COMPETING WITH COMPETITORS IN AN ENDLESS COMPETITION

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UNIVERSITY OF IBADAN

COMPETING WITH COMPETITORS IN AN ENDLESS COMPETITION

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By

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The Vice-Chancellor, Deputy Vice-Chancellor (Administration), Deputy Vice-Chancellor (Academic), Registrar, Librarian, Provost of the College of Medicine, Dean of the Faculty of Agriculture and Forestry, Dean of the Postgraduate School, Deans of other Faculties and of Students, Directors of Institutes, Distinguished Ladies and Gentlemen.

Preamble

I give the greatest thanks to God, the Almighty Father for making it possible for me to deliver my Inaugural Lecture today. The invitation to give the Inaugural Lecture came casually from my Dean, Professor E.A. Iyayi. I thank my Head of Department Professor V.O. Adetimirin for encouraging me to deliver the Lecture. Mr. Vice-Chancellor, today's Inaugural Lecture is the 42^{nd} to be delivered from the Faculty of Agriculture and Forestry, University of Ibadan since its establishment in 1949; and the 10^{th} to be delivered from our Department of Agronomy.

Mr. Vice-Chancellor, my venture into the field of Agriculture was providential. There was a gap between the completion of my primary and the start of my secondary education. I engaged myself in vegetable crops production for sustenance before my secondary education. I served an American Priest and Lecturer, Rev. Fr. Williams Hogan Ward, S.J. from whose library I read many interesting science books, as literature, while he was away to New York on his annual leave. I became fascinated by degrees such as M.Sc. and Dip. Ed. after the names of some authors or contributors in the books. On Rev. Fr. Ward's arrival, I told him that I wanted to have M.Sc. and Dip. Ed. Degrees, though I did not understand what the degrees stood for. He looked at me through his glasses, smiled and told me that I needed secondary education. I then sat for entrance examination and I was given admission at St. Joseph's College (SJC), Ondo. Rev. Fr. Ward paid fully (£25.00) for my Form One (as it was then called). I had sound science education at SJC, but agriculture was not offered as a subject in the school at that time.

My formal initiation into the field of Agriculture started in 1975 at the School of Agriculture (Federal College of Agriculture), Akure, where I properly acquired the rudiments of agriculture, both in theory and in practice. I became keenly interested in agriculture and I won Professor Ajibola Taylor's Prize for the best student in Entomology in 1977.

Mr. Vice-Chancellor, competition among competitors started in my penultimate class (1979/80 session) at the University of Ife (now Obafemi Awolowo University, OAU), Ile-Ife when the Faculty of Agriculture was to allocate its few students (about 50 students in the whole Faculty) to various Departments. Competition was first among students for Departments; later among Departments for "adequate students" and also among Lecturers within the same Department for students' supervision. Those that had godfathers eventually had their ways, but I had, and continue to have God the Father that has been paving the ways for me through the Way, the Truth and the Life. I was finally allocated, together with three other students, to the Department of Plant Science (now Department of Crop Production and Protection) under the supervision of Professor B.A. Matanmi, an Entomologist. The allocation gave me an initial demoralization to the extent that I almost failed some of my first semester courses. I did not know the prospects in Entomology that time. Professor Matanmi aroused my interest in Entomology by giving me a project that involved field work, the growing of "ewedu", *Corchorus olitorius* and the studying of its defoliators. Results of the study earned me the winning of the prestigious Duncan's First Prize for the Best Project in Plant Science in 1981 at OAU, Ile-Ife. My first journal article in Revue De Zoologie Africain titled "The life history and habits of *Acraea eponina* (Crammer) with notes on *Acraea acerata* Hewton (*Lepidoptera Nymphalidae*)" was from the study.

Mr. Vice-Chancellor, another competition was for my choice in 1982 between the discipline of Entomology where I already won two prizes and Horticulture where I was able to sustain myself through earnings from vegetable production. I eventually settled for the discipline of Horticulture at M.Sc. level in our Department of Agronomy, University of Ibadan.

There was yet competition among the disciplines of Horticulture, Weed Science and Farming System for my choice when I was to start my Ph.D programme in 1984. The competition has been endless.

Introduction

Mr. Vice-Chancellor, Sir, Food security is a challenge of global dimension, as the population gears toward 10.5 billion against 2050 (UN 2011). To feed the 33% extra human mouths, will require an estimated 60% increase in food supplies. Global food security is a growing concern with rising food prices due to growing consumers demand, increasing demand for biofuel and other industrial uses, and increased weather variability. Availability and accessibility of food in the right quantity and quality to meet the daily dietary demand of our ever growing population can be enhanced by effective agricultural production (extensive and intensive approaches) and efficient distribution (from area of surplus to area of need/deficit). These are all influenced by competition for available limited resources between agriculture and other sectors, as well as competitions within agricultural systems.

Competition is the struggle for existence and superiority. Competition exerts a powerful force in the plant community. Competition is maximum when available resource for growth becomes limited. Competition is a negative interaction where individuals make simultaneous demands that exceed limited resources and, while both suffer, one individual suffers less.

Agriculture is an important sector of the economy with high potentials for employment generation, food security and poverty reduction. However, these potentials have remained largely untapped which has led to the dwindling performance of the agricultural sector both domestically and in the international trade over years. As at 1961, Nigeria was the leading exporter of groundnut with a world's share of 42%.

The country also had 27% of the world's palm oil export, 18% of cocoa and 1.4% of cotton as the major West African cotton exporter. This glory however declined over years hence Nigeria's dominance in the export of groundnut was eclipsed by China, United States of America (USA) and Argentina as at 2008. Indonesia and Malaysia took over in palm oil, Cote d'Ivoire and Ghana also became the leading exporter of cocoa while Mali and Burkina Faso led cotton exports. The competitors maintain their dominance due to strong marketing organizations that link the farmers to markets and provide support in the form of improved planting materials, fertilizer, credit and rural infrastructure.

Agriculture is the production of animals, plants and fungi (mushroom) for food, fiber, biofuel, medicinal and other products used to sustain and enhance human life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization. The history of agriculture dates back thousands of years, and its development has been driven and defined greatly by different climates, cultures, and technologies all of which have competing elements.

Agriculture and the Economy

Agriculture is the economic mainstay of the majority of households in Nigeria and it is a significant sector in Nigeria's economy. The important benefits of the agricultural sector to Nigeria's economy include the provision of food, contribution to the Gross Domestic Product (GDP), provision of employment, provision of raw materials for agro-allied industries and generation of foreign exchange earnings; agricultural exports were the main source of foreign exchange earnings before the advent of petroleum.

· Decline in agricultural production in Nigeria began with the advent of the petroleum boom in the early 1970s. The boom in the oil sector brought about a distortion of the labour market. The distortion in turn produced adverse effects on the production levels of both food and cash crops. These in turn, progressively made agricultural work unattractive and enhanced the lure of the cities for farm workers. Collectively, these developments worsened the low productivity, both per unit of land and per worker, due to several factors—inadequate technology, acts of nature such as drought, poor transportation and infrastructure and trade restrictions.

As food production could not keep pace with increasing population, Nigeria began to import food. It also lost its status as a net exporter of such cash crops as cocoa, palm oil and groundnuts as there were competitions from other nations for the production and exportation of these commodities. Among the major imports from the United States are wheat, sugar, milk powder and consumer-ready food products.

Competition among Infrastructures

While the availability and quality of rural infrastructure are never substitutes to efficient macroeconomic and agriculture-specific policies and the effective implementation of such policies, inadequate infrastructure can be a significant constraint to growth and productivity. Rural infrastructure like other public investments raises agricultural productivity, which in turn induces growth in the rural areas, bringing about higher agricultural wages and improved opportunities for non-farm labour. Electricity and roads are significant determinants of agricultural productivity. Rural roads provide the important connectivity with growing markets adjacent to rural areas; they also lessen input costs and transaction costs of rural producers and consumers. Access to electricity creates various income-earning opportunities for rural household, enhances rural infrastructure and agricultural productivity, and reduces transaction costs, as well as poverty reduction.

Urbanization and Farmlands

Urbanization is often considered as having negative impacts on agriculture—for instance, from the loss of agricultural land to urban expansion and an urban bias in public funding for infrastructure, services and subsidies. But the scale of urban poverty suggests little evidence of urban bias for much of the urban population, and clearly, urban demand for agricultural products has great importance for rural incomes. Agricultural producers and rural consumers also rely on urban-based enterprises for a wide range of goods and services including access to markets. So the key issue is whether the growing and changing demands for food (and other agricultural products) that an increasingly urbanized population and economy brings can help underpin agricultural and rural prosperity and sustainability within a global decline in agricultural land area per person and water constraints. To this, is now added the need to adapt to the impacts of climate change that have the potential to disrupt agriculture and urban demand, and the urban enterprises that provide producer and consumer services to rural populations (Satterthwaite 2007).

Agriculture and Mineral Resources Exploration

In various parts of Nigeria where there are activities of mineral resources explorations, such as tin mining in Jos, Plateau State, gold mining in Iperindo, Osun State, crude-oil exploitation in Niger-Delta areas, there are established evidences of pollution of agricultural fields from mineral resources explorations destroying sources of livelihood of the host communities. These interferences have led to failing rural economy, misery and conflicts between the host communities and the mineral resources exploration companies; an example is the case of Niger-Delta area of Nigeria (Ibeanu 1999).

Competition with Other Sectors

There is always an unhealthy competition by other sectors with agriculture e.g. trade competing with farmers for bank loans. To stimulate agricultural development in Nigeria, it is a general belief that the provision of credit is a precondition for technological change among the rural and small-scale farmers who constitute about 70% of the country's population. Although, over the years, government has fostered the growth of rural financial markets by providing concessionary credit to farmers, minimal results have been observed. The food and agricultural organization (FAO 1999) reported that the financial sector reforms during the late 1980 caused a decline in the flow of credit to agricultural sector of most developing countries. In Nigeria, donor agencies withheld or cut down aid drastically; treasury managers sought for less risky exposures outside agriculture and rural enterprise (Usman 2000).

Competition between Cattle Rearers and Crop Farmers

Conflicts between farmers and nomadic cattle herders have been a common feature of economic livelihood in West Africa (Tonah 2006). In the period before the beginning of the 20th century, the problem was mainly restricted to the savanna belts of West Africa. Cattle-rearing was mainly prevalent in the Guinea, Sudan and Sahel savanna belts where crop production was carried out only during the short rainy season on a small scale. This gave the cattle herders access to a vast area of grass land.

Cases of farmers-herders conflict are widespread in Nigeria in recent times. For instance, in Densina Local Government of Adamawa State, 28 people were feared killed, about 2,500 farmers were displaced and rendered homeless in the hostility between cattle rearers and farmers in the host community. Nweze (2005) stated that many farmers and herders have lost their lives and herds, while others have experienced dwindling productivity in their herds. Many cases have been reported in savanna belts of the country. It has extended to the derived savanna of Oyo state, as well as the wet rain-forest of Ondo and Ekiti States. The conflicts are a threat to peace and national stability.

The results of such conflict include destruction of crops, contamination of streams by cattle, over-grazing of land, disregard for local traditional authorities, female harassment and harassment of nomads by youths of host communities, indiscriminate bush burning and defecation of cattle on roads, cattle theft and straying of cattle. The socio-economic effects of the conflicts include reduction in crop yield and income of farmers/nomads, displacement of farmers, loss of lives and property and loss of products in storage.

Nomads and the Rustlers

Cattle rustling refers to the stealing of grazing cattle. The term is of the historical United States colloquial etymology in which context pioneer farmers lost cattle while grazing on huge ranges that were difficult to patrol for policing. Traditionally, cattle rustling has been driven by the criminal intent to expropriate cow for meat or for sale. Pertinently, it must have served as a means of primitive accumulation of cow-herd in the contexts of subsistence and commercial pastoralism. Over the years, cattle rustling has evolved into a pattern of organized crime with immense criminal sophistication and efficiency. Hence, contemporary cattle rustlers operate with modern weaponry and their operations are marked by trans-locational and trans-national syndication. This clearly underscores cattle rustling as a typical and prominent instance of 'underworld franchise' in contemporary societies. Cattle rustling is a global phenomenon. It has manifested in various scales and dimensions across the nations. For instance, in Scotland, 300 cattle were reported to have been rustled by the end of 2013 leading to the declaration of cattle rustling as a national emergency by the government (*Daily Trust Editorial*, 05 February, 2014).

In Nigeria, the prevalence of cattle rustling has been widespread, particularly in the northern part of the country where cattle raring obtains as a dominant agricultural practice. Recent developments tend to have implicated cattle rustling in the rising wave of violence in northern Nigeria, as exemplified in the phenomenon of Boko Haram insurgency and herder/farmer conflicts. This scenario has accentuated the significance of cattle rustling as a fundamental national security problem in Nigeria.

Competition within Budgetary Allocation

Nigeria's budget and fiscal management for 2015 were uniquely challenging for the country because of the consistent fall in the international price of the country's major source of revenue (oil). In addition to that particular challenge, 2015 happened to be Nigeria's general election year, politicians were deploying public resources to their electioneering over and above the normal budget priorities. Out of the total federal budget of ₦4,358 trillion, Agriculture and Rural Development Sector was allocated a total of ₦39,152 billion, representing only 0.9% of the budget. This allocation to agriculture was meagre considering the importance of agriculture to the economy.

Okada Riding and Farm Labour

The use of motorcycle for commercial service rapidly grew with the massive retrenchment of civil servants in mid 1970s. Commercial motorcycles are popularly known as "okada", "Achaba", "Going", "Express" and various local names in different parts of the country. The use of motorcycle for commercial transport service which was more or less restricted to urban centers has become popular in rural areas in recent times. Today, unemployment and underemployment has forced many people to explore the regular income and casual employment opportunities in Okada riding, which is found to be dominated by youth (Ogunrinola 2011). While the commercial motorcycle has eased the transport difficulties of many people, its operation has many negative impacts in the country. For instance, it has been linked to high rate of accidents with unprecedented mortality and morbidity, increasing air pollution from carbon emission and negative impact on farm labour.

Pests and Harvest Losses

Post-harvest Food Loss (PHL) is defined as measurable qualitative and quantitative food loss along the supply chain, starting at the time of harvest till its consumption or other end uses (Buzby and Hyman 2012). Losses can occur either due to food waste or due to inadvertent losses along the way.

Thus, food waste is the loss of edible food due to human action or inaction such as throwing away wilted produce, not consuming available food before its expiry date, or taking serving sizes beyond one's ability to consume. Food loss on the other hand, is the inadvertent loss in food quantity because of infrastructure and management limitations of a given food value chain. Food losses can either be the result of a direct quantitative loss or arise indirectly due to qualitative loss. Food loss and food waste add to contribute to post-harvest food losses.

Food losses can be quantitative as measured by decreased weight or volume, or can be qualitative, such as reduced nutrient value and unwanted changes to taste, colour, texture, or cosmetic features of food (Buzby and Hyman 2012). Quantitative food loss can be defined as reduction in weight of edible grain or food available for human consumption. The quantitative loss is caused by the reduction in yield due to factors such as spoilage, consumption by pests (insects, nematodes mites, rodents, birds and weeds) and also due to physical changes in temperature, moisture content and chemical changes (FAO 1980). The qualitative loss can occur due to incidence of pathogens, or from handling, physical changes or chemical changes in fat, carbohydrates and protein, and by contamination of mycotoxins, pesticide residues, insect fragments, or excreta of rodents and birds and their dead bodies.

Competition among Crops and Weeds

Weed is a plant growing out of place. They are effectively competing with the beneficial and desirable crop plants for space, nutrients, sunlight and water; interfere with agricultural operations and thereby reduce the yield and quality of the produce. Crop weed competition occurs in two broad aspects:

(1) Direct competition - for nutrients, moisture, light and space
(2) Indirect competition - through exudation and/ production of allelopathic chemicals

By and large, weeds appear much more adapted to agro-ecosystem than our present day crop plants. In an infested field, it is possible to identify different components of the overall competitive effect:

- Intraspecific competition between plants of the cultivated species due to inappropriate spacing
- Interspecific competition between plants of the cultivated species and weed species
- Interspecific competition between plants of the different weed species
- Intraspecific competition between plants of the same weed species

Competition between weeds and crops is expressed by altered growth and development of both species. Interspecific competition occurs when two or more species coexist in time and space and simultaneously demand a limited resource. Intraspecific competition occurs when two or more plants of the same species coexist in time and space and simultaneously demand limited resources.

Losses Caused by Weeds

The competitiveness of a weed community with a crop depends on weed species composition, time of emergence relative to crops and abundance. There is a relation between the timing of weed emergence and the pressure exerted on the crop through competition and the resulting loss in crop yield. Weed–crop competition or competitive ability of a crop can be estimated in two ways, the suppression of weed growth by crop plants and reduction of yield of crop plants by weeds.

Weed–crop competition can be divided into three basic categories; (1) weed-related factors including weed species, weed density, weed emergence time, duration of weed presence in the field, (2) crop-related factors including genetic composition, crop species, crop cultivars, canopy cover, plant height, light interception rate, leaf width and angle and (3) management-related factors including seeding rate, time, and density, time of irrigation and fertilizer application, soil and other environmental conditions and efficiency of weed control methods.

Mr. Vice-Chancellor, I will use this section to highlight my contributions to scholarship in Field Crops Farming System Research. My research in the discipline of farming system has two foci, namely Cropping System and Weed Management.

Farming System

A farming system, as defined by Agboola (1987), is the distribution of plants and animals in space and time and the combination of inputs believed to give maximum production in socio-economic, cultural and political contexts. Fresco and Westphal (1988) defined Farming System as a decision making unit comprising the farm household, cropping and livestock system that transform land, capital and labour into useful products that can be consumed or sold. A farming system may be of traditional subsistence farming type, in which two or more crops are grown on the same piece of land at the same time, or it may be a mono-cropping system and perhaps include livestock management.

Mr. Vice-chancellor, most agricultural technologies developed on-station are yet to be adopted by farmers because the researchers did not put into consideration the ecological, cultural and socio-economic circumstances of the farmers. The on-farm research approach seeks to ensure two-way linkages between various participants in the research process through a pragmatic "bottom-up" orientation. The primary objective of bottom-up research strategies have been tailoring improved technologies to potential farmer and ultimately, greater production and improved welfare. There is the need for recognition that farmers have something valuable to contribute to technology development. Thus, listening to farmers and observing what they do can help to improve the potential for increased efficiency in the allocation of research resources.

Agroforestry Experiences

Small scale farmers form the majority of the rural population. Most of them face problems of land scarcity resulting from increasing population and land tenure system, low productivity, limited availability of inputs notably fertilizer, agro-chemicals, rural infrastructure and basic farm machines. The country is experiencing rapid urbanization and population growth which demand more food, energy and fiber from increasingly less land. This often results to soil exhaustion which leads to severe land degradation and environmental disequilibrium.

Attempts at transferring western-type, high-input technology to the tropics have failed because it is economically non-feasible and ecologically unstable (Agboola, Tijani-Eniola, Eneji and Ladapo 1995). The traditionally extensive bush-fallow, slash-and-burn cultivation system (shifting cultivation) of food crop production, which is known to be stable and biologically efficient, operates effectively only when there is sufficient land to allow a long fallow period to restore soil productivity, which is exhausted during the short cropping cycle. Deforestation and increasing population together have forced traditional farmers to shorten the fallow periods, setting in motion a spiral of degradation resulting in lower crop yields (Kang et al. 1986).

Agroforestry Experiences: Alley Farming and Agroforestry in the Traditional Farming System

Our team of investigators (Agboola, Olusi, Adebowale, Ekpenyong, Tijani-Eniola, Abubakar and Struts 1992) evaluated the states of alley farming in various States in Nigeria with FAO support in 1992 and our findings showed that under the traditional farming system, the first aspect of farming activities is land clearing. Farmers' underbrush the native forest by cutting down shrubs, herbs and climbers and normally ensure that the soil is left undisturbed. Some of the shrubs that are cut down are used for staking yam; others are used for firewood. Most of the debris and refuse remaining are set on fire after the under-brushing operation, and some of the dry branches are stacked-up at the bases of big trees and burnt in order to temporarily incapacitate the big trees. After this operation, the big trees shed their leaves; thus allowing light to penetrate down to the forest floor. This practice allows light to pass through the forest canopy, which allows crops to be grown during the 2-3 years in which the land is cultivated.

Farmers using traditional practices do not aim for open, clean and clear cultivation. After burning, the big trees are left undisturbed, serving as a windbreak, and their remaining canopy helps to reduce the impact of rain. Also, the roots of the big trees hold the soil in place, thereby reducing the rate of run-off and erosion under the traditional farming system; farmers farm under trees as a form of partial shade. With the introduction of plantation systems of agriculture, the traditional farmers had little or no problem in incorporating the plantation system of agriculture into the traditional farming system. The traditional farmers developed a way of inter-planting arable crops and plantation crops on the same space of land. In this form, Agroforestry is carried out to provide food for them and their families, while the plantation crops serve as a source of cash income.

At an early stage in the growth of plantation crops, arable crops are planted in between the rows of the plantation crops since the space between rows of the plantation crops is normally wide enough, even though the rows may not be straight like in the alley cropping. Prominent legumes do colonize in some of the alleys. The early colonizers are more tolerant to the daily fluctuating temperature and water stress than the shrub legumes which appear much later.

Introduction of Alley Farming to Farmers in the Forest and Derived Savanna of Southwestern Nigeria

Alley cropping has been considered as an alternative to shifting agriculture (Kang et al. 1984). The idea of alley cropping is consistent with the traditional farming system. During the 3-4 years in which the land is continuously cultivated, farmers practice a rudimentary form of alley cropping. The major difference between the traditional agroforestry and modern concept of alley cropping is that the layout of alley cropping is more organized and the alleys are in straight lines.

Since the introduction of alley farming to southwestern Nigeria in the 1980's, emphasis has been on agronomic performance of the tree species and the associated arable crops. Much less has been done to ascertain the multiple effects of this strategy on the diffusion and adoption of alley farming amongst farmers, neither have the perceived innovation-specific characteristics that enhance adoption been investigated (Olowu, Tijani-Eniola and Aken'Ova 1994). In the light of this paucity of empirical data, we (Olowu, Tijani-Eniola and Aken'Ova 1994) designed an AFNETA-supported project to investigate farmers' awareness of alley farming and determine the adoption level of the technology at Ibadan and Ubiaja.

Results of our study showed that 80% of the farmers interviewed were aware of alley farming; 33% among them knew about the technology through the AFNETA project. Most farmers (88%), knew about alley farming through interpersonal sources, while mass media accounted for 12%. The majority of interpersonal sources were researchers. About 16% of respondents were unfavourably predisposed to alley farming, while 84% had positive attitudes. Closer investigation revealed that the farmers regarded any form of involvement of trees as agroforestry.

We (Olowu, Tijani-Eniola and Aken'Ova 1994) identified major constraints that constitute hindrances to adoption of alley farming:

- (i) Alley farming leads to low yield in farmers' fields. This is attributed to tree overcrowding or crop shading. Such a view indicates ignorance of the management of alley trees.
- (ii) Seed germination rate is low.
- (iii) Alley farming discourages mechanization.

(iv) The technology leads to regular destruction of row crops by rodents.
(v) Alley trees provide shelter for reptiles.
(vi) The tree roots make ploughing difficult and compete with crops endlessly for below ground resources.
(vii) Farmers are unwilling to re-introduce trees to the land they have spent so much time and resources to clear for cultivation.
(viii) The exotic tree species introduced as hedgerow are alien and not acceptable to some farmers.
(ix) The introduced hedgerow tree species escaped into the ecosystem and became invasive.

Root Competition in Alley Cropping

Most of the reductions in crop yield due to inter-cropping with trees have been blamed on root competition between trees and crops. Root competition for water in drier areas (Singh et al. 1989) and nutrients especially in acid soils, could constitute a major problem in agroforestry systems. According to Smucker (1992), maximum and sustainable yields are at risk if extra quantities of photoassimilates are located to root systems of plants subjected to short or long-term drought.

Roots rapidly deplete nutrients in their proximity by mass flow and diffusion. Water and mobile nutrients, such as $N0_3$-N, are taken up faster. As a result, their depletion zone extends rapidly, once they overlap, there is competition. Palaniappan (1985) suggested that plants affected by competition for soil factors are likely to have an increased root/shoot ratio. Nutrient competition occurs, where depletion zones of fine roots overlap (Young 1989). In inter-cropping, roots of different species are therefore expected to compete more for nitrogen, less for potassium and least for phosphorus (Akinnifesi, Kang and Tijani-Eniola 1995).

In a trial using three root estimation methods, it was observed that tree/crop root ratio was lower in alley cropped maize than in cowpea rotations (Akinnifesi and Tijani-Eniola, unpublished data). This was due to the relative higher root length/density of maize. Additionally, plants with higher root length and deeper rooting systems will be able to capture rapid flush of mineralized N from pruning and soil organic matter N pool better.

Alley Species and Modification of the Micro-Environment
Floral richness is an important feature of the tropical forest ecosystem. Large numbers of potentially useful volunteer species are usually present in traditional farming systems. However, traditional farm lands are undergoing rapid deterioration as a result of increasing population pressure, with the resulting practice of continuous cultivation with little or no fallow. Consequently, many valuable woody species are at the verge of extinction. Our study on the phytosociology of pioneer woody species within hedgerows of *Leuncaena leucocephalla* (Lam.) de Wit and *Senna siamea* Irwin and Barneby from 16 dispersed on-farm farmer-managed alley cropped fields in southwestern Nigeria showed that hedgerows of the two species could provide suitable niches for certain woody species. *Milicia excelsa* (Iroko) suffered less attack by a gall-forming insect (*Pyhtolama lata*) under hedgerows and could thus be conserved in alley cropping systems (Akinnifesi, Mustsaers and Tijani-Eniola 1995).

Table 1 shows the diversity and abundance of woody species within hedgerows of *L. leucocephalla* and *S. siamea.* We identified a total of 31 different species that belong to 16 different families within the alley. Species that flourish well under hedgerows are likely to be tolerant of competition below and above ground. We observed generally better soil fertility properties under the hedgerows than in the alleys between the hedgerows (table 2). Significant differences in weed biomass were also observed in the following order: Control > *Leucaene* > *Senna* (table 3).

Table 1: The Diversity and Abundance of Volunteer Woody Species in Hedgerows of *Leucaena leucocephalla* and *Senna siamea* from 16 Selected Fields

Family	Species	Mean frequency (n = 16)	
		Leucaena	Senna
Annonaceae	*Monodora tenuifolia*	-	0.06
Apocynaceae	*Funtumea africana* (Benth) stapt	1.13	1.00
Bignonaceae	*Newbouldea laevis* (P. Beauv.)	2.31	2.13
Bombacaea	*Ceiba pentandra* Linn.	0.06	0.13
Cesalpinaceae	*Dialium guineense* Linn.	0.56	0.43
Euphorbiaceae	*Alchomea cordilolia* (Schum & Thorn)	2.81	5.06
Euphorbiaceae	*Alchornea laxiflora* (Bernth)	1.69	2.00
Euphorbiaceae	*Manihot glaviozii*	1.06	0.88
Meliaceae	*Trichilla monodelphia*	-	0.06
Mimosaceae	*Albizia glabberima* (Schum & Thorn)	0.06	0.38
Mimosaceae	*Albizia zygia (DC) Macbr.*	2.25	2.63
Mimosaceae	*Parkia biglobosa* Brex. & Don.	0.19	-
Moraceae	*Antiaris toxicaria* (Lesh.)	1.63	1.81
Moraceae	*Bosqueia anglolensis* (Ficallo)	0.06	0.25
Moraceae	*Ficus exasperata* (Vahl.)	2.88	2.69
Moraceae	*Ficus mucosso* (Wetw.)	0.38	1.31
Moraceae	*Millicia excelsa* (Welw.) CC. Berg	0.75	0.52
Rapillionaceae	*Agyleceae obiqua* (P. Beauv.)	0.06	0.13
Rapillionaceae	*Agylocalyx oliphyllus* (Harm.)	0.13	-
Rapillionaceae	*Baphia nitida* (Lodd.)	0.25	0.38
Rapllionaceae	*Milletia thoningii* (Schum & Thorn.)	0.43	0.31
Rutaceae	*Fagara leprueri* (Linn.)	-	0.13
Roasceae	*Pleiocarpus baterii* (Tanb.)	0.19	0.43
Saphindaceae	*Blighia sapida* (Konig.)	0.86	0.69
Saphindaceae	Blighia unjuigata (Bak.)	0.25	0.38
Saphindaceae	*Lecanodiscus cupaniodea* (Planch)	-	0.13
Sterculiaceae	*Carapa procera*	0.443	0.48
Sterculiaceae	*Cola gigantica* (Brenar & Keay)	0.31	
Sterculiaceae	*Triplochyton scletoxylon*	0.44	0.17
Tiliaceae	*Glyphae brevis* (Spheus)	0.06	0.00
Ulmaceae	*Celtis zenkeri* (Engl. I)	-	0.13
Ulmaceae	*Sterculia toag*	0.56	0.25

Note: Sample from 5 hedgerows plots

Source: Akinnifesi, Mutsaers and Tijani-Eniola (1995)

Table 2: Effect of *Leucaena* and *Senna* Hedgerows on Nutrient Status of the Surface Soil (0-15 cm) in Ayepe

	Leucaena		Senna		Control	LSD (0.05) (n = 16)
	H*	M**	H	M		
Organic C (%)	1.72	1.78	1.87	1.60	1.29	0.5
Soil pH (H_2O)	6.6	6.6	6.7	6.6	6.7	0.3
Available P (ppm)	4.0	4.2	4.8	4.4	3.8	1.6
Exchange Ca^{2+} (meq $100g^{1}$)	9.5	8.5	8.8	8.7	7.6	2.0
Exchange Mg^{2+} (meq $100g^{1}$)	1.56	1.49	1.63	1.56	1.46	0.4
Exchange K^{+} (meq $100g^{1}$)	0.27	0.33	0.31	0.33	0.31	0.02
Exchange Na^{+} (meq $100g^{1}$)	0.15	0.15	0.14	0.16	0.21	0.03
Exchange Mn^{+} (meq 100g1)	0.20	0.19	0.18	0.19	0.19	0.02
ECEC (meq $100g^{1}$)	11.3	10.9	10.1	10.8	9.8	2.7

Notes: *H = Within hedgerow
*M = Between hedgerows

Source: Akinnifesi, Mutsaers and Tijani-Eniola (1995)

Table 3: Effect of *Leucaena* and *Senna* Hedgerow on Weed Biomass and Microsite Variables

	Weed dry weight (g m^{-2})	Bulk density (g cm^{-2})	Soil temperature (°C)	Relative light transmission (%)	
				Pruned	Unpruned
Leucaenia	55.5	1.06	27.7	47.6	53.5
Senna	52.3	1.10	27.1	32.0	46.5
Control `	72.6	1.21	28.0	100	100
LSD 05	11.1	0.12	1.5	9.8	11.2

Source: Akinnifesi, Mutsaers and Tijani-Eniola, 1995

Fertilizer Use in Cropping System

In southwestern Nigeria, the fertilizer recommendation is 15-15-15 (NPK). However, using the critical level of 0.15 cmol/kg for K, we (Agboola, Tijani-Eniola, Aiyelari and Eneji 1997) found that only about 15% of 40 selected farm soils were deficient in K. The high K content in most of the soils could be attributed to bush burning carried out before sampling. Our investigations, using the SPAT approach, continued on 10 selected farms where we used a strip cropping technique: A row of maize with a complete nutrient was compared with an adjacent row where only K was missing. In general, we realized quite close grain yields for both treatments, indicating no special K requirements. Mr. Vice-Chancellor, these experiences led to the formulation of NPK 20:10:5 instead of 15:15:15 NPK fertilizer. In another trial series, we observed a significant effect of K on plantain in an intercropping system (table 4).

We realized that in intercropping systems, K requirements could be higher due to higher above-ground and below-ground competition. Plantain intercropping with melon increased the yield of plantain by conserving moisture, reducing soil temperature and weed infestation (Agboola, Tijani-Eniola, Aiyelari and Eneji 1997).

Table 4: Effect of K on Plantain Morphological, Physiological, and yield Parameters when Intercropped with Melon (M), Maize (Mz) and Cassava (C) in 1994

K levels	Cropping system	Plant height at shooting (cm)	Number of functional leaves at shooting	Number of days to shooting	Total bunch weight (t ha^{-1})
0	P+M	290.38bede	8.50bed	511.00a	4.20f
	P+Mz	257.31f	6.50g	511.75a	4.02f
	P+C	280.91ede	8.00de	438.50b	3.26g
150	P+M	312.38b	8.50bed	420.00b	6.84c
	P+Mz	263.60cf	6.88fg	414.00bc	5.74d
	P+C	283.38edef	8.13de	391.00cd	4.96c
300	P+M	349.00a	9.13ab	362.50e	9.97a
	P+Mz	289.12bede	8.00dc	360.00c	7.06c
	P+C	306.39bc	8.63bcd	356.00ef	5.66d
450	P+M	363.50a	9.38a	330.00f	10.39a
	P+Mz	285.67bede	8.00de	359.00cf	8.84b
	P+C	306.86bc	8.38cd	344.25ef	6.75c
600	P+M	345.40a	9.00abc	340.00ef	10.11a
	P+M	275.83def	7.50ef	364.50de	8.67b
	P+C	293.13bed	8.50bed	341.25ef	6.91c

Data from Average of four Farmers

Means followed by the same letter in a column are not significantly different by Duncan's Multiple Range Test at the 5% level.

Source: Agboola, Tijani-Eniola, Aiyelari and Eneji (1997)

My Research Experience in Multiple Cropping

Multiple cropping is essentially the intercropping of two or more crops on the same piece of land during the same year. Intercrop interaction is either in space or in time sequence. Common intercropping systems are characterized by spatial arrangements such as mixed, row, alternate row, strip, relay, sequential and multi-story cropping systems. African farmers have for long recognised the role of intercropping not only as insurance against crop failure, but also as convenient strategy for dietary purposes. Starch crops like yam, cassava and maize are intercropped with legumes such as cowpea, soybean, pigeon pea, groundnut and vegetable crops. Many workers agree that this system is sustainable and compatible with the traditional farming system (Tijani-Eniola and

Akinnifesi 1996; Akinyemi and Tijani-Eniola 1997; Tijani-Eniola and Nwagwu 2001).

Maize is one of the staple foods in Nigeria and it features prominently in intercropping systems (Ogungbaigbe, Tijani-Eniola and Akanbi 1996). Results of our study on comparative effects of intercropping melon, cowpea and sweet potato with maize indicated that intercropping the different crop species was very productive (table 5).

Table 5: Productivity Indices of Intercropped Maize with Melon, Cowpea and Sweet potato Cropping System

	Maize/Melon	Maize/Cowpea	Maize/Sweet potato
Maize yield (t/ha)	4.84	4.23	3.65
Melon yield (t/ha)	0.174	-	-
Cowpea yield (t/ha)	-	0.28	-
Sweet potato yield (t/ha)	-	-	6.36
LER	1.47	1.52	1.44
CAI (N/ha)	127.0	6,000	29,120

LER = Land equivalent ratio
CAI = Cash advantage due to intercropping
₦ = Naira

Source: Ogungbaigbe, Tijani-Eniola, and Akanbi (1996)

Groundnut is one of the most important grain leguminous crops in Nigeria where it is commonly intercropped with cassava, maize and other cereal crops. Aduramigba-Modupe and Tijani-Eniola (2001) evaluated the performance of groundnut at three densities in a cassava/groundnut intercrop on-farm and on-station. Our results showed that groundnut yield was depressed by as much as 23% on-station with increasing plant densities, while groundnut yield actually increased by up to 15% on farmer-managed plots (tables 6 and 7). In the context of traditional farming systems, our results suggested that groundnut population is an important factor in cassava/ groundnut intercropping system.

Table 6: Growth and Performance of Groundnut (GN) at three Densities in Groundnut/Cassava (CS) Intercrops in Farmers' Field

Cropping system	Plant height (cm)			Leaf area index (cm^2)			Pods/ plant	Grain yield (kg ha^{-1})	100-wt (g)	Relative yield
	Weeks after planting									
	4	8	12	4	8	12				
Sole GN (80,000)	22.0	36.6	51.8	0.49	3.52	3.14	10.4	345	53.6	1.00
Sole GN (100,000)	24.0	39.6	51.8	0.65	4.83	4.25	6.0	306	59.4	1.00
Sole GN (160,000)	26.4	43.9	61.8	0.60	4.36	3.64	2.5	182	57.6	1.00
GN (80,000) + CS	24.7	38.5	61.8	0.55	3.46	3.01	6.6	176	46.6	0.51
GN (100,000) + CS	23.3	36.9	55.5	0.68	4.19	3.76	8.2	346	50.9	1.13
GN (160,000) + CS	25.5	40.9	55.8	0.56	3.41	2.71	3.4	209	55.0	1.15
LSD (0.05)	2.2	ns	ns	0.12	0.86	0.63	Ns	Ns	6.7	-

ns = Not significant at P<0.05; GN = groundnut; CS = Cassava

Source: Aduramigba and Tijani-Eniola (2003)

Table 7: Growth and Performance of Groundnut (GN) at Three Densities in Groundnut/Cassava (CS) Intercrops in Researcher's Field

Cropping system	Plant height (cm)			Leaf area index (cm^2)			Pods/ plant	Grain yield (kg ha^{-1})	100-wt (g)	Relative yield
	Weeks after planting									
	4	8	12	4	8	12				
Sole GN (80,000)	21.3	34.2	60.3	0.54	3.39	2.42	5.7	142	42.3	1.00
Sole GN (100,000)	23.6	35.5	67.2	0.79	4.88	3.48	5.5	177	38.9	1.00
Sole GN (160,000)	23.5	39.2	69.1	0.68	3.86	3.26	2.5	141	47.3	1.00
GN (80,000) + CS	21.8	34.9	62.8	0.48	3.84	3.02	5.5	122	39.8	0.86
GN (100,000) + CS	23.5	36.4	60.9	0.73	4.17	3.73	5.2	146	36.0	0.82
GN (160,000) + CS	25.9	41.4	66.9	0.65	4.39	2.84	2.6	108	37.0	0.77
LSD (0.05)	2.2	ns	ns	0.12	0.86	0.63	Ns	ns	6.7	-

ns = Not significant at P<0.05; GN = groundnut; CS = Cassava

Source: Aduramigba and Tijani-Eniola (2001)

In another experiment, Tijani-Eniola and Akinnifesi (1996) determined the biophysical compatibility of soybean and cassava intercrop and the optimum time for introducing cassava in soybean-based intercropping systems. Our results indicated that soybean yield was generally reduced by intercropping (table 8) while the land equivalent ratio increased with the growth stage of soybean prior to the introduction of the cassava component. Cassava tuber yield was enhanced by soybean intercrop (table 9).

Akinyemi and Tijani-Eniola (1999) assessed the appropriate cassava density in intercrop with plantain for optimal yield. Plantain (1,666 stands/ha) was intercropped with three different densities of cassava. Our results indicated that plantain yield, bunch weight and number of fingers per bunch were reduced by very high cassava populations. Cassava intercrop at 5,000 plants/ha gave higher returns than any other combination. Cassava yield was, however, enhanced by intercropping.

Akinyemi and Tijani-Eniola (2001) also determined the optimum population densities of melon, maize and cassava compatible with plantain under intercropping. Results of our study showed that melon had no negative effect on plantain growth, but maize and cassava delayed plantain shooting by 34 and 159 days, respectively. Akinyemi and Tijani-Eniola (2001) reported that intercropping melon with plantain gave the best economic returns.

Cocoyam is widely cultivated and eaten in Nigeria. The production trend of this crop has been declining. Constraints to cocoyam production have been reported to include, among others: lack of adequate research attention, pests and diseases, limited ecology and poor cultural practices (Hahn 1994). Tijani-Eniola and Nwagwu (2001) assessed the compatibility of cocoyam, melon and pumpkin in intercropping system under tilled and no tillage practices. It was observed that tillage had no significant effect on crop yield, but pumpkin reduced the number of leaves of the cocoyam on heaped seedbeds. On the other hand, cocoyam yield was enhanced by intercropping with melon (Tijani-Eniola and Nwagwu 2001).

Tijani-Eniola, Nwagwu and Aiyelari (2000) assessed the response of *Celosia argentea* to different nitrogen sources and frequency of harvest. Our results showed that NPK (15:15:15) proved a better source of N than diammonium phosphate (DAP, 16:48:0) for adequate nutrient balance, in the plant and soil. In addition, harvesting at 10-day intervals gave greater yield and income than any of the other harvesting frequencies attempted.

In another study, Aduramigba-Modupe, Tijani-Eniola and Jagtap (2001) investigated the effects of N (0; 60 kg ha^{-1}) and fractional recovery modulated P (0; 15; 30; 60 kg ha^{-1}) on mineral N and P dynamics, uptake and budget using sole soybean as the test crop. Our findings showed increasing total mineral N with increased P, while the reverse was the response of the cumulative mineral P. Higher soybean yield was obtained with increased N and P application, with a similar trend being observed for nitrogen balance. In another experiment, the highest soybean grain yield was obtained at 30 kg N/ha while that of maize was at 60 kg N/ha (Tijani-Eniola, Togun, Ihekandu and Adegbite 2000).

Plantain (*Musa* AAB) plays a dominant role in farming systems of the forest zone in Nigeria. Akinyemi and Tijani-Eniola (2001) investigated the effects of K on the productivity of plantain grown under different cropping systems. We observed that potassium use efficiency decreased with increasing rates of K, though K application above 360 kg/ha significantly increased plantain yield and bunch weight (table 10). Our study showed that the best crop to be grown with plantain as intercrop was melon and the highest yield that was obtained was 10.39 t/ha at 360 kg K/ha (Akinyemi, Tijani-Eniola and Olaleye 2003).

In a study conducted in 1998 and 1999 to quantify P fractions under natural fallow (NF) and *Pueraria* cover fallow, Kolawole, Tian and Tijani-Eniola (2003) observed that P was reallocated to non-readily available organic P fractions irrespective of fallow type and previous land use. Biomass production under the two fallow types was comparative and increased linearly with fallow age reaching slightly above 7 t DM/ha after 8 months of fallow. Soils with natural bush fallow had higher NaOH-extractable inorganic P fractions than those with *Pueraria* fallow (table 11).

In another study aimed at determining the effects of burning, incorporation and surface mulching after one year of natural regrowth (NF) and *Pueraria* cover crop fallows on soil P fractions and maize and cassava yields, Kolawole, Tijani-Eniola and Tian (2003) observed that fallow systems and residue management options had no consistent and significant effect on P availability within the short period of two years of the study (table 12).

Table 8: Growth and Yield of Cassava at different Planting Dates in a Soybean + Cassava Intercrop

Cropping system	Growth at 50% Soybean flowering		Growth at harvest			Tuber at harvest			
	Height (cm)	Diameter (cm)	Plant height (cm)	Number of stems stand^{-1}	Stem weight	Number stand^{-1}	Length (cm)	Diameter (cm)	Fresh weight (kg ha^{-1})
Sole cassava (0 WAP)	24.5	5.8	351.5	1.8	3.1	8.0	32.7	7.1	33.8
Soybean + cassava (0 WAP)	31.6	5.3	338.8	1.6	3.0	7.7	35.5	7.1	31.0
Sole cassava (2 WAP)	24.8	8.0	377.3	2.2	2.5	6.3	27.9	8.4	22.8
Soybean + cassava (2 WAP)	30.8	5.2	361.5	1.4	2.3	7.5	80.6	7.5	26.6
Sole cassava (4 WAP)	9.0	4.6	360.6	2.4	3.2	7.9	29.2	7.5	27.8
Soybean + cassava (4 WAP)	17.6	4.3	304.5	1.6	2.5	7.1	28.9	6.6	30.7
Sole cassava (6 WAP)	-	-	382.0	2.2	2.8	8.1	32.0	7.7	81.4
Soybean + cassava (6 WAP)	-	-	340.2	2.0	2.5	9.9	27.7	6.1	33.8
LSD (0.05)	4.1	0.9	ns	0.7	ns	1.7	7.3	ns	2.7

ns = not significant at 5% level of probability
WAP = Weeks after planting

Source: Tijani-Eniola and Akinnifesi (1996)

Table 9: Assessment of Competitive and Yield Advantage in a Soybean + Cassava Intercrop in Researcher Managed Field

Cropping system	Land equivalent ratio		Relative yield Total (RYT)	Aggressivity of intercrop
	Soybean	Cassava		
Soybean + cassava (0 WAP)	0.60	0.93	1.54	0.33
Soybean + cassava (2 WAP)	0.65	1.17	1.82	0.52
Soybean + cassava (4 WAP)	0.85	1.10	1.95	0.25
Soybean + cassava (6 WAP)	0.98	1.08	2.06	0.10
LSD (0.05)	0.19	0.14	0.97	0.12

*Aggressivity values are positive for cassava and negative for soybean
WAP = Weeks after planting

Source: Tijani-Eniola and Akinnifesi (1996)

Table 10: Plantain Yield Components and Potassium-use Efficiency (KUE) of Plantain (P) in Intercropping Systems with Melon, Maize and Cassava

Cropping systems	K rates (kg ha^{-1})	Plantain bunch yield (t ha^{-1})	KUE	Days to 50% shooting
Plantain (sole)	0	3.96	-	496a
	120	6.25	19	450b
	240	8.95	21	380cd
	360	9.47	15	350efg
	480	9.04	11	330gh
Plantain +Melon	0	4.01	-	505a
	120	6.60	22	442b
	240	8.86	20	385cd
	360	9.58	15	372cde
	480	9.22	11	363de
Plantain +Maize	0	4.14	-	374cde
	120	5.27	9	323h
	240	6.45	10	305ij
	360	7.94	10	295j
	480	7.56	7	284j
Plantain + Cassava	0	3.50	-	442b
	120	4.24	6	392c
	240	5.34	8	352efg
	360	6.83	9	342gh
	480	5.58	4	349fg

Source: Akinyemi and Tijani-Eniola (2001)

Table 11: Mean Values of Phosphorous Fractions (mg kg^{-1}) under different Fallow Systems, Crop/Fallow Ratio and Length of Fallow (months after fallow) at Ibadan, South-Western Nigeria

	Resin P	$NaHCO_3$-Pi	$NaHCO_3$-Po	NaOH-Pi	NaOH-Po	Conc. HCl-Po	Total P
Fallow systems							
Natural fallow	0.81*	1.70	6.32	6.40a	17.45	20.19	85.26
Pueraria	0.71	1.30	7.05	5.14b	18.27	15.64	76.96
Crop/fallow ratio							
1:1	0.75	1.55	5.99	5.61	17.69	15.99	77.03
1:2	0.82	1.63	6.73	5.71	17.96	18.92	83.99
1:3	0.72	1.33	7.33	5.98	17.94	18.83	82.31
Length of fallow (months)							
0	0.47b	1.44	9.80a	7.58a	10.63b	15.60c	77.41bc
4	1.53a	1.57	4.82c	6.35a	20.76a	7.32d	73.67c
8	0.49b	1.44	6.92b	4.49b	19.80a	22.16b	84.47ab
12	0.56b	1.57	5.19bc	4.66b	20.26a	26.58a	88.90a

*Means followed by different letters within a column are significantly different at $P = \leq 0.05$. absence of letters indicates no significant differences. Pi = inorganic P; Po = organic P.

Source: Kolawole, Tian and Tijani-Eniola (2003)

Table 12: Effects of Residue Management on Maize and Cassava Yields after Natural or Pueraria Fallows

Residue management	Maize grain (kg ha^{-1})					
	1998			1999		
	Nat. fallow	Pueraria	Residue mgt. mean	Nat. fallow	Pueraria	Residue mgt. mean
Burning	2029	1898	1995	745ab	993b	869b
Incorporation	1859	1898	1879	965a	1571a	1268a
Mulching	2085	2208	2147	493b	837b	665b
Fallow system means	2012	2001		734	1134	
	Cassava fresh tuber (t ha^{-1})					
Burning	5.4	5.6	5.5	12.8	13.3b	13.1ab
Incorporation	6.3	5.6	6.0	14.1	19.3a	16.7a
Mulching	6.6	5.8	6.2	9.0	14.2b	11.6b
Fallow system means	6.1	5.7		12.0	15.6	

Source: Kolawole, Tijani-Eniola and Tian (2003)

Kolawole, Tian and Tijani-Eniola (2003) also reported that labile P fractions in soil increased as the duration of the fallow increased with consequent increase in P uptakes by maize and cassava crops; P was transformed from a form unavailable to plants to available form during fallow (table 13).

Table 13: Effects of Fallow Systems and Fallow Lengths on Dry Matter Production (DM) and P Accumulation of Fallow Vegetation

	1998		1999	
	DM (kg ha^{-1})	P content (kg ha^{-1})	DM (kg ha^{-1})	P content (kg ha^{-1})
Natural fallow				
Duration				
0	2222	1.4	2249	1.5
1	3860	4.2	8283	8.9
2	11 784	10.1	13 322	11.1
3	10 131	9.4	13 208	12.1
Mean	6999	7.9	11 604	10.7
Pueraria fallow				
0	2012	1.3	3600	1.9
1	5741	6.3	7845	6.1
2	7416	9.7	9608	12.5
3	5751	7.4	11 292	13.5
Mean	5230	7.8	9582	10.7
s.e.d.				
Between fallow system	632	1.5	711	1.8
Between fallow durations	894	2.2	1006	2.6
Between fallow duration means at same fallow system	1264	3.1	1422	3.7

Source: Kolawole, Tian and Tijani-Eniola (2004)

Continuous use of inorganic fertilizers on farmers' plots has low acceptability, while organic fertilizers may be slow in upgrading soil properties. In addition, soil types can also influence the efficiency of fertilizers. The effects of organic, organomineral and NPK fertilizers on soil pH, organic matter and micronutrient contents in two soil types (Orthic Luvisol and Dystric Fuvisol) in Lagos State were investigated (Makinde, Tijani-Eniola and Fagbola 2009). The results of our study showed that soil pH and organic carbon were positively influenced by the application of organic and organomineral fertilizers. The micronutrient status of the soil was also enhanced (Makinde, Tijani-Eniola and Fagbola 2009).

Leafy vegetables are essential components of daily food intake for both the rural and urban dwellers. They provide the much needed vitamins, minerals and supplementary protein for majority of the populace that depends largely on starch staples (Tijani-Eniola 2002). Tijani-Eniola (2002) investigated the response of *Celosia argente34a* to two tillage techniques and four planting densities. The crops on raised seedbeds grew and yielded better than those on zero tillage. Optimal yield was obtained under a planting density of 444, 444 plants/ha (Tijani-Eniola 2002).

Ayepe On-Farm Experience

Ayepe On-Farm Research (OFR) started in 1986 as a tripartite collaborative effort involving the International Institute of Tropical Agriculture (IITA), Ibadan, the University of Ibadan (UI) and old Oyo State (Oyo State and the State of Osun) Ministries of Agriculture and Natural Resources (MANR) under the coordination of Dr. H.J.W. Mutsaers of IITA. I later coordinated the project from 1991 to 1994. The project from its inception was funded by Ford Foundation.

Ayepe On-Farm Research has as its primary objective, the development of farming systems methodologies. Other objectives include the provision of field/social laboratory forum for postgraduate students embarking on farming systems research as well as providing research facilities to IITA and UI Scientists. Research efforts in the project under IITA management have been largely directed at crops under IITA mandate. The University of Ibadan took over total control of the project in 1993. Consequent upon this change, the main objective of the project was broadened to: the development of on-farm methodologies for arable and permanent crops as well as livestock through an inter-disciplinary approach. This new direction was concretized by synthesizing past research activities as well as elucidating their effects as a first step towards delineating areas of research concentration and identifying new frontiers of farming system research within the project site. This reasoning informed the Baseline Survey of Ayepe On-Farm Research Area by H. Tijani-Eniola, Department of Agronomy; T.A. Olowu, Department of Agricultural Extension and Rural Development and F. Okumadewa, Department of Agricultural Economics. The baseline survey served as a bench mark for future assessment of the project.

The objectives of the survey were to:

(i) Assess the impact of the On-Farm-Research Programme on Ayepe inhabitants.
(ii) Determine the socio-economic status of Ayepe inhabitants.
(iii) Investigate the agronomic practices status of Ayepe inhabitants.
(iv) Collate and summarize all research efforts of the project.
(v) Outline research themes and programmes for future development of Ayepe On-Farm research area.

In the survey, abstracts of graduate research at Ayepe were collated and the socio-economic characteristics of households were determined

It was observed that the top five problems encountered by Ayepe farmers in their cropping enterprises were pests/rodents (77.4%), lack of fertilizers (45.2%), lack of chemicals/insecticides (22.6%), lack of credit facilities (19%) and diseases (17.9%) as shown in table 14.

Table 14: Constraints to Crop Production at Ayepe On-Farm Research Project Area

	Constraints	Frequency	Percent
1	Rodents/pests	65	77.4
2	Lack of fertilizers	38	45.2
3	Chemicals/Insecticides	19	22.6
4	Credit facilities	16	19
5	Diseases	15	17.9
6	Drought	2	2.4
7	Transportation	3	3.6
8	Processing	13	15.5
9	Harvesting/storage	11	13.1
10	Labour	10	11.9
11	Weeds	2	2.4
12	Others	19	22.6

*Total frequency more than 84 as respondents could give multiple responses.

Source: Tijani-Eniola, Olowu and Okumadewa (1995)

Availability of Agricultural Inputs and Support Services

Ayepe Project though basically concerned with field research and development of farming system methodologies, it is important to have an overview of the agricultural support system within Ayepe communities if the researches embarked upon are to be properly interpreted within their particular context. Table 15 shows that Ayepe community does not have a supportive agricultural input/services environment. However, there was provision of improved seeds. This may not be unrelated to the provision of improved cassava cuttings to the community as well as the assistance, usually given to the farmers in the purchase of improved soybeans and maize seeds.

Results of our survey indicated the need for better interaction between the researchers and the extension workers. Adult literacy was recommended to increase the ability of farmers to appreciate improved technologies. In reaching out to farmers, a multi-media approach was recommended.

Table 15: Availability of Agricultural Inputs and Services at Ayepe On-Farm Research Area

	Services/Inputs	Always	Often	Seldom	Never
1	Improved seeds	37(44)*	10(11.9)	8(9.5)	29(34.5)
2	Fertilizer	10(11.9)	2(2.4)	24(28.6)	65(57.2)
3	Pesticides	12(14.3)	5(5.9)	2(0.4)	65(77.4)
4	Agricultural credit	1(1.2)	0(0)	4(4.8)	79(84.1)
5	Tractor service	0(0)	0(0)	0(0)	84(100)
6	Agricultural Extension	7(8.3)	3(3.6)	20(23.8)	54(64.3)

*Figures in parenthesis are percentages.

Source: Tijani-Eniola, Olowu and Okumadewa (1995)

Weed Management

Weeds are plants growing where they are not desired. They effectively compete with beneficial and desirable crop plants for space, nutrients, sunlight and water. They interfere with agricultural operations and thereby reduce the yield and quality of the produce. The approaches in weed management include cultural method mainly by hand weeding at different weeding regimes for various crops, biological method using low growing crops, chemical method using various herbicides and integrated weed management practices.

Tijani-Eniola and Akinnifesi (1998) investigated the effect of weeding regimes and crop spacing on the performance of soybean (*Glycine max* (L.) Merill). Our findings indicated that weed density and biomass decreased with crop growth due to canopy closure. Greater weed suppression was achieved at 50 cm than 75 cm and 100 cm inter-row spacing. One weeding reduced weed biomass by 70% compared to no weed control; soybean grain yield was increased by 72-79% when soybean was weeded once compared to no weeding. The effect of one additional weeding to the growth and yield of soybean was not significant (tables 16 and 17). The critical weed interference period required for soybean in our study was established at 3-6 weeks after sowing (WAS), after which weed competition was not important. Our results indicated that weeding done during 4-5 WAS could be cost effective, while extra weeding was considered superfluous.

Table 16: Growth Attributes of Soybean as affected by Spacing and Wedding Regimes

Weeding regimes spacing (cm)		Pint height (cm)*		Number of branches* (cm)		Number of pod/plant **	
		1992	1993	1992	1993	1992	1993
No weeding							
	5x50	39.7	45.2	7	7	12.1	13.0
	5x75	41.9	40.1	7	7	15.4	13.3
	5x100	35.7	41.9	7	7	12.7	10.2
One weeding							
	5x50	41.4	38.3	8	8	27.7	30.4
	5x75	38.3	44.3	8	8	27.8	31.6
	5x100	36.3	36.3	8	8	21.6	23.2
Two weedings							
	5x50	36.9	39.4	8	8	33.4	34.8
	5x75	39.1	39.4	8	8	27.5	32.9
	5x100	34.8	40.5	8	8	27.5	23.9
+LSD (0.05)							
Year		Ns			0.3	2.6	
Spacing		Ns			0.3	3.0	
Weeding regime		Ns			0.2	6.2	

*At 50% flowering: **At full podding (excluding aborted pods).
*The LSD compares the same given parameter for the two years.

Source: Tijani-Eniola and Akinnifesi (1998)

Table 17: Grain yield (kg/ha) of soybean as affected by interrow spacing (cm) and weeding regimes, 1992 and 1993

		Weeding regime			
Year	Spacing	0	1	2	Mean
1992	5x50	338(1.9)a	1676(9.3)	2419(10.3)	1485(7.2)
	5x75	190(1.20	936(6.5)	1910(11.5)	1012(6.4)
	5x100	183(1.5)	717(5.7)	1649(13.2)	850(6.8)
	Mean	237(1.5)	1110(7.2)	1993(11.7)	1116(6.8)
1993	5x50	523(2.5)	1697(7.2)	2204(8.5)	1475(6.0)
	5x75	313(1.5)	1166(7.1)	1860(7.3)	1113(5.3)
	5x100	206(1.0)	982(6.4)	1922(11.4)	1037(6.3)
	Mean	347(1.7)	1282(6.9)	1995(9.1)	1208(5.9)
LSD		Year		197(ns)	
		Spacing		235(ns)	
		Weeding regime		315(9.4)	

a. Values in parenthesis indicate seed yield in g/plant

Source: Tijani-Eniola and Akinnifesi (1998)

More than 70% of Nigerian farmers remain peasant. They cultivate less than 2 ha of land and depend mainly on manual labour. Michael and Tijani-Eniola (2009) in a survey of the 16 local governments of Taraba State reported that majority of the farmers were male (86%) and aged between 21-30 years (40%). We observed that farm size was smaller in the mountain zone (< 1 ha) compared with 1-3 ha in other zones. Majority of farmers in the northern (62.2%) and southern (57.1%) zones indicated that grasses were more prominent than broad leave weeds on their farms compared to those in the forest and semi-temperate zone. Manual weeding was the most common practice (62%) followed by the use of herbicides (25%), while cover crops were less than (6%). Farmers in all the zones indicated that weed infestation reduced fertilizer use efficiency, hindered harvesting, increased pest attack and caused grainless cobs in maize.

In another experiment, Tijani-Eniola, Ndaeyo, Aiyelari and Nwagwu (2003) investigated the response of soybean to crop density and delayed weeding and reported that no weeding and delayed weeding generally reduced soybean performance; while soybean grain yield increased with planting density. Using melon and pumpkin as cover crops, Nwagwu, Tijani-Eniola and Chia (2000) assessed the influence of tillage regimes and cover crops on weed control in cocoyam field. The results of our study showed that weed density was highest at 6 Weeks after Planting (WAP) when crop canopy had not closed; while the least weed densities were recorded 10 WAP during two cropping seasons.

Pumpkin significantly reduced weed density irrespective of the tillage method. In another study, Akinyemi and Tijani-Eniola (1997) reported that intercropping plantain with 20,000 stands of melon per hectare gave better plantain yield, melon vine coverage and reduced weed emergence.

Tijani-Eniola (2001) investigated the effects of spacing and duration of weed association on cowpea growth and yield. Results of the study showed that delayed weeding up to 5 WAS caused 49% reduction in the grain yield of cowpea, while unweeded plot suffered 69% yield reduction (tables 18a and 18b).

Table 18(a): Effects of Intra-row Spacing and Weeding Regime on Cowpea Growth and Yield Components in Ibadan in 1997

Intra-row spacing (cm)	Weeding treatment	Plant height (cm)		Numbers of leaves/Plant		Number of branches/Plant		50% Flowering	Pod weight (t/ha)	Grain yield (t/ha)
		4 WAS	6 WAS	4 WAS	6 WAS	4 WAS	6 WAS			
75cm x 25cm										
	Unweeded check	26.2a	29.7a	11.0b	18.5b	2.2b	3.0b	47.0a	1.4d	0.6c
	Regular weeding	23.0b	26.9b	14.8a	29.2a	2.8b	5.4a	49.1a	3.8a	1.7a
	one weeding at 3 WAS	23.1b	27.1b	13.5a	27.5a	2.8b	4.6ab	49.0a	3.8a	1.7a
	one weeding at 4 WAS	23.1b	27.1b	12.6ab	22.4b	2.0b	4.2ab	47.0a	2.9b	1.2b
	One weeding at 5 WAS	24.7ab	29.0a	11.5b	19.6bc	2.0b	3.2b	48.0a	1.9c	0.9c
75cm x 20cm	Unweeded check	26.4a	29.8a	10.5b	20.0b	2.4b	3.2b	46.0a	1.5d	0.7c
	Regular weeding	23.2b	27.1b	14.0a	30.6a	3.5a	4.8ab	49.0a	3.9a	1.8a
	One weeding at 3 WAS	23.5b	27.3b	13.2a	29.0a	3.8a	4.6ab	48.0a	3.9a	1.8a
	One weeding at 4 WAS	23.4b	28.3ab	12.0ab	23.5b	2.0b	4.5ab	47.0a	2.8b	1.2b
	One weeding at 5 WAS	25.0ab	29.2a	11.0b	21.0b	2.0b	3.0b	47.0a	1.9c	0.8c
75cm x 15cm	Unweeded check	26.2a	29.6b	10.4b	18.2c	2.0b	3.0b	47.0a	1.8c	0.7c
	Regular weeding	23.1b	27.0b	13.5a	28.6a	2.5b	4.5ab	49.0a	4.0a	1.9a
	One weeding at 3 WAS	22.7b	27.2b	12.5ab	27.0a	2.5b	4.0ab	49.0a	4.0a	1.8a
	One weeding at 4 WAS	20.2b	28.2ab	11.5b	24.4b	2.2b	3.8ab	48.0a	2.9b	1.3b
	One weeding at 5 WAS	24.8ab	29.1a	10.5b	19.0bc	2.0b	3.0b	47.0a	1.9c	0.8c

WAS = Weeks After Sowing
Means followed by the same letter(s) in the same column are not significantly different at 5% level of probability using DMRT

Source: Tijani-Eniola (2001)

Table 18(b): Effects of Intra-row Spacing and Weeding Regime on Cowpea Growth and Yield Components in Ibadan in 1998

Intra-row spacing (cm)	Weeding treatment	Plant height (cm)		Numbers of leaves/Plant		Number of branches/Plant		Days to 50% Flowering	Pod weight (t/ha)	Grain yield (t/ha)
		4 WAS	6 WAS	4 WAS	6 WAS	4 WAS	6 WAS			
75cm x 25cm										
	Unweeded check	20.2a	28.3a	9.0b	17.5b	2.8a	4.7a	46.8a	0.6c	0.7b
	Regular weeding	18.1b	25.3b	11.3a	21.1a	3.0a	4.7a	48.0a	1.7a	2.0a
	one weeding at 3 WAS	18.1b	25.3b	10.7a	20.5a	2.8a	4.9a	48.0a	1.7b	2.0a
	one weeding at 4 WAS	18.3ab	27.1a	10.5a	20.6a	2.7a	4.7a	48.0a	1.2b	1.8a
	One weeding at 5 WAS	20.3ab	27.1a	9.2b	18.6b	2.8a	4.8a	46.0a	0.9c	1.7a
75cm x 20cm	Unweeded check	20.2a	28.3a	8.9b	17.3b	2.8a	4.4a	46.8a	0.7c	0.9b
	Regular weeding	18.5ab	26.3ab	11.2a	20.5a	3.0a	4.5a	47.8a	1.8a	2.3a
	One weeding at 3 WAS	18.9ab	26.5ab	10.6a	20.1a	2.8a	4.6a	48.0a	1.8a	2.2a
	One weeding at 4 WAS	18.7ab	26.9ab	10.4a	20.1a	2.7a	4.4a	47.8a	1.2b	2.0a
	One weeding at 5 WAS	19.7a	27.0a	9.2b	16.6b	2.8a	4.9a	46.8a	0.8c	1.8a
75cm x 15cm	Unweeded check	21.5a	27.2a	9.5ab	12.7c	2.7a	4.8a	46.8a	0.7c	1.0ab
	Regular weeding	20.1a	28.9b	11.8a	20.2a	2.9a	4.3a	48.0a	1.9a	2.2a
	One weeding at 3 WAS	20.1a	26.2ab	11.2a	20.7a	2.7a	4.5a	48.0a	1.8a	2.2a
	One weeding at 4 WAS	20.4a	26.6ab	11.0a	20.5a	2.6a	4.3a	48.0a	1.3b	1.0a
	One weeding at 5 WAS	21.4a	26.7ab	9.0b	18.5b	2.7a	4.4a	47.0a	0.8c	1.0a

WAS = Weeks after Sowing
Means followed by the same letter(s) in the same column are not significantly different at 5% level of probability using DMRT

Source: Tijani-Eniola (2001)

Weed occurrence, composition and density are a reflection of agricultural methods being practiced. Okore, Tijani-Eniola, Agboola and Nwagwu (2001) studied the influence of three land clearing techniques—slash and burn (SB) bulldozed not windrowed (BNW) and bulldozed and windrowed (BN) on the changes in weed flora and composition under continuous arable crop productions at Lisagbede, Ondo State. Results of our study showed that weed species diversity increased with prolonged cropping. Mechanized land clearing with windrowing promoted weed infestation.

In another study, Okore, Tijani-Eniola, Agboola and Aiyelari (2006) assessed the impact of land clearing methods and cropping systems on labile soil C and N pools in the humid forest zone of Nigeria. The results of our study indicated that the degree of losses (compared to the adjacent matured high forest) in labile soil C and N pools upon the conversion of a humid tropical forest to arable land depended on the method deployed in removing the natural vegetation. We observed that the magnitude of losses was in the order, bulldozed windrowed > bulldozed non-windrowed > slash and burn. While among the cropping systems, it was 5-year cropping > 4-year cropping /2-year cassava fallow.

In Nigeria, weed control accounts for about one third of the maintenance cost in immature rubber plantations (Esekhade et al. 1996). The influence of 11 rubber-based cropping systems was evaluated on weed species composition, density and weed biomass (Esekhade, Tijani-Eniola and Aiyelari 2003). Results of our study showed that weed biomas was least under rubber-cassava intercrop. Our study also showed that the use of intercrop significantly enhanced weed management in young rubber plantations.

Allelopathic Activities of Some Weeds

Siam weed (*Chromolaena odorata* (L) R.M. King and Robinson) and wild poinsettia (*Euphorbia heterophylla* L.) are among the troublesome weeds in arable crop production in the humid tropics. They produce large numbers of viable seeds under varying environmental conditions and they are therefore readily established. They also compete vigorously in upland agriculture and readily suppress the growth of other weeds, a characteristic commonly associated with plants, with allelopathic influence. Allelopathy, the regulation of growth of one plant specie by chemicals released from another, occurs widely in many plant communities (Achhireddy et al. 1985). Tijani-Eniola and Fawusi (1989) assessed the relative biological activities of the basic and acidic portions of petroleum spirit, diethyl ether and ethyl acetate fractions of crude methanol extracts of siam weed and wild poinsettia on seed germination and seedling growth of tomato (*Solanum lycopersicun*). We observed that the ethyl acetate fractions of the two weed species produced a more detrimental effect than the diethyl ether and petroleum spirit fractions, respectively, and their effects were more on root than shoot development.

In another study, Tijani-Eniola and Fawusi (1991) investigated the influence of extracts from fresh samples of five tropical weeds on seed germination and early seedling development of selected crop species. We observed that the effects of extracts from the different weed species on the test crops in order of potency were siam weed > wild poinsettia > nutsedge > itchgrass > speargrass. The inhibitory effects tended to be more on the germination of smaller seeds (tomato, pepper, millet and rice) than on bigger seeds (maize and cowpea) and the development of young seedling root was more inhibited than that of young seedling shoot (Tijani-Eniola and Fawusi 1991).

Postharvest Quality of Tomato

Postharvest qualities of three tomato varieties (Roma VF, Ibadan Local and NHLe 158-13) that were ripened on the parent plant, transparent polythene, black polythene and laboratory tabletop were determined (Adebooye, Adeoye and Tijani-Eniola 2005). Results of our study showed that height at which 50% of the fruits cracked (cracking height 50% - CH_{50}) for Ibadan Local was between 100 cm and 125 cm while Roma VF and NHLe 158-13 had CH_{50} of 150 cm and 220 cm, respectively. For the three varieties of tomato, the lycopene contents were significantly higher ($P< 0.05$) during the late season than the early season. The moisture content, crude fibre, lycopene and crude protein contents of fruits that ripened on the parent plant were significantly higher than those ripened in other media (table 19).

Table 19: Effect of Variety and Ripening Methods on Quality Components of Tomato Fruits

Ripening method	Variety	Quality components						
		Total soluble Solids (%)	Moisture Content (%)	Crude Fibre (%)	Lycopene (µg/100g)	Crude Protein (%)	Ascorbic acid (µg/100g)	Ether Extract (%)
Field ripened	Ibadan Local	3.44b	11.31a	0.88a	28.09a	0.58a	11.42b	0.22a
	Roma VF	3.54a	11.24a	0.89a	23.0bc	0.59a	13.12a	0.21a
	NHLe 158-13	3.40b	11.30a	0.87a	23.0bc	0.56a	13.09a	0.22a
Transparent polythene	Ibadan Local	3.41b	10.04b	0.71b	24.0b	0.38b	11.38b	0.21a
	Roma VF	3.58a	10.01b	0.72b	20.1d	0.39b	13.14a	0.22a
	NHLe 158-13	3.40b	10.02b	0.70b	20.4d	0.37b	13.16a	0.21a
Black polythene	Ibadan Local	3.42b	10.03b	0.71b	22.1c	0.40b	11.40b	0.22a
	Roma VF	3.57a	10.01b	0.72b	20.0d	0.38b	13.13a	0.21a
	NHLe 158-13	3.41b	10.06b	0.70b	20.0d	0.38b	13.15a	0.22a
Lab table top	Ibadan Local	3.40b	10.04b	0.71b	24.7b	0.41b	11.36b	0.21a
	Roma VF	3.58a	10.03b	0.71b	20.0d	0.39b	13.14a	0.22a
	NHLe 158-13	3.40b	10.05b	0.72b	20.8d	0.38b	13.16a	0.21a

Means followed by different alphabets in each column are significantly different at P=0.05 based on Duncan's Multiple Range Test

Source: Adebooye, Adeoye and Tijani-Eniola (2005)

In another study, Adebooye Adeoye and Tijani-Eniola (2006) determined how tomato fruit qualities were affected by phosphorous (P) nutrition. Our results indicated that except for the moisture content and ether extract, the P level had significant ($p < 0.05$) effects on the pH, total soluble solid, lycopene, ascorbic acid, crude fibre and crude protein contents of tomato fruits with the optimum values recorded at 26.4 kg/ha. The study established that 26.4 kg P/ha was the optimum P level for the tomato varieties used in the study (Adebooye, Adeoye and Tijani-Eniola 2006).

Practical Year Training Programme (PYTP) Experience

I contributed my little quota to the proper reorganization of the Practical Year Training Programme (PYTP). Mr. Vice-Chancellor, I was appointed by the then Dean of the Faculty of Agriculture and Forestry, Professor Janice E. Olawoye, as the 17th Chairman (table 20) to direct the activities of the Practical Year Training Programme (PYTP) in the Faculty with effect from Monday 1st August, 2005.

Table 20: Past and Present Chairmen of the PYTP

Name	Year of Service
Professor A.A. Agboola	1978 – 1980
Professor T.E. Ekpenyong	1980 – 1982
Professor J.K. Olayemi	1982 – 1983
Professor G.O. Obigbesan	1983 – 1984
Professor E.O. Lucas	1984 – 1986
Professor I.O.A. Adeleye	1986 – 1988
Professor G.O. Adeoye	1988 – 1990
Professor F.K. Ewete	1990 – 1992
Professor T.A. Olowu	1992 – 1994
Professor I. Fawole	1994 – 1996
Professor J.A. Fagbayide	1996 – 1998
Professor A.O. Togun	2000 – 2001
Professor E.A. Iyayi	2001 – 2002
Professor T.T. Awoyemi	2001 – 2002
Professor G.O. Adeoye	2002 – 2004
Professor E.A. Adekoya	2004 – 2005
Professor H. Tijani-Eniola	2005 – 2008
Professor A.A. Omoloye	2008 – 2012
Dr K.O. Oluwasemire	2012 – 2014
Dr. A.O. Abu	2014 to date

Activities of the PYTP

The PYTP spans one academic session. The programme is designed for the students to spend six months on out-of-campus posting and the remaining period in the various production units of the Teaching and Research farm and the valley bottom farm of the PYTP. The students also receive instruction on various subject areas to enable them cover the following activities:

(i) Production of a cereal crop such as maize

(ii) Production of a leguminous crop (cowpea, soybean, groundnut etc.)

(iii) Production of a tuber crop (cassava, yam etc.)

(iv) Production of fruit and leafy vegetable crops, both local and exotic (*Amaranthus*, *Celosia* okra, *Corchorus*, Lettuce, Cabbage, Water melon etc.)

(v) Raising and maintenance of seedlings of plantation crops (oil palm, cocoa, cashew, kolanut, citrus, teak, neem etc.)

(vi) Horticultural production which covers vegetative propagation techniques (cutting, grafting, budding, marcotting, tissue culture etc.), seed multiplication, nursery establishment and maintenance of plant hedges in the Faculty and general maintenance of Faculty environment.

(vii) Establishment and maintenance of permanent crops at Ile-Ogbo and Ajibode farms of the University.

(viii) Livestock production, feed composition and general management.

(ix) Agricultural Mechanization (tractor driving, wood work, metal fabrication, etc.)

(x) Excursion to some National and International Agricultural Research Institutes not covered in the 6 months out-of-campus postings and

(xi) Daily record keeping of farm activities and cash transactions.

Mr. Vice-Chancellor, after assuming office, I observed that the attitude of the students to training was very poor. I also observed decadence in the activities of the PYTP students including absenteeism, lateness and rudeness to instructors, insubordination, pregnancy during the programme and baby nursing, vandalism, use of hired labour to carry out assignments, among others. I then set up a 5-man committee to prepare Practical Year Training Programme Handbook for prospective students of the Faculty of Agriculture and Forestry. Members of the committee were Professor R.O. Awodoyin, Professor B. Omitoyin, Dr. T.O. Ososanya, late Mr. S.A. Raji and Mr. I.A. Olowu.

The ethics and regulations guiding conduct of students during the practical year contain all activities of the University of Ibadan and the curriculum of the Faculty of Agriculture and Forestry aimed at achieving the vision of the University, "To expand the frontier of knowledge and transform the society through innovation" and that of the Faculty, "To be a world-class training and research centre in the sustainable production and management of renewable natural resources". The various activities of the PYTP were tailored to contribute to achieving the above visions and help the Faculty in achieving one of its missions, "To produce knowledgeable graduates of integrity in the renewable natural resources sector that are highly employable and able to create employment".

In order to ensure all these and bring the best out of the students participating in the PYTP, rules and regulations were provided to guide and moderate their activities and behaviours. Compliance with, and infringement of the rules and regulations were subject to rewards and sanctions as the case may be.

The students became disgruntled at the introduction of the PYTP Handbook. The chairman's action was widely reported, but I remained resolute in the execution of the contents of the Handbook. Mr. Vice-Chancellor, I am happy to report that the behaviour of most of the PYTP students was moulded; we later became friends and I was not only recommended to the succeeding Dean, Prof. S.O. Bada to continue the Chairmanship of the PYTP, but was also honoured by an award for my contribution to the development of the PYTP.

Summary, Conclusions and Recommendations

Having understood the significant role of agriculture in maintenance of human livelihood, food security and enhanced standard of living at individual, family, community, National and global levels, it is necessary to aid agricultural systems and processes to have a competitive advantage, at policy and decision making levels—on the field and at postharvest levels. Competition between agriculture and infrastructure, urbanization, petroleum and other sectors is reflected in the denial or poor attention given to agriculture in the struggle to share limited resources including land, labour, capital etc. Corruption within agricultural and non-agricultural systems has had an untold but avoidable negative impact on Nigeria's agriculture.

Conclusively, well designed sustainable farming system with local realities in various agro-ecological zones and effective sustainable weed management that addresses the peculiar weed situation is the answer to the primary competitions limiting agricultural productivity. This needs to be complemented by other enabling policies, programmes and projects that are usually beyond the control of the farmers for agriculture to yield its best and reverse the lost glory in agriculture.

Currently, Nigeria can either invest in large-scale production units or develop a programme to provide subsidized key inputs to smallholders. The former is an inflexible option as the majority of Nigerian labour force is employed in agriculture. Moreover, capitalistic mind sets of manufacturing facility owners will exploit labour, discourage entrepreneurship and increase the income disparity gap. The latter option is more applicable to the Nigerian economy though expensive, but still affordable. It will encourage self-employment, empower the poor and help farmers get the right price for their produce. Being an agro-based economy, this plan will help Nigeria ensure food security and a consistent income for smallholders. It will help the country pull itself out of debt and poverty.

The following recommendations are therefore suggested:

- There is need for effective supply chain network structure which involves various stages including consumers, retailers, distributors, manufacturers and raw material suppliers.
- Nigeria needs to diversify her economy and harness to the fullest her agricultural potentials.
- Nigeria also needs to re-route savings mode from blocked leakages and funds usually lost to un-patriotic budgetary items in the overheads and capital budgets of ministries, departments and agencies (MDAs) to agricultural development.
- Agricultural Youth Development Programmes should be made available in rural areas to train youths in modern farming techniques so as to improve their knowledge and make farming more attractive to them.
- Local development plans should be established to reduce cattle rearers and crop farmers' conflicts in different parts of the country.
- Supportive fiscal policies should be in place: lower taxes and duties on farm inputs and machineries are to be paid.
- Market information systems should be made available for farmers' use in order to have adequate planning and circumvent risks and uncertainties.
- Insurance for farmers and farm produce as well as necessary supports like pipe-borne water and clinics, provision of ambulances dedicated for use of rural dwellers will go a long way to reduce rural-urban migration, hence, more agricultural productivity.

The endless completion is aptly illustrated with the parable of the sower in Mathew 13: 3 – 9.

> *And He told them many things in parables, saying A sower went out to sow. And as he sowed, some seeds fell along the path, and the birds came and*

devoured them. Other seeds fell on a rocky ground, where they had not much soil, and immediately they sprung up, since they had no depth of soil, but when the sun rose, they were scorched; and since they had no roots, they withered away. Other seeds fell upon thorns, and the thorns grew up and choked them. Other seeds fell on a good soil and brought forth grains, some an hundred fold, some sixty, some thirty. He who has ears, let him hear.(RSV).

In verse 7 specifically, it was sown that other plants (thorns can affect yield or result in 100% yield loss, while verse 5 also underscores the need for soil amendment. Hence, profitability of our tropical farming system must be based on multidisciplinary approach in other to reduce competition among the competitors.

What shall I say unto the LORD?
All I have to say is thank you LORD,
thank you Lord (2ce),
all I have to say is thank you LORD.

Acknowledgements
I give thanks, all glory and adoration to Almighty God, my protector and my provider. I thank Jehovah for helping me to deliver this inaugural lecture. He has lifted me beyond my dreams. I thank the Dean of my Faculty for nominating me to deliver this lecture. The invitation to me to give the lecture came casually from my Dean. I immediately reported to my Head of Department who supported my nomination and gave me optimum encouragement. I thank the duo for the confidence in me.

My appreciation goes to my late parents, Mr. Kadiri Tijani and Mrs. Olayemi Tijani (nee Otemuyiwa Olofin) for striving hard to give me the best education and also to Chief J.A. Orimogunje, the Lomofe Otu of Ondo Kingdom. I lost

my father after receiving a letter of admission to study agriculture in North Carolina USA, in 1977. Chief Orimogunje stood by me after the demise of my father. He has since then been very supportive.

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I thank Professor Janice E. Olawoye for appointing me as the Chairman of the Faculty of Agriculture and Forestry Practical Year Training Programme (PYTP) during her Deanship. I also appreciate her for her trust in my capacity and by recommending me to her successor, Professor S.O. Bada under whose Deanship I also served as the PYTP chairman. I gained a lot of experience on the programme. I appreciate the PYTP students under my Chairmanship (2005 – 2008) for giving me an award in recognition of my contributions to the progress of the PYTP (AGRICULTURE), Faculty of Agriculture and Forestry, University of Ibadan, Ibadan Nigeria.

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I thank my children whose lively arguments with me have been constructive and entertaining. They have contributed to my success in no small way. I share this joyful occasion with my joy, my wife, Mrs. Mofoluke Omobonike Tijani (nee Akinkuolie). She has contributed immensely to my success. To God be the glory.

Mr. Vice-Chancellor, Ladies and Gentlemen, thank you all for your attention.

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BIODATA OF
PROFESSOR HASSAN AYOOLA TIJANI-ENIOLA

Professor Hassan Ayoola Tijani-Eniola was born on 18 December 1954 in Ondo to late Mr. Kadiri Tijani and late Mrs. Olayemi Tijani (nee Otemuyiwa Olofin). He attended St. Joseph's College (SJC), Ondo from 1969 to 1973 for his secondary education. He later proceeded to the School of Agriculture (Federal College of Agriculture), Akure (1975-1977) for a Certificate in Agriculture. He won Professor Ajibola Taylor's Prize for the Best Student in Entomology at the School of Agriculture, Akure in 1977. He gained admission to the University of Ife (now Obafemi Awolowo University) Ile-Ife in 1977 from where he obtained B.Sc. (Hons) in Plant Science in 1981. Professor Tijani-Eniola won the prestigious Duncan's 1st Prize for the best project in Plant Science at the University of Ife, Ile-Ife in 1981. He proceeded to the University of Ibadan, after his National Youth Service Corps (NYSC) in 1982 for his M.Sc. programme in Crop Science (Horticulture). He later obtained Federal Government of Nigeria Scholarship for his Ph.D programme in Agronomy which he completed in 1987 in the same University.

Professor Tijani-Eniola joined the service of University of Ibadan as Graduate Assistant in the General Studies, 1986-1987. He was appointed Assistant Lecturer in the Department of Agronomy, University of Ibadan in 1987. His appointment was later upgraded to Lecturer II, having completed his Ph.D programme in December, 1987. Professor Tijani-Eniola was promoted to Lecturer I in 1991, Senior Lecturer in 1996, Reader in 2001 and Professor in 2004.

Professor Tijani-Eniola has served this and other Universities both within and outside Nigeria in various capacities. He was the first African Project Coordinator of the joint International Institute of Tropical Agriculture (IITA) and University of Ibadan Ford Foundation Supported Farmers-Participatory On-Farm Project, 1991-1994, Departmental representative on the Faculty of Agriculture and Forestry Farm Users Committee, 1992-1996.

Departmental Postgraduate Seminar Coordinator, 1991-1994; 1997-1999 and 2002-2004. Member, University of Ibadan 50th anniversary celebration, exhibition sub-committee, 1997-1998. Professor Tijani-Eniola was a member of the 4-man committee that established the Faculty of Agriculture, University of Ado-Ekiti (UNAD), now Ekiti State University (EKSU) in 2000. He was the first Ag. Head of Department in the Faculty of Agriculture, UNAD 2000-2001. He served as Alternative Chairman (Crops), Faculty of Agriculture and Forestry Practical Year Training Programme (PYTP), 2002-2004. Member, University Teaching and Research Farm Resuscitation Committee, 2004-2008. Chairman, PYTP, Faculty of Agriculture and Forestry, 2005-2008. Head, Department of Agronomy, 2008-2012 and member of University Senate, 1988 till date.

Professor Tijani-Eniola is a recipient of several international awards and fellowships. They include The Netherlands Fellowship on Potato Production, Storage and Seed Technology, Wageningen, The Swedish International Development Agency (SIDA) Fellowship on Pesticide Management and Pesticide Risk Reduction, Stockholm, Sweden, May-June 2004 and in Arusha, Tanzania, November, 2004. Professor Tijani-Eniola has served as Visiting Scientist to Wageningen Agricultural University, Wageningen, The Netherlands, 1994-1995. Visiting Professor to Ekiti State University, 2012-2013. He has served as Resource Person and Consultant to Alley Farming Network for Tropical Africa (AFNETA), 1992-1994, Food and Agricultural Organization (FAO), 1995.

Professor Tijani-Eniola has served as External Examiner to the Federal University of Agriculture, Abeokuta (FUNAAB); University of Ilorin; Michael Okpara University of Agriculture, Umudike (MOUAU); Ekiti State University (EKSU), Ado-Ekiti; Obafemi Awolowo University (OAU), Ile-Ife; and University of Fort Hare, Alice, South Africa.

Professor Tijani-Eniola has successfully supervised and graduated several students, including 40 graduate students: 42 M.Sc.; one (1) M.Phil and 16 doctoral students who occupy responsible positions within and outside the country. Three (3) of his students are Directors in National and Internal Research Institutes, while four (4) of them are already Professors in Nigerian Universities; two of them are Heads of Departments in their Universities. Professor Tijani-Eniola has over 70 articles in reputable local, national and international journals. Professor Tijani-Eniola is married to Mofoluke Omobonike (nee Akinkuolie) and they are blessed with children.

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

UNIVERSITY OF IBADAN ANTHEM

Unibadan, Fountainhead
Of true learning, deep and sound
Soothing spring for all who thirst
Bounds of knowledge to advance
Pledge to serve our cherished goals!
Self-reliance, unity
That our nation may with pride
Help to build a world that is truly free

Unibadan, first and best
Raise true minds for a noble cause
Social justice, equal chance
Greatness won with honest toil
Guide our people this to know
Wisdom's best to service turned
Help enshrine the right to learn
For a mind that knows is a mind that's free