is so prodigiously and embarrassingly blessed with renewable and non–renewable resources. In the course of my academic career, as a professional agitator then, I found myself coordinating the Campaign for Democracy (CD) in Kwara State. We had struggled for the termination of military rule and enthronement of democracy in Nigeria. But if I may ask, could this jaded, convoluted demonstration of greed and corrupted democracy in place today be what we struggled for in the early 90s? No. We deserve better.

Mr. Vice-Chancellor Sir, do I now have your permission to continue to agitate for the right political order while still researching on agroforestry so that my humble effort will lead to farmers extensively planting locust bean tree on their arable farms? The trouble that I have has to do with how I am to continue to relate with the bulk of the near bagasse making up the political leadership at all tiers of government in Nigeria. Research findings have demonstrated that the current unemployment of our youth which is a threat to the security of Nigeria can be resolved by agriculture, forestry (Fagbemi, 2003), mining, technology and industrial expansion. The history of this country supports the capacity of agriculture to absorb mass labour force. However, the idea of encouraging everybody to farm whatever her or his profession is does not show that we are serious as a nation that wants to be sufficient in food and wood production on a sustainable basis.

Agroforester as an Environmental Activist.

Nigeria used to be at peace with itself. When there were fewer Nigerians to share the resources of the country, the room for conflicts arising from meeting their need was nonexistent. However, as the population was growing without adequate provisions for the citizens and with importation and cross fertilization of religious, political and economic ideas contending with the mind, these created a mental cramp. With growing population and technological development in the world, human beings began to experiment with selling their economic, socio-political or religious philosophies to other fellow beings. Where persuasions failed to work, force was sometimes employed (Oluwagbemi, 2015). This has resulted in widespread violence in attempts at winning converts. This unfortunate trend has led to guerilla style or full-scale wars hence the phenomenon called terrorism. While these terror acts are most often

viewed through the political, social, cultural, economic, technological or religious prisms, the silent terrorism that the environment suffers is excused under some nebulous 'freedoms' that man exercises over the environment (Oluwagbemi, 2012).

Oluwagbemi (2015) took the liberty of the statutory definition of terrorism in Nigeria as contained in Section 46 of the Economic and Financial Crimes Commission (EFCC) (Establishment) Act 2004 (Omolaiye-Ajileye, personal communication) to interrogate some of the terror acts that Nigerians visit on the environment without any qualms. Nigeria has been fighting the menace of terrorism occasioned by Boko Haramists in the North East of the country close to eight years for their terror acts against the State. But most Nigerians have been acting in their relationships with the environment in ways that are similar to what the Boko Haramists are doing to the State. The provision on the need to prevent damage to the environment as reflected in Section 46 of the EFCC (Establishment) Act 2004 is kept in abeyance in Nigeria's quest to route out terrorism in the country. Till date no Nigerian has ever been successfully prosecuted for her/his terror acts to the environment. The gory sights of baby-mothers carrying their children displayed by various camps of Internally Displaced Persons (IDPs) would testify to the fact that future involuntary environmental terrorists are already being incubated. Oluwagbemi (2016) was so worried that he likened the growing number of children being born today in Nigeria that may not be well educated and therefore will remain unskilled as a result of lack of adequate planning by governments to care for them as a recipe for setting on the loose environmental rapists.

Exercise of freedom at raping the Environment

Man has been under the illusion of being able to conquer the environment and that gives him the license to do whatsoever he likes with and to the environment. In exercising his freedom he does not only populate the limited land space, spreads his tenets over it, he sometimes over draws from the available resources not only to meet his **need** but to satisfy his greedy **wants**. In doing this man exerts such pressure that pushes the environment to its ecological limits. This failure to respect the carrying capacity of the earth has led man to make 1.5 demands of the size of the planet earth (Oladipo, 2015).

The unmanaged population of Nigeria is a rape on the environment. A population of over 178 million with gluttonous consumption cannot but draw heavily from a country of size 923,766 km^2. To meet the food need of this humongous population (Oluwagbemi, 2015) asserted that

various efforts are put in place to extract from the soil as much as possible including the application of chemicals to achieve this. This way, the soil is subjected to double jeopardy-yielding at great pain and also having to cope with toxins from man's actions. The policy of four (4) children per woman of the Babangida's era was dead on arrival and as at today there is no piece of legislation regulating the number of children a couple could have in Nigeria. Oluwagbemi (2015) had advocated that Nigeria should come up with a law limiting a couple to have two (2) children. Any contravening couple with 3 children will get a yellow card, with 4 a red card that would have the man castrated while the woman will be made to go through tubal ligation. I submit that attempting to develop an agroforestry system that will produce food and wood on a sustainable basis for a population that is beyond the carrying capacity of the available land space in Nigeria is like journeying on a bucolic path to an unknown destination.

Consumption Patterns that terrorize the Environment

Foresters are worried stiff at the unmitigated level of deforestation in Nigeria. The rate has been on the rise due to the reckless manner of timber extraction and indiscriminate fuel wood collection with the collateral negative impact on the environment. Most State Governments in Nigeria have forestry laws on how their forest estates should be managed. However, there are States which have democratized environmental brigandage by by-passing their Forestry Departments in giving contractors the management of their forest estates. This has led to unrestricted forest destruction all in the quest to increase internally generated revenue. Oluwagbemi (2015) likened this attitude on the part of governments to approving the use of Improvised Explosive Device (IED) against the forest. Nigerians in positions of political authority fail to realize that when we turn the terror gun against the environment, it backfires. The processes of wood conversion in Nigeria lead to huge 'waste'. Our consumption of pulp and paper products is also sub-optimal. There is no reason why students' projects, dissertations and theses cannot be produced on both sides of foolscap sheets in all our institutions of higher learning in Nigeria as a way of optimizing that forest resource. God demonstrated resource-use optimization in Exodus Chapter 32 verse 15 when He wrote on both sides of the two tables of testimony that He gave to Moses.

For the health of our environment, there is the need for the re definition of our culture. The idea of over wearing of textile materials in form of a parachute known as babanriga or agbada draws unnecessarily from the environment. The idea of eating food and deliberately leaving leftovers

constitutes an insult to the environment. This general lack of respect for the environment raised here may be considered small and characteristically, Nigerians are not likely to take the required actions. Nigerians have this lackadaisical attitude to issues when they are still small until they fester and become big issues (Fagbemi, 2003).

Actions that indirectly terrorize the Environment.

The conversion of forested land to agricultural land in order to produce more cash/food crops is a subtle form of terrorism. AFF (2015) reported the apprehension of the Society for Conservation Biology (SCB) to the threat to biodiversity posed by expansion of industrial oil palm production in Africa. The alarm raised was aimed at highlighting the steady and unsustainable destruction of forests as a result of industrial oil palm expansion in West and Central Africa and the role of oil palm expansion in the attrition of biodiversity including flagship animal such as ages as well as associated human and economic implications. The horizontal urban growth in Nigeria is also anti biodiversity. Most of the spaces that are built up should have been left green. Why should urban centres in Nigeria wait until they are faced with land hunger before embracing vertical growth as the case is in Onitsha, Anambra State, Nigeria?

The primitive political economy that celebrates'financialism' or what Professor Eskor Toyo will like to refer to as 'moneyism' in Nigeria is environmental terrorism personified. This system concentrates the wealth of this country in the hands of a few people in Nigeria while majority are without. This economic disorder has forced majority of the rural dwellers to virtually live on the environment. These are the unconscious environmental terrorists that the greed of a few has set on the loose in Nigeria. Their demand from the environment is high and the Nigerian environment is sighing under this heavy weight. When an exploited and oppressed man sets a bush on fire in an attempt to capture some rodents or as a tool of clearing his land for cropping, he commits environmental abortion. The vandalism of oil pipelines by the Niger Delta Avengers to protest against socio-economic injustice is not only an act of economic terrorism but also environmental terrorism. It is hoped that good sense will prevail in handling this issue of Niger Delta militancy so that Nigeria does not achieve a temporary relief from Boko Haram in the North East only to have another war coming from the creeks. The Nigerian State that fails to create a system for equity for all to access the wealth of the nation aids and abets an act of environmental terrorism. The end of the story is that the environment will not

only prosecute the man that commits and the State that aids environmental terrorism, it will also be the judge. Welcome Climate Change! The more there are Nigerian environmental terrorists on the loose the greater the punishment by the environment.

My call on the United Nations (UN)

I have seen Nigerians serving themselves at dinner buffet and I cannot just stop thinking that something must be done to punish food wasters. How do we explain a situation that will inform a person (usually a man, for women are not that greedy) serving himself double the ration his stomach could normally accommodate only to waste half of the food at the end of the day? I would like a situation that Nigeria will come up with an appropriate fine for every person that wastes food. Even my Lord Jesus Christ is against food wasting. As recorded in John Chapter 6 verse 12 – 'So when they were filled. He said to His disciples, "Gather up the fragments that remain, so that nothing is lost" (TPDB, 2007). We need to consume sustainable in Nigeria.

Already the United Nations (UN) has set aside certain days in the year to mark given events. For instance, the 5th of June of every year is set aside as the World Environment Day. World Hunger Day is marked on May 28; World Food Day is celebrated on October 16 every year etc. How well do we remember the future? I believe sincerely in the option of *conservada in–situ*. As a way of caring for future generations, I am of the firm view that people of the world can start to conserve food for the children yet unborn. Therefore the United Nations (UN) could consider modifying activities ear marked for celebrating either World Hunger Day or World Food Day each year or set aside a different day when we are to remember the future, so that there will be food for children that will be born tomorrow. We should consume today so that our children will not have to starve tomorrow.

What the day will entail is simply having all healthy citizens of the world aged eighteen (18) years and above abstaining from eating food and drinking any liquid for a whole day. Anyone willing to voluntarily participate should be well informed that to resume eating the next day would involve starting with warm liquid followed by light meal. This is important to prevent system break down that can follow the consumption of heavy meal intake immediately thereafter. For the first timer, the experience could be tough. But then, it can also serve as an opportunity for the wealthy citizens of the world to experience what the poor endure who go for days without food because they lack.

Conclusion

Researchers in Nigeria and elsewhere have made their humble contributions to how Nigeria can overcome its present predicament of lack of adequate food and wood in the midst of potential plenty. It is my take that Nigeria has unfortunately swallowed sufficiency of not having sufficient food and wood that has not left enough space for sustainable food and wood production to feed her citizens sustainably. Therefore it is just proper and correct for the country to throw up its hands in search for rescue. We have had enough food for thought in the mind but little for the stomach that can help nourish the body and deepen the thought process that can lead to sustainable food and wood production. No matter how elegant research findings on food and wood production may be the absence of a progressively stable polity will not engender food and wood sufficiency in Nigeria. Balancing the equilibrium among the three (3) varieties of *Homo sapiens* namely *H. sapiens var. ecologicus, H. sapiens var. economicus and H. sapiens var politicus* is a *sine qua non* for sustainable food and wood production and availability for all Nigerians. No matter how beautiful and inspiring the architecture of the frame for sustainable food and wood production put together by researchers may look like, an environment that is unsafe, chaotic and governed by politically naïve leadership will make the structure none enduring.

Recommendations

For us in Nigeria to have sufficient food, fibre and wood for the majority of our people to have access to them, I wish to make the following recommendations:

- The struggle for a political order that can guarantee equitable distribution of renewable and non- renewable resources of the country should be intensified. Pro-democracy, cultural and Civil Rights groups must wake up from their slumber to make the politicians do that which are in the interest of the people,
- Greed among the members of the political class must be fought to a standstill and the people must insist that proven cases of corruption at every level of governance must be adequately punished to serve as deterrent to others,
- Nigeria should still favourably consider adopting the suggestion of Professor Thomas Adeoye Lambo that those who may wish to contest for one elective position or the other need to pass through rigorous psychiatric evaluation to supervised the UN to determine

their mental fitness before they are thrown up for elections. That call which was made in 1983 is as germane today as when it was first made,

- Nigeria should embark on running a more compact government to cut down on waste and free more money for research and development. At the level of the presidency, we do not need more than twenty (20) political appointees: - a Secretary to the Government of the Federation, one National Security Adviser and eighteen (18) Ministers (3 per each geo – political zone). At the State level, a Secretary to the State Government, one State Chief Security Adviser and nine (9) Commissioners (3 per each senatorial zone).
- Failure to pay public servants and retirees fully for two (2) consecutive months must be made an impeachable offence at all tiers of government in Nigeria.
- Agroforestry should be used by the Great Green Wall Agency in establishing the corridors of plantations in its States of operation,
- Aside from the Great Green Wall Agency, an Environment Conservation Trust Fund (EnConTFund) for aggressive afforestation using agroforestry systems should be established in Nigeria by parliament.

  The EnConTFund could be funded from these sources.

  (a) Zero point two (0.2%) percent from the monthly federation account allocation.
  (b) Two percent from Sunday offering collected in churches and Friday fisablillahi from mosques all over Nigeria.
  (c) Two percent of the wealth of each Nigerian in excess of two billion naira.
  (d) United Nations should request for two percent of the yearly earnings of the Federation of International Football Association (FIFA) to be donated to United Nations Environment Programme (UNEP). This contribution is to be distributed to all developing nations. The share of Nigeria from this should go to EnConTFund. Similar contribution could come from Confederation of African Football (CAF) to African nations. The justification for this is that football pitches are denied of arable and forest cover.
  (e) Two percent from the profit of all road construction companies in Nigeria. This will require an amendment to the Companies Income Tax Act 2004 so that the ten percent tax that such companies pay will be reduced to eight percent.

(f) If we must continue with the presidential system of government, then the constitution should be amended to change the national bicameral legislature to unicameral whereby the Senate component will be scrapped. The money that should have been budgeted to maintain the Senate could be utilized to support research,

- Nigeria should come up with a law allowing a couple to have a maximum of two (2) children with the *proviso* that the government will help in the education of the two children. This will help to keep the population of Nigeria in check,
- The Nigeria Urban Planning Act CAP N 138, LFN 2004 should be amended to make vertical urban development enforceable in Nigeria where the soil geology permits,
- The United Nations should consider modifying the celebration of either the World Hunger Day (May 28) or World Food Day (October16) or create another day every year by encouraging healthy citizens of the world that are eighteen (18) years and above to donate a day's meals to future children by abstaining from eating food or drinking any liquid (one day dry fast for the sake of the future!),
- The aspect of the Constitution in the 5th Schedule that makes farming all comers' vocation should be removed,
- Policy of cremation should be put in place and government to bear the cost for citizens.

Trouble shooting outside of Agroforestry

Mr. Vice-Chancellor Sir, permit me to take advantage of thisopportunity of my inaugural lecture to trouble shoot outside of agroforestry. In January, 1965, the first lessonthat Mrs. Janet Abodunde taught my class was how to recite the twenty six (26) letters of the English alphabet as follows:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	B	C	D	E	F	G	H	I	J	K	L	M	N
15	16	17	18	19	20	21	22	23	24	25	26	27	
O	P	Q	R	S	T	U	V	W	X	Y	Z	?	

Fifty two (52) years later I have not learnt more than these twenty six (26) letters! And I ask when shall we have the 27th letter of the English alphabet?

Mr. Vice-Chancellor Sir, permit me once again as a gender activist to make this innocuous suggestion of a marriage between letters H and S to form the 27th letter of the alphabet. Something like:  . If scholars of letters will consider this, then when we need to write She or

He, we would have:Se (first letter upper case)and she or he: Se (first letter in lower case). Ifwe succeed then we shall have the following. Instead of seven letters for 'she or he', we may end up with just two letters - Se. Another conservation of space! We then have the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	B	C	D	E	F	G	H	I	J	K	L	M	N
15	16	17	18	19	20	21	22	23	24	25	26	27	
O	P	Q	R	S	T	U	V	W	X	Y	Z	Se	

By all means let research continue.

Acknowledgements.

Mr. Vice-Chancellor sir, let me make a confession. This for me has not been as easy as I have found writing the other sections of this lecture. This is simply because God has been so nice to me and He has used many people to get me to where I am today and to be in a position to deliver this inaugural lecture. The dilemma I had was how to choose those who will represent the galaxy of my well-wishers without offending others. My consolation is in the fact that God sees my heart and He knows that I am grateful to all.

Let me first of all give glory and adoration to my Creator, the Alpha and the Omega who has made the totality of this day what it is, for He is the one that we cannot question. He alone knew me before I was born on the first of October, 1958 to the family of Chief Ade Fagbemi of Kajola Quarters in Ekinrin-Adde, Ijumu Local Government Area of Kogi State, Nigeria. Though born in a polygamous home, my siblings and I were raised as if we all are from the same mother. I appreciate my mother – Madam Ayo Fagbemi and step mothers for their collective efforts in making sure that all of us are united as one loving big happy family. All my siblings have been most supportive and wonderful. Namely; Mrs. Funke Atta, Mrs. Ronke Ajewole, Prof. Oyin Medubi, Mrs. Kehinde Pariya, Miss Seyi Fagbemi, Miss Dolapo Fagbemi, Col. Tunde Fagbemi (retd), Dr. Gboyegba Fagbemi, Mr. Kunle Ade-Adeleye, Mr. Kolade Fagbemi, Mr. Banwo Fagbemi, Mr. Funsho Oluwadamilareincluding their spouses and others in the extensive families.

I will like to recognize with thanks all those who taught me beginning with Mrs. Janet Abodunde in 1965 at Baptist Day Primary School, Ekinrin-Adde to Baba S. K. Moody representing the crop of dedicated teachers at Titcombe College Egbe to Dr J. O. Ajolore

standing in the gap for those at Kwara State College of Technology, Ilorin to Professor G. Berry and others at the University of Jos, and Emeritus Professor S. K. Adeyoju leading the team at the University of Ibadan, Ibadan. I cannot forget the positive impaction to my academic voyage of those who supervised me. Dr. M.A. Khan supervised my undergraduate project; Professor A. E. Akachuku handled my master's dissertation and Professor L.C. Nwoboshi (now the Obi of Ibzu in Delta) saw me through my doctoral thesis at the University of Ibadan.

God used Professors L. B. Olugbemi and A. A. Adesiyun to facilitate my employment at the University of Ilorin, Ilorin in 1984 for which I will ever remain grateful. Professor Olugbemi was a nice Dean and Professor Adesiyun was such a wonderful administrator while he was my Head of Department. I have worked with many administrative and academic colleagues at various Universities who have left me with lasting impressions. Such Universities include those at Ilorin, Makurdi, Ago-Iwoye, Anyigba, Keffi, Ado-Ekiti all in Nigeria and Arab Moi in Kenya. All the students in these Universities that I have had the opportunity of teaching and supervising have continued to demonstrate love and support for me. I wish to thank them all.

In my thirty two years in the University system, I have served under various Vice-Chancellors, starting from Professor S. Afolabi Toye at the University of Ilorin, Ilorin to the present – Professor M. S. Abdulkadri in Kogi State University, Anyigba. Many of them tolerated me but a few related with me by adopting a deliberate policy of excluding the includers and including the excluders apologies to Tatalo of the Nation Newspapers, Lagos. All the same, I have had one lesson or the other to learn from each one of them. Three Vice-Chancellors deserve special commendation. Professor S. Afolabi Toye my first Vice-Chancellor at the University of Ilorin exposed me to how a University in the true sense should be administered. Professor F. S. Idachaba reinforced my belief in a functional University. It was during his tenure that the Council of the Kogi State University announced my professorial appointment. The current Vice-Chancellor in Kogi State University – Professor M. S. Abdulkadri struck in me a feeling of *déjà vu* by bringing to my memory the golden days of Professor Afolabi Toye in being time conscious. The fact that I am giving my inaugural lecture when an Economic Historian is the Vice-Chancellor is not accidental for I always tell my students that I am a permanent student of History! Mr. Vice-Chancellor sir, I thank you for honouring me with this day and also for agreeing to feast my guests with a cocktail. To all the Vice-Chancellors that I have had the fortune or misfortune of working under, I thank them all.

I have enjoyed the mentorship of a number of seasoned academics. Professor J. A. Ogunwale started with me at the University of Ilorin. Professor L. C. Nwoboshi supervised my doctoral thesis at the University of Ibadan and handed me over to Emeritus Professor D. U. U. Okali to mentor. At the Federal University of Agriculture, Makurdi, it was the turn of Professor I. Verinumbe. Here in Kogi State University, Anyigba, I have been adopted by Professors T. F. Balogun, A. A. Adebayo, K. B. Adeoye, and A. Aduku for mentorship. They have been wonderful to me and I thank them all.

A few friends have been sincere in their relationship with me. From my place of birth, my lord Justice Alaba Omolaiye-Ajileye has been very supportive of my family. Mr. Folorunsho Ilugbemi and Dr. Silas Gbenle stand tall among those friends that I made while at Titcombe College, Egbe. Professors Biodun Sanni and Niyi Togun are not just friends but have become part of my extended families in Iwo and Ogbomoso respectively. The original Assistant Lecturers in the Faculty of Agriculture at the University of Ilorin in 1984 are: Professors Yomi Omotesho, Debo Ajayi and Kunte Ladele. Professor Kolade Joseph joined the jolly group in 1985. They have all remained true to our friendship and brotherhood.

Members of the political cell that provided the platform for agitation for me in trying to move this country forward have helped in shaping my political thoughts. A few of them are Professors Tunde Oduleye, Olu Obafemi, Poju Akinyanju, Albert Olayemi, Omotoye Olorode, Idowu Awopetu, Festus Iyayi, Abubakar Momoh, Drs. Segun Osoba, Dipo Fasina, Remi Medupin, Gab. Ojegbile, Ade Oyeyemi, Funmi Adewumi etc. My associates on the platform of Campaign for Democracy (CD), Mr. Alao Aka Bashorun, Chief Gani Fawehinmi (SAN), Dr. Beko Ransome Kuti, Barrister Femi Falana (SAN), Dr. Joe Okei-Odumakin, Mr. Niyi Odapidan, Sanjo Hamzat, Mr. Chima Ubani, Barrister Charles Mann etc. I thank them for their roles in the struggles to terminate military rule in Nigeria.

I will not fail to acknowledge the efforts of my legal team in the course of my life sojourn beginning with my permanent counsel – Barrister John Baiyeshea (SAN), Barrister Chief John Ajewole and Barrister Samuel Owoyomi. They did not only provide me with a landing pad when some forces at the University of Ilorin conspired to throw me out of a flying jet but God used them to restore me back to the academic jet. To God is the glory.

My baptism in the pool of environmental discourse was on the platform of the Nigerian Environmental Study Action Team (NEST) based at Ibadan, Nigeria. After the successful

defence of my doctoral thesis at the University of Ibadan on the 23rd day of April, 1991, the first office that I went to was that of Emeritus Professor David Okali. As soon as I informed him of the success of my oral examination, he told me that I should join NEST and he gave me the form to fill. Ever since that time, I have been sinking in the pool of knowledge on the environment. I have had the privilege of serving on the Board of NEST along with Mr. Henry Osadolor, Dr. Olasimbo Apata, Dr. Gloria Ujor (current Executive Director of NEST), Dr. Deborah Msheliza, Dr. Usman Dukku, Professors Enoch Okpara, Dan Gwary, Emmanuel Nzegbule and Chinedum Nwajiuba (current Vice-Chancellor of the Federal University, Ndufu-Alike Ikwo, Ebonyi State, Nigeria) under the distinguished chairmanship of Emeritus Professor David Okali. For affording me the opportunity to deepen my knowledge on the environment thereby turning me to an environmental troubleshooter, I thank all members of the NEST family.

My short political sojourn in Lokoja while serving as the Commissioner of Agriculture, Water Resources and Rural Development was made memorable because of the support that I received from a number of good people. Chief (Dr.) and Chief (Mrs.) Abanida hosted me early enough to enable me settle down. Friends like Bar. Sunday Fagbemi, Bar. Tunde Bello, Engr. David Alege, Chief Femi Ajisafe and Dr. Mathias Makoju gave me the necessary support to adjust to the weather of Lokoja in 1998/1999. I appreciate you all.

Colleagues who admit that I am one of their mentors led by Dr. O. J. Saliu have not stopped being interested in my progress and joy. These colleagues are spread across many Universities in and out of Nigeria. I thank them for believing in me.

A number of good shepherds have attended to my spiritual development. While growing up as a young lad at Ekinrin-Adde, Revd. Moses Olugbami of First Baptist Church was like a small god to us then. At Ilorin Revd. Gbenga Odebiri fed me with the word of God. At Mountain of Fire and Miracles Ministries, North Central Regions 3 and 19 and South West Region 5, I have enjoined worshipping under a few Regional Overseers as Pastors Precious Omolade, Zaccheus Emmanuel, Sola Adegoke, Olusola Emmanuel, Olawale E. John and Olumide Adebayo. All these men of God in the Mountain of Fire and Miracles Ministries pastor under the leadership of Dr. D. K. Olukoya the General Overseer. My prayer for them all is that their labour in the vineyard of God will not be in vain and that their anointing will not run dry in Jesus name.

I thank my jewel of inestimable value, my love, prayer partner, the manager of the home and my wife, Oluwatosin Enitan Oluwagbemi. Indeed, statistically speaking, you are better by far at alpha zero point zero one and degree of freedom of one! It was after a lecture on ecology given by Dr. Bob Dransfield in 1978 on carrying capacity and stocking rate that I prayed to God to give me two children. I want to thank God for answering me through Sarafina and Toluwa. My God has given you both to me for signs and wonders and so shall you be in Jesus name. Let me say publicly that my children are free to cremate me when I die as a way of conserving wood! Finally, I wish to honour God my Maker once again by rendering a stanza each in two hymns that I first fell in love with as a small boy at Titcombe College, Egbe, Nigeria in 1972. The first is by John Newton and the other by Carl Boberg.

Amazing grace How sweet the sound,
That saved a wretch like me!
I once was lost, but now am found,
Was blind but now I see.
When thru the woods and forest glades I wonder
And hear the birds sing sweetly in the trees,
When I look down from lofty mountain grandeur
And hear the brook and feel the gentle breeze
Chorus:
Then sings my soul, my Saviour God, to Thee,
How great Thou art, how great Thou art!
Then sings my soul, my Saviour God, to Thee;
How great Thou art, how great Thou art!

And as Madam Fanny Crosby would like me to end this lecture:

This is my story, this is my song.
Praising my Saviour all the day long,
This is my story, this is my song.
Praising my Saviour all the day long.

Mr. Vice-Chancellor Sir, ladies and gentlemen, I say *ne wewe newe buana*. God bless you all and *gracias* for listening to my story.

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