Landmark University

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Breaking New Grounds

1st Inaugural Lecture

AGRO-INNOVATION: MEDICAMENT FOR FARMERS' PREDICAMENTS AND NATIONAL FOOD SECURITY

By

PROFESSOR GIDEON O. AGBAJE

B. Agric , M.Sc., Ph.D
Professor of Agronomy
Dean, College of College of Agricultural Sciences,
Landmark University, Omu-Aran, Kwara State.

THURSDAY, 19th MAY, 2016

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This 1st Inaugural Lecture was delivered under the Chairperson of:

The Chancellor, Landmark University
Dr. David O. Oyedepo

Host:
The Vice-Chancellor, Landmark University
Professor Aize Obayan

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Short Biography of Professor Gideon Olubunmi Agbaje

Professor Gideon Olubunmi Agbaje was born about 51 years ago in Owo town, Ondo State to the family of late Rt. Rev. Joseph Agbaje and Mrs M. B. Agbaje. His family is part of the Royal House in Owo Kingdom. He started his primary school education at Methodist Primary School 1, Okeogun, Owo in 1970 and completed in 1976. He led his class throughout his primary school days.

In 1976 Professor Gideon Olubunmi Agbaje gained admission into the prestigious Imade College for his secondary education and later proceeded to the Ondo State College of Art and Science in Ikare-Akoko where he wrote the A-Levels examination in Chemistry, Agricultural Science and Biology.

Professor Gideon Olubunmi Agbaje, obtained a B.Agriculture degree (Second Class Upper Division) in 1988 and M.Sc. degree in Crop Production in 1991 both from the University of Ilorin. Most of his classmates who read Agriculture at the A-Levels proceeded to obtain University degrees in Agriculture and are now key players in the field of agriculture as Professors, Senior Lecturers and in key management positions in Agricultural Development Programmes (ADPs) and NGOs. Various States in Nigeria.

Professor Gideon Olubunmi Agbaje had worked as Agrochemical sales representative and also engaged in auto-services while living in Lagos before starting a career as Junior Research Fellow in 1994 at the Institute of Agricultural Research and Training, Obafemi Awolowo University, located in Ibadan. He enrolled for his PhD programme in 1995 and successfully defended his thesis in May, 1999 at the Department of Crop Production, University of Ilorin.

Professor Olubunmi Agbaje rose through the ranks and became a Reader/Principal Research Fellow in 2005 and transferred his appointment in June 2011 to the Department of Crop Production and Protection in Obafemi Awolowo University, Ile-Ife where he had been an Associate Lecturer since 2006.

Professor Olubunmi Agbaje was appointed as the first Professor in Landmark University on 1st September, 2014. He has taught a number of courses both at the undergraduate and postgraduate level in Babcock University, Obafemi Awolowo University and now Landmark University.

Professor Agbaje belongs to a number of professional bodies including the African Crop Science Association and the International Society for Tropical Root and Tuber Crops, Africa Branch. He has published both in local and foreign journals and has fifty publications to his credit, which are mostly full article papers. He has worked extensively on varietal selection and adaptation of new technologies to the farming system in south-western Nigeria in yam, cassava and groundnut. He has published with his Ph.D students in high-impact journals on the effect of fertilizer on antioxidant composition of Cucurbita pepo. He is currently working on Tomato production in greenhouses and on-station demonstration of FADAMA rice.

Professor Agbaje has occupied many management positions in the course of his career. He was Head of Industrial Crops Improvement Programme, IAR&T; and current Chairman, Landmark University Farm Board; current Dean, College of Agricultural Sciences, Landmark University, current member of Senate Business Committee, Landmark University, to mention a few.

Professor Agbaje is married to Margaret B. Agbaje, his wife of twenty-two years and the marriage is blessed with three children Blessed, Gbemi and Oluwadara.

Established Protocols

Chancellor, Landmark University,

Distinguished Members of Board of Regents, Landmark University,

The Vice- Chancellor,

Deputy Vice-Chancellor,

Registrar,

Vice-Chancellors from other Universities,

Deans of Colleges,

Eminent Professors,

Directors of Various Units,

Heads of Departments,

All Academic Colleagues,

All members of Administrative and Technical Staff,

The Olomu of Omu-Aran,

Royal Highnesses present,

Directors and Chief Executive Officers of Leading Farms,

and Agricultural Institutions in Nigeria,

Distinguished Invited Guests,

Gentlemen of the Print and Electronic Media,

Great Kings and Queens, of Landmark University,

Ladies and Gentlemen.

Preamble

The Chancellor,Vice-Chancellor, Deputy Vice Chancellor, Registrar, distinguished Scholars and Colleagues, Students of this great University, Ladies and Gentlemen. With all sense humility, I feel highly privileged and honoured to stand before you this afternoon to deliver the 1st Inaugural Lecture in Landmark University. **The topic of the Lecture is "Agro-innovation: Medicament for Farmers' Predicaments and National Food Security.**

Chancellor Sir, I thank God for giving me the strength and fortitude to sail through stresslessly in my academic pursuit. He granted me skill and the knowledge to cope with the rigours and challenges that at a time became overwhelming. Like the story of Isaac in the Bible, I was never tired of digging wells, and God has been faithful. I waited patiently for this day to come to pass and disappointed the princes of this world who wanted to share today's glory and honour with Christ Jesus. I prayed and prayed and consoled and encouraged myself that my own time will come and it came in spite of the long tortuous waiting and watching. Let me quote two passages that has been my energizer: Psalm 37:25: "I was young and now I am old, yet I have never seen the righteous forsaken or their children beg for bread." Psalm 34:10: "the young lion do lack and suffer hunger, but they that seek Jehovah shall not want any good thing." I thank those who stood by me during my trying period. On behalf of myself and my entire family I am indeed grateful to the Chancellor and the Board of Regents who approved my appointment as the first Professor in Landmark University on 1st September, 2014. I will also like to congratulate the Chancellor and the entire University community for this giant stride of launching its own Professor into the academic order of excellence to prove to the whole world that we are determined to change the fortune of agriculture in Africa using God's endowed resources.

“Agro-innovation: Medicament for Farmers' Predicament and National Food Security”

Introduction

Farmers' Predicament

Poverty is the farmers' predicament in Nigeria. Poverty is rife in our society, seventy (70) percent of the people are poor and the farmers' that produce ninety (90) percent of the food crops in the country are worst hit. Ninety percent of the rural dwellers are engaged in agriculture and the total rural population as at 2014 was estimated to be about ninety five (95) million and this is fifty three (53) percent of the total population of Nigeria. However, poverty is more severe in rural areas and 80 % of the rural populations, representing about 76 million people, live below poverty line. They actually live on less than US $ 1.25 a day. It is ironical that farmers which were able to achieve the feat of being the world's largest producer of cassava, yam and cowpea suffer from extreme poverty. The food crop production is driven by farmers who cultivate small plots of land and depends on rainfall (http://www.ruralpovertyportal.org/country/home/tags/nigeria). Poverty among food crop farmers' could be associated to their limited capacity to engage machines, fertilizer inputs and low average farm holdings when compared with intensive cultivation techniques and use of cutting-edge technology in USA, Brazil and India (Vaughan et al, 2014).

A typical Nigerian farmer manages production at the subsistence level and could hardly handle agricultural risk factors but most often resign to fate by applying indigenous knowledge at the expense of available research technologies. The risks affecting food production systems are multi-faceted and include production risks, marketing risks, human risks, obsolescence risks and institutional risks (Emery et al, 1987). In Nigeria, as in other developing nations, the risk specifically includes unreliable rainfall, pests and diseases outbreak, soil erosion and fertility issues, low yielding crops etc. (Upton, 1997; Ingrid, 2002).

Management of agricultural risks determine the productivity of this sector and this low productivity in small holder farming systems is the cause of high poverty level in Nigeria (World Bank, 1996). An unproductive agricultural sector bedevilled with limited investment as in the case of Nigeria has a lot of implications on employment and poverty rate in the society.

The rural farmer is faced with the problem of infrastructures, good road, educational facilities, health social services, water supply, land degradation, high input cost, drought, deforestation, overgrazing, high cost of equipment and tractors etc. This has led to the flight of the young ones to move to urban areas for jobs.

National Food Security

Agriculture is the primary source of income to rural dwellers and also provides employment for 70 % of working population in Nigeria. Nigeria economy depends on agriculture and it contributes 40 % to the National Gross Domestic Product (GDP). It is indisputable that, the provision of healthy, safe and nutritious food for a population of over 170 million Nigerians and their animals without depending on foreign importation of food is the barometer for measuring economic wellness/prosperity, dignity, security and sovereignty of a nation. In the 1960's, Nigeria do not import food to feed its people. With the astronomical increase in population, estimated to be 170 million, Nigeria has resorted to food importation.

The inability of the Nigerian agricultural sector to feed the nation is based on our unproductive farming system which is dominated by resource poor small-holder farmers (Idachaba, 1993; Aderibigbe, 2013). Vaughan et al, (2014) reported that Nigeria imported on the average N1.923 trillion worth of commodities per annum between 1990 and 2010. This translated to N 1.0 billion worth of food being imported per day in 1990-2010. In 2010 alone, the amount spent annually on importation of wheat to Nigeria was N635 billion while that of rice was N356 billion i.e. N1.0 billion per day (NBS, 2012). As a result of low productivity trend in the agricultural sector, unemployment rose from 12.9 % in 2009 to 21.1 % in 2010 and to 23 % in 2011 and poverty rate also increased from 54.5% in 2005 to 70 % in 2010 (NBS, 2012). It is evident that most farmers in Nigeria are poor and this has affected the selection of farming as a career by the youth and has caused the dwindling enrolment into different colleges of Agriculture.

To abate the escalating food insecurity and poverty in Nigeria, so that we can eat and live in dignity, the National Policy on Agriculture was formulated in 2001 (FMARD, 2002). It has the following objectives:

- The achievement of self-sufficiency in basic food supply and the attainment of food security;
- Increased production and processing of export crops, using improved production and processing technologies;
- Generating gainful employment;
- Rational utilization of agricultural resources, improved protection of agricultural land resources from drought, desert encroachment, soil erosion and flood and the general preservation of the environment for the sustainability of agricultural production and
- Improvement in the quality of life of rural dwellers.

It is germane to state that the success of this policy is dependent on the small holder farmers and rural dwellers. Attention therefore should be focused on them by formulating and implementing deliberate policies that will expand and enhance their income (Aderibigbe, 2013; Donye et al, 2013). One of the strategies to improve farmers income is to increase productivity which involves appropriate management of risks with the application of simple and cost effective agronomic practices. In crop production, the use of improved crop varieties, proper timing of planting operations based on reliable weather information and insurance coverage, crop rotation system with leguminous cover crops, reduced tillage, appropriate fertilizer type and use, simple irrigation techniques etc., are possible technologies that are essential to increase yield and harvest quality (Okereke, 2012).

Innovation and Research

Innovation simply means driving a process efficiently more than before by introducing simple or complex changes. This can be achieved through carefully planned research, recording of observations, analysis and interpretation of observation. The development of appropriate agricultural innovations to fit a particular ecological zone with consideration of their existing farming systems is the responsibility of agronomists. They play a pivotal role in the research and development (R&D) of technologies which are practicable, simple, inexpensive, environment friendly and adoptable by farmers. This is important to decrease the gap between actual yield and potential yield in most of the tropical crops.

Vaughan et al (2014) reported a wide gap or difference ranging from 100 % - 367 % between the actual and potential yield of maize, rice, cassava, yam and tomato cultivated in southwest Nigeria. This big gap can only be radically reduced by the translation of innovative ideas into practicable simple technologies. This may include the introduction of drought tolerant, disease and pest resistant and nutrient-use efficient varieties and the adoption of inexpensive production techniques to improve yield and farmers income.

Although public finance of R&D in agriculture is low, it ranged from 0.5 % of China GDP, 2.25 % of GDP in Canada, 2.25 % of GDP in South Africa (OECD, 2015). In Nigeria, no record could be traced but 0.2 % of GDP was reported in 2007 (Annon, 2010). The federal government recently announced that it has set-up a National Research Fund at the University of Sokoto convocation ceremony held in March, 2016. This confirmed the little attention paid by the Nigerian government to funding of research.

The quote below from Bill Gates, the richest man in the World and the foremost computer guru in this generation is important even to agriculture if poverty among farmers and food insecurity in our nation is to be eradicated: *"I believe in innovation and that the way you get innovation is you fund research and you learn the basic facts"*. In the developed nations, the adoption of innovations in farm inputs and farming practices with the support of extension and advisory services has been reported to increase productivity in Europe. Also, the benefit of investing in R&D in Europe was reported to far exceed its cost with an annual return of between 20 % and 80 % (Alston, 2010; OECD, 2015). Sustained funding of extension services and continuous research will be of benefit to the Nigerian farmers' and her economy

My Research Philosophy

In the course of my career which is over two decades in agronomic research and innovation development, I started as a Junior Research Fellow (Agronomist) in March, 1994 and rose to the position of Principal Research Fellow (Reader) in 2005 at the Institute of Agricultural Research and Training, Moor Plantation, Obafemi Awolowo University, where I remained before I transferred my appointment in June 2011 to the Department of Crop Production and Protection, Obafemi Awolowo University still as a Reader and by fate joined Landmark university as a Professor in 2014. I have made landmark contributions to the development of innovative practices that enhanced crop yield, quality of harvests, soil quality and farmers' income. During this period, farming systems and technologies which will enhance productivity in a sustainable manner without negatively impacting on the environment within different agro-ecological zones in southwest Nigeria were identified in response to farmers' needs.

My guiding philosophy had been to narrow the yield gap in cultivated crops through the use of simple agronomic techniques or technologies and also assess the economic advantage of adopting the new technologies so that small holder farmers and consequently our nation can be food sufficient and prosperous.
This lecture will cover broad areas of multidisciplinary approach to Agro-innovation system development by describing technologies generated through research and its application in the areas of varietal selection, farming systems, and adoption studies. The economic implications of the technologies were also assessed. All these I have gone through painstakingly using multidisciplinary approach with other colleagues in faith that we can develop efficient medicament to eradicate farmers' predicament and national food insecurity.

The Chancellor Sir, my contributions towards the profitable cultivation of groundnut, yam and kenaf is summarised below:

1) Selection of groundnut genotypes for adaptation and Yield in marginal Areas of production: Export Expansion Strategy.

Groundnut (Arachis hypogea) is a leguminous crop that is important for its edible-vegetable oil and the groundnut cake (GNC) which provides protein for human and animal nutrition.

forage and feed for ruminant animals.

It became obvious in the mid 1970's that the groundnut pyramids that was popular in the fifties and sixties in Northern Nigeria could not be sustained and it started disappearing due to severe drought, poor rainfall distribution and the attack of rosette virus and the increasing occurrence of rust. To sustain groundnut exportation, the use of early maturing, multiple disease resistant lines and the expansion of cultivation to marginal areas of production were suggested (Schilling and Misari, 1991; Oyekan, 1992). Earlier reports had shown that groundnut can perform well in derived savanna and southern guinea savannah zones of southwest Nigeria (Ojomo and Adelana, 1970; Adelana, 1976).

Studies were therefore conducted in 1995, 1996, 1997 and 1998 using groundnut varieties that are moderately resistant to rust, wilt, Cercospora leaf spot and rosette virus diseases. The lines were evaluated for resistance to pests and diseases, seed and biomass yield in the derived savanna and southern guinea savannah areas of southwest Nigeria (Oyekan and Agbaje, 1999; Agbaje, 2000; Agbaje and Oyekan, 2001)

Table 1 showed that the following early maturing groundnut varieties, UGA 4, UGA 13 , UGA 3, UGA 9 and UGA 10 are top rated in terms of superiority over others in seed yield, seed weight and resistant to rosette virus and leaf spot diseases. The local variety used had the lowest yield and was susceptible to both rosette virus and leaf spot infection.

Table 2 also showed the potential of some early maturing varieties for both seed and biomass production. Among many others, ICG-IS-93530, ICGV-SM 93528, ICGV-SM 93531 and ICGV-SM-89754 could perform dual role of seed production for food and biomass as forage to animals.

The yield performance of UGA 3, UGA 4 and UGA 13 and the local cultivar (Ogbomoso cv.) were subjected to on-farm adaptation trials on twenty four farmers field across six sites in two years. The results showed that UGA 3 with high and stable yield across the different location used will fit well into the farming system in south-western Nigeria (Figures 1 and 2). At the current commodity price of $1,800 dollars per tonne of groundnut seed in the international market, a gross income of $3,600 is expected per hectare (about N1.08 million /ha) in the derived or southern guinea savannah areas of southwest Nigeria (www.indexmundi.com/commodities=gnut 16.02, 18/03/16).

Table 1: Mean Values for Yield Traits and Disease Scores of Early Maturing Groundnut Varieties Evaluated for Two Years (1995 and 1996) at Ilora, Southwestern Nigeria.

Varieties	Seed Yield ($t\ ha^{-1}$)	100-seed Weight (g)	Shelling %	Rosette %	Leaf Spot Score (1-5)
UGA 4	2.73^{a}	51.92^{ab}	68^{a}	1.21^{ef}	1.00^{f}
UGA 13	2.26^{ab}	51.52^{ab}	72^{a}	1.74^{cdef}	1.83^{def}
UGA 3	2.16^{ab}	51.60^{ab}	73^{a}	1.11^{f}	1.16^{ef}
UGA 9	2.05^{abc}	53.29^{a}	72^{a}	0.95^{f}	1.00^{f}
UGA 10	1.99^{abcd}	46.76^{bcd}	71^{a}	1.51^{def}	1.16^{ef}
M563-78	1.87^{bcd}	44.60^{cd}	71^{a}	2.28^{abcde}	2.16^{bcd}
ICG-90135	1.82^{bcd}	47.55^{abcd}	73^{a}	1.47^{def}	1.83^{def}
ICGV-88023	1.31^{cde}	50.11^{abc}	72^{a}	2.31^{abcd}	3.50^{a}
FPEUR 11	1.28^{de}	46.76^{abcd}	72^{a}	2.34^{abcd}	3.50^{a}
ICGV-86015	1.24^{de}	49.85^{abc}	69^{a}	1.96^{bcdef}	2.83^{abc}
ICGV-90127	$1.24d^{e}$	41.97^{d}	69^{a}	1.87^{bcdef}	2.50^{bcd}
ICGVSM-85045	1.22^{e}	46.06^{bcd}	72^{a}	3.05^{a}	3.00^{ab}
55-437	0.99^{e}	49.19^{abcd}	68^{a}	1.88^{bcdef}	2.66^{abcd}
ICGV-86124	0.88^{e}	$46.21b^{cd}$	70^{a}	2.78^{abc}	3.50^{a}
RRB	0.64^{e}	42.46^{d}	73^{a}	1.94^{bcdef}	2.00^{cde}
LOCAL	0.58^{e}	42.46^{d}	69^{a}	2.92^{ab}	2.83^{abc}

Means along the column with the same letters are not significantly different at $P \geq 0.05$ using DMRT.

Source: Oyekan and Agbaje (1999).

Table 2. Seed and Biomass Yield ($t\ Ha^{-1}$) Of Early Maturing Groundnut Cultivars Planted In 1998 At Ilora, Southwestern Nigeria.

Early Maturing Cultivars (EMCs)	Seed Yield ($t\ ha^{-1}$)	Biomass Yield ($t\ ha^{-1}$)
ICG-IS 93530	1.32[a]	2.30[a]
ICGV-SM 93528	1.11[ab]	1.80[ab]
ICGV-SM 93521	1.09[ab]	1.94[ab]
ICGV-SM 89754	1.06[ab]	1.88[ab]
ICG-IS 96802	1.05[abc]	1.94[ab]
ICG-IS 96801	1.02[abcd]	1.60[ab]
UGA 7	0.94[abcde]	1.46[ab]
ICGV-SM 93518	0.92[abcde]	1.78[ab]
ICG-IS 96808	0.92[abcde]	1.56[ab]
ICGV-SM 89767	0.89[abcde]	1.79[ab]
ICGV-SM 93534	0.87[abcde]	1.60[ab]
ICGV-SM 93524	0.84[abcde]	1.82[ab]
ICG-IS 96855	0.83[bcde]	1.68[ab]
ICGV-SM 93533	0.80[bcde]	1.46[ab]
ICGV-SM 94583	0.76[bcde]	1.59[ab]
ICGV-SM 94587	0.74[bcde]	1.59[ab]
ICGV-SM 93523	0.73[bcde]	1.26[ab]
ICGV-SM 93535	0.69[bcde]	1.68[ab]
55-437	0.61[bcde]	1.12[b]
Ogbomoso*	0.55[cde]	0.92[b]
ICG-IS 96827	0.54[de]	1.23[ab]
ICGV-SM 93525	0.54[e]	1.36[ab]
ICG-IS 96845	0.51[e]	1.06[b]
ICG-IS 96826	0.46[e]	1.54[ab]

Means in the column followed by same letters are not significantly different at P = 0.05.
*Commercial cultivar and control.
Source: Agbaje (2000).

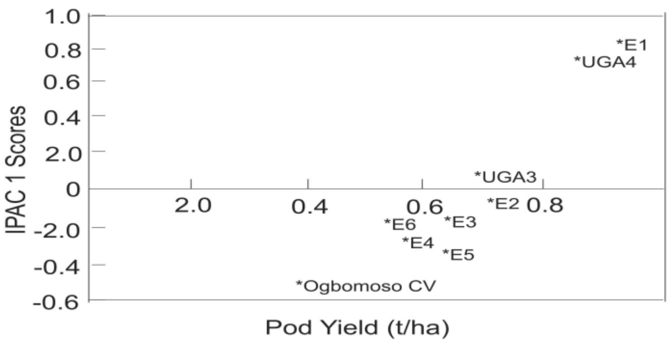

Fig. 1. Biplot graph showing the relationship between IPAC1 scores and mean yields of four groundnut varieties and six environments in Southwestern Nigeria.

Source: Agbaje and Oyekan, 2001.

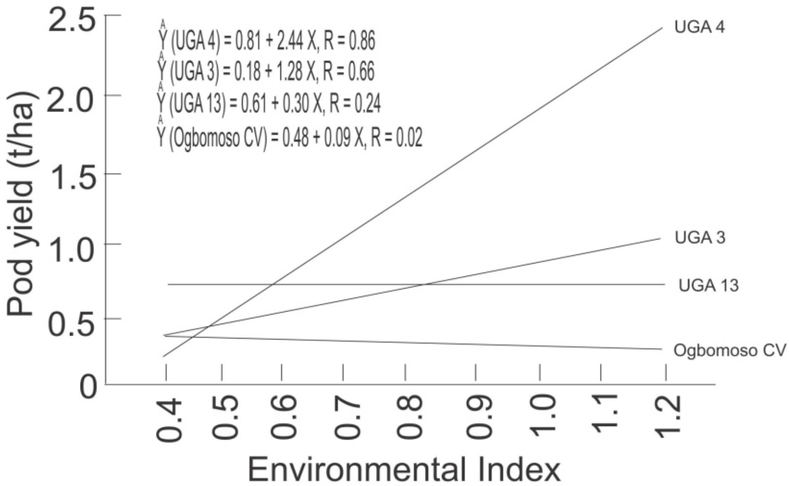

Fig. 2. Linear response of yield in four groundnut varieties to environmental changes.

Source: Agbaje and Oyekan, 2001.

2) Intercropping Studies in Food Crops with Emphasis on Yam

(I) Issues of Crop Compatibility, Land Productivity and Profitability

Small holder farmers usually practice intercropping so as to spread their risk and ensure that they maximize their limited or available land to accommodate most of the crops consumed by their household. Intercropping is also a risk management strategy for the control of the spread of pests and diseases where crops not affected by same disease or pest are planted together. However, the effectiveness of this escape from attack varies and are unpredictable (Trenbath, 1993).

Cassava and maize is common in the diet of the people of Southwest Nigeria and these are widely intercropped. To select the best cassava suitable for intercropping with maize, bearing in mind that there are different branching types in cassava, a five year study was embarked upon. The study (1992 - 1996) compared the yield of TMS30572, a profusely branched cultivar, with MS6, an un-branched indigenous cultivar for compatibility and productivity as sole crop and in combination with maize under intercrop production system. Maize which grows faster and utilize nutrients earlier does not experience depressed grain yield under the intercrop system. However, cassava tuber yield was depressed by 14% – 18% when compared to its yield under sole cropping (Agbaje et al, 1999). Land equivalent ratio (LER) was used to assess the productivity of the intercrop and the values were greater than 1.0. This indicated that all cassava mophotypes can be intercropped with maize. Thus cultivable lands can be efficiently utilized by adopting the intercrop system.

To improve protein consumption in most diets which had been mainly carbohydrate or starch based, soybean was introduced as intercrop with maize. The demand for soybean in animal feed industry and for vegetable oil due to its low cholesterol content has also soared. The demand for soybean and its economic benefits necessitated the evaluation of soybean and maize intercrop using different intercropping. The aim of the project was to determine appropriate population density that will be most productive and profitable. A three (3) year experiment conducted both in the rainforest and in the southern guinea savannah of south west Nigeria showed that intercropping maize and soybean is productive using the LER index. The profitability indices confirmed that total marginal equivalent ratio(MER) and total net MER were highest at the combination of one (1) row of Maize intercropped with one (1) row of Soybean and also at (one) 1 row of Maize intercropped with two (2) rows of Soybean (Agbaje et al, 2000). Economic analysis of intercropping recently also showed that total revenue and net benefits are higher in maize intercrop than in monocrop (Midega et al, 2014)

(ii) Intercropping in yam for Nematode Suppression and High Tuber Quality

Yam is a very important staple crop in Nigeria and it is highly susceptible to nematodes attack (Green and Florini, 1996; Okwor, 2003). The crop commands a high price and is grown as first crop under intercropping in newly-opened or long-fallowed lands. Traditional festivals are also instituted all over the country to celebrate the harvest of yam. However, parasitic nematodes which are soil borne pests do attack yam tubers and expose them to secondary infection like fungi and other pathogens which may cause complete decay of tubers and most post-harvest losses are caused by nematode attack (Adesiyan and Odihirin, 1978). The attack of tubers by mealy bugs had also been reported by Akinlosotu (1984).

The comparison of a local cultivar Ex-Abuja with four hybrid yam varieties for two years under sole, yam variety + maize intercrop and yam + maize + melon intercrop confirmed that increasing the intercrop mixtures further decreased yam yield as predicted by Odurukwe (1986). Also, the newly introduced hybrid varieties TDr 89/02665, TDr 89/02565 consistently performed better than the local variety Ex-Abuja. However, the cropping system does not inhibit pests attack and the severity of disease infection on yam varieties when compared across the intercrop levels (Agbaje et al, 2002). Thus earlier claims that intercropping reduces pests and diseases attack could not be established (Egunjobi et al, 1986; Trenbath, 1993).

The failure of intercropping to inhibit nematode and mealy bug infestation led to the suggestion of the use of legumes as short fallow crops or as intercrop to control soil borne pests. The development of nematode resistant yam varieties as permanent control measures is also considered as a feat worthy of accomplishment.

To achieve this objective, four new improved hybrid yam varieties and three local cultivars were evaluated on the field for nematode resistance for three years (1999, 2000, 2001). None of the cultivars was resistant and Obiaturugo, a local cultivar, was the worst affected (Agbaje et al, 2003).

Table 3: Comparison Of Yam Varieties For Differences In Tuber Yield, Virus Resistance And Nematode Infection At Orin-ekiti, Southwestern Nigeria.

Variety	Tuber yield t/ha	% weight of ware yams	& number of ware yams	Tuber girth cm*	Tuber length cm*	Nematode Severity Ratings 1 - 5	Virus Severity Ratings 1 - 5
TDr95/01924	13.85^{a}	46.76^{a}	34.44^{a}	29.48±6.1^{ab}	30.84±4.26^{b}	1.88	1.88^{b}
Danacha	5.02^{d}	11.46^{d}	6.73^{c}	22.39±3.93^{d}	25.51±4.09^{c}	1.88	3.00^{c}
TDr89/02665	16.01^{a}	53.31^{a}	34.57^{a}	31.82±4.07^{a}	36.68±5.01^{a}	1.88	1.22^{a}
TDr89/01438	6.67^{d}	34.63^{c}	21.24^{b}	24.17±4.96^{d}	28.06±3.45^{b}	1.77	3.00^{c}
93-2	8.69^{c}	44.63^{b}	25.99^{b}	26.11±4.95^{c}	28.16±3.78^{b}	1.88	3.33^{c}
TDr89/01213	10.89^{c}	44.25^{b}	25.97^{b}	27.38±3.88^{bc}	30.95±3.35^{b}	1.88	2.22^{b}
Obiaturugo	13.29^{b}	47.54^{ab}	28.14^{b}	24.82±3.12^{cd}	27.73±4.62^{b}	2.00	2.27^{b}
Mean	10.63	40.37	25.30^{b}	26.59±5.43	29.71±5.35	1.88	2.42
LSD 0.05							
Variety (V)	2.28	8.08	5.47	3.05	3.33	NS	0.59
Year (Y)	NS	NS	NS	NS	NS	NS	NS
Interaction (V x Y)	NS	NS	NS	NS	NS	NS	NS
CV (%)	22.60	21.04	22.71	12.04	11.77	15.16	25.67

NS= Not significant at P = 0.05.

*=Mean ± Standard deviation

Table 4: Yam Tuber (t/ha) Yield Under Different Cropping Systems In 1997 And 1997/98 At Ibadan, Southwestern, Nigeria.

Cropping System								
	Sole		Yam + Maize		Yam + Maize + Melon		Variety Mean	
Yam Variety	1997	1998	1997	1998	1997	1998	1997	1998
TDr89/02665	22.06	32.40	19.33	26.53	16.63	18.78	19.34	25.91
TDr89/02565	26.71	26.78	19.86	26.15	16.76	20.13	21.11	24.35
TDr87/00559	15.30	22.80	12.00	13.50	11.90	11.96	13.06	16.08
TDr89/02677	18.70	28.50	17.00	20.93	15.10	28.16	16.93	25.86
TDr93-1	12.58	19.25	11.93	13.66	8.80	7.53	11.10	13.48
Mean of cropping system	19.07	25.95	16.02	20.15	13.84	17.31		
			1997		1998			
LSD (0.05) Variety			4.12		3.17			
LSD (0.05) cropping system			3.19		2.46			
LSD (0.05) interaction			NS		NS			
CV (%)			26.32		21.70			

Table 5: Reaction Of Different Yam Varieties To Pests And Diseases Under Three Cropping Systems During 1997 – 1998.

Severity scores								
	Leaf mosaic		Nematode		Mealy bug		Beetle	
Yam Variety	1997	1998	1997	1998	1997	1998	1997	1998
TDr89/02665	1.3*	1.4	2.2	2.5	2.3	2.2	2.1	1.9
TDr89/02565	2.0	2.0	2.4	3.0	2.4	2.3	2.2	2.0
TDr87/00559	3.2	3.1	2.6	2.6	2.2	2.2	1.8	2.1
TDr89/02677	3.1	3.0	2.1	3.6	2.4	2.2	2.0	2.1
TDr93-1 (ex-Abuja)	3.6	3.8	2.4	20.	2.0	2.1	2.1	1.8
LSD (0.05) Variety	0.33	0.48	NS	0.77	NS	NS	NS	NS
CV (%)	17.17	26.40	18.96	37.89	21.34	26.47	21.43	26.54

LSD for cropping system and interactions of varieties and cropping systems were not significant ($P \geq 0.05$).

* Scoring scheme: 1= no symptom, 2 = mild infection, 3 = moderate infection, 4 = severe infection, 5 = very severe infection.

(iii) Use of Biodegradable Pesticide to Control Nematode and Improve Tuber Quality

It is obvious that farmers in Nigeria are aware that nematode is a problem in yam production but do not know how to control the pest (Green and Florini, 1996; Agbaje et al., 2005). To solve the problem of soil borne pests on short term, the use of nematicide chemical was considered. Although, this approach was least desirable due to economic implications as this will increases the cost of yam production to small holders, it will at least ensure that good harvest can be obtained for seed yam production in particular. The use of appropriate chemical which will not contaminate or pollute the environment is a serious issue of concern. The use of D-D and DBCP as nematicide had been reported to effectively control nematodes (PANS, 1978).

To reduce soil pollution and human hazards, carbofuran, a non-persistent chemical of carbamates group which is rapidly metabolized into less toxic and non-toxic metabolites was tried. The experiment was conducted for two (2) years in both forest and derived savannah areas of Southwest Nigeria. Different rates of carbofuran (2G) were applied on three (3) hybrid yam varieties at different days after planting. The application of fifty (50) kg ha^{-1} of Carbofuran at planting and same quantity at three (3) months after planting gave the highest tuber yield, lowest percent of Meleidogyne incognita nematode incidence and lowest severity rating across varieties, locations and years. It was observed that increasing carbofuran rate above a total of hundred (100) kg ha^{-1} will amount to waste of resources since neither increase in yield nor nor better control of nematode pest will be experienced (Adegbite and Agbaje, 2007).

(iv) Incorporating Leguminous and Non-leguminous Crops as Fallow to Control Yam Tuber Pests, Diseases and Improve Soil Fertility.

The Chancellor Sir, for the long term control of nematodes the use of legumes and natural forests as fallows which had been practiced by farmers is considered to be safer and environment friendlier when compared to chemical control method. There is the need to identify the best fallow plant to achieve the above purpose in a short period of time. It is well known that leguminous crops are important in the fallow systems. They fix nitrogen into the soil using the nitrogen fixing bacteria in their root nodules and their leaves add to the organic matter in the soil and also serve as fodder to livestock (Tarawali et al, 1997).

For the above reasons, non-food leguminous crops and common weeds were established as fallow crops for three years (1997 – 1999) to assess their contribution to the control of soil borne pests and to soil organic matter improvement. For three years in Ilora (derived savannah), Ibadan (dry rain forest) and Ikenne, wet rainforest areas of Southwest Nigeria, the contributions of Mucuna utilis, Chromolaena odorata and natural fallow in fertility enhancement and nematode control were monitored.
The two fallow crops were found to be effective in nematode population suppression by 74-79 % within 30 months while the bush regrowth gave less than 50 % reduction during the same period (Adediran et al, 2005).

However, Siam weed gave the highest organic matter content, followed by mucuna and natural forest in all locations within two years. Available P added increased by as high as 115 % in Siam, 50 % from mucuna and 36 % from natural fallow (Adediran et al, 2003). Although a non-food crop and also non- leguminous, Siam weed was identified as a good fallow plant for nematode suppression and soil fertility improvement.

To ensure that farmers can feed and make income from fallowed lands, cowpea genotypes that have reasonable seed yield and are also resistant to nematode infection were selected for inclusion as intercrop or in a fallow system. This conscious selection will drastically reduce the population density of nematodes and this will improve soil and tuber quality in a farming system where cowpea is followed by yam under the crop rotation system. This method will reduce production cost and avoid environmental pollution which is often associated with the use of pesticide.

For two years in 2002 and 2003, experiments were carried out to select nematode resistant cowpea lines that can be used in a fallow system or intercropped with main crops. Cowpea line, 46 – 4 was identified to be tolerant to M. incognita infection while IT84S-2049 was reported to be resistant to nematode infection. Thus, their cultivation will significantly reduce nematode M. incognita population densities when cultivated before yam. This will enhance tuber yield and tuber quality since a period of fallow and rotation with non-host crops have been shown to reduce infection significantly (Adegbite et al, 2005).

3) Agronomic Studies on Cultural Practices that Determines Yield Improvement in yam

The Chancellor Sir, in our determination to improve yam productivity and enhance farmers' income, different cultural practices was introduced and the results are summarily presented.

(I) Development of viable Seed Yam Production System.

The quality of harvest in any crop depends, above any factor, on the quality of the seed input. Farmers prefer whole tuber seeds than yam tuber setts as planting materials. Most of the seeds are obtained from their previous harvests. This implies that field pests and diseases are rolled over to the next planting season. Planting materials and labor had been identified as major constraints to yam production. The cost of planting materials is about one-third of total cost of yam production (Acquah and Evange, 1991; Agbaje et al, 2005).

To increase seed supply, the yam mini-sett technology was introduced. This technology produces yam seeds from small tuber setts within 6-7 months. It was aimed at encouraging farmers to specialize in seed production so that clean and healthy seeds can be made available to wareyam farmers. (Otoo et al, 2001).

Survey showed that farmers are ready to adopt seed yams from the mini-sett technology but majority still depends on seed yams from the traditional "milking" technology in which seeds are raised by decapitating the tubers at maturity and allowing new tuber growth from the stem vines (Agbaje and Oyegbami, 2005). To improve seed yam yield, the traditional 'milking' method which produces new yam seeds within 2-3 months was subjected to different time of vine severance. This was aimed at balancing the yield from ware tuber production and the generation of sizeable seed tubers since the two has compensatory relationship (Agbaje, 2007).

Table 6: Influence of variety and 'milking' Data on Tuber Yield and Yield components in yam (d. Rotundata**).**

Date of 'milking' (M)	Mother Tubers t/ha	Seed Yield t/ha	Total Tubers wt t/ha	Seed wt (kg)
August 3	9.37^{d}	9.03^{a}	18.43^{a}	0.92^{a}
August 17	11.90^{cd}	6.70^{b}	19.08^{a}	0.80^{a}
September 5	12.19^{c}	5.02^{c}	17.21^{c}	0.41^{b}
September 19	15.63^{b}	3.06^{d}	18.69^{a}	0.27^{c}
October 2	17.32^{ab}	1.70^{c}	19.02^{a}	0.16^{d}
October 16	18.42^{a}	0.60^{f}	19.02^{a}	0.08^{d}
TDr89/02665	14.58^{a}	5.25^{a}	20.05^{a}	0.53^{a}
TDr89/02565	15.27^{a}	5.03^{a}	20.30^{a}	0.48^{a}
Ikene Local	12.81^{b}	2.31^{b}	15.12^{b}	0.37^{b}

Figures with same letters along the column are significant at $P \geq 0.05$

Table 7: Economics of Seeds and ware Tuber Yam Cultivation as Influenced by variety and date of 'milking'

Treatments	MTY (t/ha)	Seed Yield (t/ha)	Gross Return (S)	Total Cost of Production (S)	Net Returns (S)	Benefit Cost Ratio (n
August 3 'milking'						
TDr89/02665	10.41	8.98	7470	3.112	4304	1.40
TDr89/02565	9.35	9.17	7372	3.112	4260	1.36
Ikene Local	8.35	4.41	4316	3.112	1204	0.38
August 17 'milking'						
TDr89/02665	13.36	9.01	8078	3.112	4966	1.59
TDr89/02565	12.91	8.08	7430	3.112	4318	1.38
Ikene Local	10.93	3.03	4004	3.112	829	0.28
September 5 'milking'						
TDr89/02665	10.33	6.41	5912	3.112	2800	0.89
TDr89/02565	14.13	7.36	7242	3.112	4130	1.32
Ikene Local	12.11	1.30	3202	3.112	90	0.03
September 19 'milking'						
TDr89/02665	15.40	3.96	5456	3.112	2344	0.75
TDr89/02565	17.28	3.40	5496	3.112	2384	0.76
Ikene Local	14.23	1.81	3932	3.112	820	0.26
October 2 'milking'						
TDr89/02665	18.55	2.10	4970	3.112	1858	0.59
TDr89/02565	18.48	1.92	4848	3.112	1736	0.55
Ikene Local	19.95	1.08	4638	3.112	1526	0.49
October 16 'milking'						
TDr89/02665	19.46	1.05	4522	3.112	1410	0.45
TDr89/02565	19.50	0.55	4320	3.112	1118	0.33
Ikene Local	16.30	1.75	4310	3.112	1198	0.38

Assumptions: Sale of seed and ware yam tubers at N75,000 and N25,000 per ton respectively. Total cost of production (Land preparation N20,000/ha, Fetiilizer N4,000, Planting seed N300,000/ha, Planting N5000/ha, weeding N20,000, staking 25,000/ha, Harvesting N10,000/ha, Transportation N5,000) N389.000 or $3.112.00. Exchange rate N125.00 = 1$

It was observed that milking between 1st and 2nd week of August was the best (Table 6). Also, the hybrid yam varieties gave higher seed and tuber yield more than the local variety used (Ikene local). The economic implications showed that the highest net revenue (\$4,300 - \$5,000 ha^{-1}) was obtained when milking was carried out in mid-August from the hybrid varieties (Table 7).

The use of 'milking' method to obtain double harvest of ware and seed yams using appropriate pre and post-milking agronomic practices that takes into consideration the reduction of soil borne pests and diseases should be further researched into.

(ii) Fertilizer use and effects on yam Yield

Yam (Dioscorea spp) contributes substantially to food security in Nigeria and the country is the largest producer and consumer of the crop in the world. Yam is rich in the supply of energy and in micronutrients like Fe, Zn and pro-vitamin A carotenoids (FAO, 2008; Ukom et al, 2014).

Chemical fertilizers constitute a major cost in yam production as this is used to complement the reduction in years of fallow among farmers in Nigeria (Agbaje et al, 2005). Yam requires large amount of soil N and K for leaves and tuber development respectively. Soils with N (< 0.10 % total N) and K (< 0.15 meq/100g) will require additional fertilizer for optimum tuber yield (Kang and Wilson, 1981; Kayode, 1985).

Chemical fertilizer has been reported to influence the nutrient composition of yam tubers and other crops. For example the addition of 200kg/ha (NPK 15 – 15 – 15) increased nitrogen, K and crude protein concentration (g/kg) in yam tubers significantly and the values were higher than the control, without fertilizer, in a local cultivar, Obiaturugo (Law-Ogbomo and Remison, 2009).

Oloyede et al (2012) also reported similar effects in vegetables nutrient composition under different rates of NPK, fertilizer application.

The applications of complete inorganic fertilizers had been reported to increase nitrate concentration in crop products. Increasing N fertilizer rate actually increased the nitrate-nitrogen in potato tubers (Carter and Bosma, 1974). Nitrates (NO_3^-) in tubers are converted to nitrites on consumption and this is toxic and can cause bad or ill health. Nitrate concentration greater than 67ppm is toxic for human consumption.

However, due to the increasing demand for healthier foods, the use of organic fertilizers is promoted by pro-organic food associations. It has been reported that higher concentration of beneficial nutrients are generated through the use of organic fertilizers in crops (Lundegardh and Mattesson, 2003; Brandth and Molgaard, 2001).

In yam production, the application of inorganic fertilizer to yamcultivars has not shown consistent and positive yield response. The local varieties still gave low yields and did not respond to additional fertilizer rates. The use of genetically improved varieties that will respond to fertilizer input in areas with declining soil fertility status was therefore suggested (Obigbesan, 1982). To assess the response of improved hybrid yam varieties to fertilizer trials were conducted for two seasons 1999/2000 and 2001. Three hybrid yam varieties, TDr89/02665, TDr89/02565, TDr89/02677 were treated with 0 to 600 kg ha^{-1} of NPK (20 – 10 – 10) in different soils – Kanhaplic Haplustalf soil type (USDA) at Ibadan, dry rainforest; Typic Troposamment, derived savannah at Ilora; Rhodic Kandiudalf at Orin-Ekiti and Rhodic Kandiudult at Ikenne both in humid rainforest.

All the soils have medium fertility rating in % total N (0.7 – 1.6) and K (0.29 – 0.71) Cmol/kg. The three sites have low P (3.22 – 7.11) mg/kg except Ibadan with medium P (8.5 – 10.5 mg/kg).

The experiment showed that planting time had pronounced effect on yield rather than fertilizer rate in all the trial sites. Yield was not influenced by fertilizer in early season planting in Ibadan and Ikenne, however due to the low N and P status of soils in both locations, the tuber yield from late season planting responded to fertilizer increase (Table 8). Thus, late planting of yams will require additional fertilizer to boost yield due to short vegetative growth and tuber growth duration available for the completion of their growth cycle (Agbaje et al, 2004).

Table 8: Influenceof NPK (20-10-10) on Total Tuber Yield (tty) (t Ha^{-1}) of Three Hybrid Yam Varieties.

	Ibadan		Ikene		Ilora		Orin-Ekiti	
	2000	**2001**	**2000**	**2001**	**2000**	**2001**	**2000**	**2001**
Variety								
TDr89/02665	31.67	17.01	23.13	18.80	27.49	27.05	22.15	18.62
TDr89/02565	29.99	15.83	19.14	13.42	26.68	27.92	19.20	16.47
TDr89/02677	30.48	16.04	13.07	13.79	26.08	26.05	14.57	13.24
Fertilizer rates								
0kg/ha	29.37	13.87	16.82	14.54	23.26	23.42	18.79	16.88
200kg/ha	28.11	16.22	16.38	17.69	25.58	26.71	16.88	16.06
400kg/ha	33.05	15.94	20.12	22.74	27.68	28.16	20.24	16.05
600kg/ha	32.33	19.14	20.41	20.25	30.48	29.74	18.65	15.44
Mean	30.71	16.29	18.43	18.80	26.75	27.00	18.64	16.10
LSD								
Variety (V)	NS	NS	2.07	2.67	NS	NS	2.31	2.12
Fertilizer (F)	NS	2.14	NS	3.08	NS	NS	NS	NS
F x V interaction	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	30.71	16.29	18.43	18.80	26.75	27.01	14.67	15.57

(iii) Non-staking of yam

To reduce the cost of production by eliminating cost of stakes and vine training, non-staking of yam was evaluated. It has been reported that one hundred and twenty (120) man days is spent on procuring stakes for one (1) hectare of farm land. (Obiazi, 1995; Jansen, 2001).

The cost of man hours could be diverted to other activities to reduce cost of yam production or other productive enterprise. A yield depression of 35-85% had been reported when stakes are not used especially in humid rainforest area with high cloudiness and even from Guinea savannah where rainfall is moderate and insolation high (Ndegwe et al, 1990).

However, similar yields were consistently obtained between "staked" and "unstaked" tuber yields from improved hybrid yam variety TDr89/02665 and TDr 89/02565 in 2003, and 2004 (Table 9). The benefit cost ratio showed consistency of above one (1.0) in TDr89/02665 and TDr89/02565 in 2002 and 2004 (Table 10). The local varieties 93-31, NO10, 93-2 performed poorly in term of yield and return on investment in all the three (3) years. This implied that selection of yams for non-staking will be economically beneficial to farmers.

Table 9: Total Yield (t Ha^{-1}) of Yam Varieties in Staked and Unstaked Production System in year 2004.

Variety	Tuber yield t/ha		Variety mean yield t/ha	Differences betw staked and n staked Pr>\t\
	Staked	Unstaked		
TDr95/18555	7.2^{de}	7.56^{fgh}	7.42^{e}	0.85
TDr95/18922	12.21^{bc}	10.69^{cde}	11.45^{bc}	0.34
TDr95/18944	12.30^{bc}	12.758^{bc}	12.52^{b}	0.77
TDr95/18988	12.63^{bc}	14.08^{b}	13.35^{b}	0.36
TDr95/19158	11.27^{bc}	8.50^{efg}	9.88^{cd}	0.08
TDr95/18949	7.99^{cd}	7.80^{fgh}	7.89^{de}	0.90
TDr95/18894	14.05^{b}	12.76^{bc}	13.40^{b}	0.42
TDr95/19177	14.15^{b}	9.75^{cde}	11.95^{bc}	0.008
TDr89/02565	17.46^{a}	15.53^{a}	16.50^{a}	0.22
93-31	7.46^{de}	4.65^{h}	6.06^{e}	0.08
N010	6.96^{de}	7.71^{fgh}	7.33^{e}	0.64
TDr89/01213	9.06^{cd}	7.53^{fgh}	8.30^{de}	0.33
TDr89/01438	13.22^{bc}	11.51^{bcde}	12.37^{b}	0.28
TDr95/0924	5.63^{e}	9.07^{defg}	7.35^{e}	0.03
TDr89/02665	17.64^{a}	18.16^{a}	17.90^{a}	0.74
TDr131	7.16^{de}	6.09^{gh}	6.63^{e}	0.50
93-2	6.02^{de}	5.78^{gh}	5.90^{e}	0.87
TDr95/18531	12.74^{bc}	11.99^{bcd}	12.36^{b}	0.63
Mean	10.85^{a}	10.10^{a}		0.22

Yield values of varieties with some letters along the column are not significantly different at P<0.05.

Table 10: Economic analysis of staked and unstakedyam productionsysteminyear 2004.

Variety	Staked production system				Unstaked production system			
	Gross Return (US $ ha^{-1})	Total Cost (US $ ha^{-1})	Net Return (US $ ha^{-1})	Benefit to cost ratio	Gross Return (US $ ha^{-1})	Total Cost (US $ha^{-1})	Net Return (US $ ha^{-1})	Bene it t cost ratio
TDr95/18555	2599.97	2778.57	-178.59	-0.06	2699.97	2600	99.97	0.03
TDr95/18922	4360.67	2778.57	1582.10	0.56	3817.82	2600	1217.82	0.46
TDr95/18944	4392.82	2778.57	1614.25	0.58	4553.53	2600	1953.53	0.75
TDr95/18988	4510.67	2778.57	1732.10	0.68	5028.53	2600	2428.53	0.93
TDr95/19158	4024.96	2778.57	1246.39	0.44	3035.69	2600	435.69	0.16
TDr95/18949	2853.54	2778.57	74.97	0.02	2785.69	2600	185.69	0.07
TDr95/18894	5017.81	2778.57	2239.24	0.80	4557.10	2600	1957.10	0.75
TDr95/19177	5053.53	2778.57	2274.96	0.81	3482.11	2600	882.11	0.33
TDr89/02565	6235.66	2778.57	3457.09	1.24	5546.38	2600	2946.38	1.31
93-31	2664.26	2778.57	-114.30	-0.04	1660.70	2600	-939.29	-0.36
N010	2485.69	2778.57	-292.87	-0.11	2753.54	2600	153.54	0.05
TDr89/01213	3235.68	2778.57	457.11	0.16	2689.26	2600	89.26	0.03
TDr89/01438	4721.39	2778.57	1942.82	0.69	4110.68	2600	1510.68	0.58
TDr95/0924	2010.69	2778.57	-767.87	-0.27	3239.25	2600	639.25	0.24
TDr89/02665	6299.94	2778.57	3521.37	1.26	6485.66	2600	3085.66	1.49
TDr131	2557.12	2778.57	-221.44	-0.07	2174.98	2600	-425.01	-0.16
93-2	2149.98	2778.57	-628.58	-0.22	2064.26	2600	-535.73	-0.21
TDr95/18531	4453.53	2778.57	1674.96	0.60	4282.10	2600	1682.10	0.64

Assumptions for economic analysis: Sales N50,000/ton of tubers; Land preparation N20,000/ha, Fertilizer N4,000; Planting seed N300,000/ha; Planting N5,000/ha; Weeding N20,000/ha; Staking N25,000/ha; harvesting N10,000/ha; Transportation N5,000. Total cost for staked production N389,000 ($2,778.57), N364,000 cost for for non-staked production ($2,600). Exchange rate N140 = $1.

In some years past, polythene cover was introduced by IITA to prevent the contact of yam vines and leaves with soil, but this was abandoned due to the high cost of the material and dearth of recycling industries when the technology was first introduced in the 1980's. However, with the recent establishment of various polymer industries in Nigeria, both manufacturing and recycling plants, the cost of polythene has significantly reduced. This technology can be employed with non-staking in seed or ware yam production system and complimented with drip irrigation for all year round production.

(iv) On-farm Evaluation of Yam Production With and Without Staking

The validation of results from the researcher's field by farmers is essential before technologies are released for farmers' adoption. The improved yam variety TDr89/02665 was compared to the best local cultivar 'Igbakumo' in 50 farmers field in two years, 2006 and 2007. TDr89/02665 was noted for superior tuber yield, field tolerance to Meloidogyne incognita and resistant to potymosiac virus (Agbaje et al, 2002; 2003).

Hybrid yam and local cultivars were compared under farmers' condition by staking in Ekiti area which is in the rainforest agro-ecological zone of southwest Nigeria. Late planting of the crops resulted into low yield in both cultivars, however, early planting gave significantly higher yield from the hybrid with a mean yield of 28 tons/ha while the local was 18ton/ha (Table 11).

In the drier Savannah areas, unstaked TDr89/02665 was compared to staked local cultivar. Yield from the unstaked hybrid yam was higher in many farms (Table 11). This showed that the hybrid yam is acceptable to farmers and that they can adapt it into their various farming systems.

Table 11: Mean Tuber Yield (t/ha) of Staked Local Cultivar (igbakumo) and Hybrid Variety (tdr89/02665) at Ikole, Southwestern Nigeria in 2008.

Tuber yield (t/ha)			
Farm	**Igbakumo**	**TDr89/02665**	**Difference between varieties Pr < t**
1	18.31	26.60	0.0001*
2	22.89	33.00	0.0001*
3	13.10	17.00	0.0003*
4	27.36	38.73	0.0001*
5	17.40	32.94	0.0001*
6	21.33	34.60	0.0001*
7	14.70	21.60	0.0001*
8	11.80	17.03	0.001*
Mean	18.35	27.68	0.003*

* Mean tuber yield between varieties are significantly different within the farm.

Table 12: Mean Tuber Yield (t/ha) of Staked Local Cultivar (igbakumo) and Unstaked Hybrid Variety (tdr89/02665) at Igbope in 2006.

Tuber yield (t/ha)			
Farm	**Igbakumo (Staked)**	**TDr89/02665 (Not staked)**	**Difference between varieties Pr < t**
1	15.56	26.86	0.04*
2	17.75	20.86	0.26
3	13.74	22.86	0.02*
4	18.41	13.64	0.44
5	31.88	33.82	0.39
6	27.08	31.79	0.14
7	23.17	35.41	0.003*
8	17.46	13.35	0.50
Mean	20.63	24.82	0.12

* Mean tuber yield between varieties are significantly different within the farm.

Table 13: Mean Tuber Yield (t/ha) of Staked Local Cultivar (igbakumo) and Unstaked Hybrid Variety (tdr89/02665) at Ilora In 2006.

Tuber yield (t ha^{-1})			
Farm	Igbakumo (Staked)	TDr89/02665 (Not staked)	Difference between varieties Pr < t
1	26.86	33.82	0.03*
2	27.08	31.79	0.08
3	19.27	26.51	0.03*
4	23.17	35.40	0.01*
5	17.46	13.35	0.82
6	27.10	35.81	0.001*
7	25.42	30.06	0.08
8	18.84	24.75	0.05
Mean	23.15	28.93	0.01*

* Mean tuber yield between treatments are significantly different within the farm.

3) Survey of Yam Production System and Production Constraints in Southwest Nigeria

It was observed that the yam tubers harvested from various zones in Nigeria were all consumed internally. Countries like Ghana are exporting large quantities of yam tubers to European market and Nigeria is not benefiting from this initiative.

The Chancellor Sir, the low participation in yam export in Nigeria evoked the comprehensive survey of the yam production system in Southwestern Nigeria. Constraints which militated against the optimum production and export were identified.

i) Demographic and Land Development Constraints

The survey of socioeconomic traits of respondent revealed that yam farmers are mostly male (82 %), they are aging with an average age of 52 years and with least 12 household members. Access to cultivable land is not a problem since family and community lands are always available. Over 71% of the respondent farmers fallow their lands between 2 and 3 years before yam is cultivated. Farmers (78 %) agreed that tractors are readily available for land cultivation but majority (96 %) manually cultivate the land by using hoes. The farmers rely on both family labour and hired labour, but depend mostly (54%) on hired labour.

ii) Agronomic Practices

Most of the farmers (74%) start planting between October and February. Sixty-eight (68 %) of respondents use seeds from their personal farms with only 12% purchasing seeds from open market. Farmers (83%) prefer seeds for planting than the use of cut tubers or yam setts.

Farmers (94%) use hoe to manually control weeds and depend on hired labour complemented with family labour. However, the hired labour is hardly available. Staking is done to keep the vines upright and seventy-eight (78) % of the farmers obtain stakes from nearby forests.

It has been observed that yam setts do emerge with shoots or vines between February and March due to trickles of rain during the same period. The rains are not stable and often cease leaving the vines to suffer from drought which leads to stem die-back and final death.

This is a major cause of colossal loss to farmers since the seeds rot within the soil as a result of heat. Farmers often sustain 70-80% losses during this period.

iii) Fertilizer Application

Sixty percent (60 %) of farmers apply fertilizers and NPK is mostly used. The fertilizers are hardly available and are not available as confirmed by 60% of the farmers. Over 80% of the farmers believe that fertilizers increase yield and do not affect yam quality.

iv) Yam Tuber Yield and Indigenous Varieties and Pests

Farmers' average yield was low, 53% of farmers had yield of 2 – 6 tons per ha, 21% had 7 – 10 tons per ha while 26% had greater than 10 tons per ha. The varieties that produce the yield range are in Table 14. These varieties have their special attributes, for example, Marodojo – is noted for early maturing; Ihobia –noted for good poundability and small size, Areingbakumo also desired for good poundability etc.

v) Cropping System

Seventy-nine percent (79 %) of farmers plant yam as mono-crop while 21 % engage in inter-crop. The farmers were able to identify nematodes, mealy bugs, scales, millipedes, crickets and common pests of yam tubers and fungal and bacterial rot diseases in yam tubers.

vi) Finance

Farmers have no access to bank credit facilities but source their capital from cooperative societies and personal savings.

Table 14: Yam Varieties Cultivated By Farmers In Southwestern Nigeria.

Saki	Owo	Ikare	Edo
Odo	Apepe	Abinueran	Nekedesi*
Amula*	Amula	Aro	Oli
Kokumo	Aro pupa	Agbakomo*	Pawpaw*
Lasinrin*	Aro funfun	Adabe	Paper*
Abuja	Ajimokun	Alaka	Dan Onisha
Efuru*	Areingbakumo	Apada	Ayana
Ajelonwa	Aleka	Areingbakumo	Edira
Omiefun	Bida	Eleusu*	Uneka*
Da Onisha*	Elentu	Efuru	Ineguba
Itakun-Efon	Ehusu	Elentu	Popo
Akoko	Efuru	Egunmare	Uwana
Dariboko	Gambari*	Gambari	Azukulu
Ihobia	Ga Onisha	Lasinrin	Asunege
	Hausa	Marodojo	Obinesa
	Idaje	Oshogbo	Alaago
	Iyawo	Orose	Asukumo*
	Idere	Olowo	Asoko
	Lokoja	Odo*	Okpokoro
	Marodojo*	Okumodu	Uzomogu
	Owana*	Olobe	Alebo
	Ogunmare	Sagbedoba	Obioma
	Odo*	Shagari	Oya
	Omi-efun	Kege	
	Lasirin*	Udere	
	Sagbedoba	Owana*	
	Petisan		
	Shagari		
	Senegen		

* Most popular among farmers

Characteristics of Some of the Varieties

Edo

1. Uneka: good for pounding, early maturing 6-7 MAP
2. Pawpaw: late maturing, harvested during the dry season (Nov/Dec), 7-9 MAP

Owo

1. Idasa: good for pounding
2. Ehusu: high yielding
3. Petisan: good for pounding
4. Gambari: high yielding
5. Marodojo: early maturing
6. Aro: early maturing
7. Apepe: high dry matter percent, good for pounding
8. Elentu: early maturing

Saki

1. Amula: good aroma and taste, high pounding ability, late maturing
2. Lasirin: early maturing, harvest in July/August when planted in October, gives high income for arriving early in market, high yielding and whiteness, less alkaloid
3. Kokumo: high yielding
4. Ehuru: early maturing
5. Dariboko: good for fadama cultivation and high yielding
6. Ihobia: good for flour and high pounding ability

5) Kenaf Improvement in Nigeria

The Chancellor sir, I was appointed in 2006 as the Head, Industrial Crops Improvement Programme to revamp the kenaf industry in Nigeria. The National mandate on kenaf production and its utilisation is ceded to the Institute of Agricultural Research, Obafemi Awolowo University where I started my work career.

Kenaf, a fibre plant and belongs to the family malvacea and matures between 90 to 120 days. All the parts of the plant are useful. The leaves have protein (15 - 30 %) and are used in animal feed (Francois et al, 1992). The stem bark is usually retted in water so that the fibre can easily be separated from the core. Decorticating machines can also be used tho separate the fibre from stem by a process called decortication.

Kenaf fibre is used in the manufacture of fabrics, pulp, currency mint and with combined with synthetic polyesters for non-woven mats. The kenaf core in powder is mixed with synthetic polymers (PVC, PP, PE) as biodegradable component of plastic fence, doors, decking, furniture. The kenaf core is also used as oil spill absorbent and in production of ethanol (Mossello et al, 2010; Cao et al, 2011; Mohd Hadi et al, 2014).

My strategy in the area of industrial development then was to develop indigenous machine that can process fibre from the plant, process the core to fines, convert the fibre to many products and extract edible oil from the seed. The pictures of the products including its use in POP interior decorations are shown. Having achieved all those, my next plan was to start the production of kenaf fines and PVC/PE/PP composites for window, doors and floor tiles production having visited the kenaf research centre in Malaysia. This new drive could not be achieved because of institutional challenges. However, in the area of yield improvement the following modest contributions were made:

(I) Kenaf Fibre Production and Profitability

The commercial production of kenaf in Nigeria started in 1960's. Processing plants for kenaf sacks or jute bags were established by the then Western Regional government in 1965 in Badagry and another in Jos by the Northern Regional government in 1967. The companies became extinct due to massive importation of cheap raw materials or fibres from Bangladesh, India and Pakistan.

To improve kenaf fibre yield and its profitability, an integrated approach to agronomic practices was evaluated in 2003 and 2004. The aim of the experiment was to encourage farmers to cultivate this crop and make living income from the enterprise. It was observed that elite varieties used, Cuba 108 and Ifeken 400 and the local cultivar (Ibadan local) have similar yield in total dry matter, fibre and core. The leaf biomas from local cultivar was significantly higher than other varieties (Table15). The improved agronomic practice (IMP) of using inputs such as fertilizer, insecticide and nematicides gave 76 to 161 % increases in fibre yield over the conventional method of production.

The marginal rate of return (MRR) in income from the IMP was 106 to 121 % higher in IMP than the farmer's practice (Table 16). The adoption of improved technologies will benefit the sustenance of kenaf industries if established now as this was the albatross that befell the initial take-off of the kenaf industries in the mid-sixties.

Table 15: Influence of Management Practices and Variety on Agronomic Traits of Kenaf in 2002 and 2003 (combined).

Treatment	Agronomic Trait				
	TDY (t/ha)	FY (t/ha)	CY (t/ha)	LB (t/ha)	HE (m)
Control	6.66[c]	1.29[c]	2.74[c]	2.20[b]	1.24[b]
IMP 1	11.19[b]	2.28[b]	4.84[b]	3.24[b]	1.57[a]
IMP 2	17.03[a]	3.37[a]	7.44[a]	5.02[a]	1.71[a]
SE	0.61	0.61	0.39	0.51	0.14
Variety					
Cuba 108	11.36[a]	2.27[a]	5.17[a]	2.79[b]	1.69[a]
Ifeken 400	11.35[a]	2.18[a]	5.06[a]	3.02[b]	1.69[a]
Ibadan local	12.18[a]	2.49[a]	4.95[a]	4.48[a]	1.14[b]
SE	0.61	0.61	0.44	0.19	0.06

Imp – Improved Management Practices, Tdy – Total Dry Matter Yield, Fy – Fibre Yield, Cy – Core Yield, Lb – Leaf Biomass, He – Plant Height.
Means In The Column Followed By The Same Letters Are Not Significantly Different At $P<0.05$.

Table 16: Marginal Rate of Return Analysis for Chemical Inputs Application in Kenaf Fibre Production

Variety	Treatment	Cost	Net Ben	Dominance	Incr. Ben	Incr. Cost	MRR (%)
Cuba 108	Contr	0	98100	Un	-	-	-
	IMP-1	52346	153754	Un	55654	52346	106.3195
	IMP-2	98692	210008	Un	56254	46346	121.3783
Ifeken 400	Contr	0	93600	Un	-	-	-
	IMP-1	52346	124954	Un	31354	52346	59.8976
	IMP-2	98692	218108	Un	93154	46346	200.9968
Local Variety	Contr	0	155700	Un	-	-	-
	IMP-1	52346	178954	Un	23254	52346	44.42364
	IMP-2	98692	184808	Un	5854	46346	12.63108

* incr ben = incremental benefit; cost = incremental cost;
net ben = net benefit.

(ii) Kenaf Powder Production and Profitability

The economic feasibility of industrial processing of the whole plant harvested at pre-flowering stage for kenaf fines or powder was analyzed. It was assumed that 10 hectares will be cultivated with an estimated yield of 100 tonnes at a price of N65,000 per tonne. At a bank lending rate of 25 % and interest on saving of 7 %, the profitability and payback period of a kenaf processing business were calculated. Table 17 showed that the initial capital outlay for processing plant and cost of materials was N 28,950,940. A net of N2,683,433 was expected from the enterprise (Table 18). If the initial capital is borrowed from the bank, the payback period will be at the third year or third cycle of production. Thus, from the 4th production to 10th production cycle, profit generated increased over years (Table 19). It was concluded that it was better to invest in kenaf processing than saving of money at seven (7) % on saving in banks.

Table 17: Processing Cost of Kenaf Powder From 10 Hectares Plantation

Materials	**Qty**	**Unit Price (₦)**	**Amount (₦)**
Variable cost of processing			
l	120ltrs	100	12,000
Packaging (50kg)	3md	1,000/md	3,000
Sealing/bagging	3md	1,000/md	3,000
Grinding/hammer mill	3md	1,000/md	3,000
Cost of bags	120bags	100/bag	12,000
Sub-total			**33,000**
Total variable cost ha^{-1}			133,490
Total variable cost for 10ha (TVC)	10ha	330,000	330,000
Fixed cost of processing			
Construction of shed			3,000,000
Freight charges on imported machines			499,040
Forage harvester			8,000,000
Cost of 90hp tractor	1		6,467,000
Chipping machine	1		250,000
Bailing machine	1		500,000
Drying machine	1		800,000
Hammer mil rind r	1		000
Truck/ca bstar	1		3,000,000
Alternative power source	1		3,000,000
Machine installation			500,000
Contingency allowance			1,000,000
Sub-total (TVC)			**27,616,040**
Total production cost (TPC) for 10ha			**1,004,900**
Total (TVC + TFC)			**1,334,900**
Initial capital outlay for 10ha			**28,950,940**

Table 18: Production/processing Costs and Revenue Ha^{-1} In Kenaf Powder Processing

Cost ha^{-1}	**Amount (N)**
Total variable cost ha^{-1}	133,490
Total fixed cost (depreciated value) ha^{-1}	248,166.67
Revenue ha^{-1}	650,000
Net returns ha^{-1}	268,343.33
Net returns for 10 ha	2,683,433.33

Table 19: Pay-back Period for Investment in kenaf Powder Processing

Year	**Initial Capital Outlay**	**Sum of estimated annual cash inflow**	**Amount (₦)**
0	28,950,940		
1		6,500,000	(22,450,940)
2		7,475,000	(14,975,940)
3		8,596,250	(6,379,690)
4		9,885,687.50	3,494,002.50
5		11,368,540.63	14,874,538.13
6		13,073,821.72	27,948,359.85
7		15,034,894.98	42,983,254.83
8		17,290,129.22	60,273,384.05
9		19,883,648.61	80,157,032.66
10		22,866,195.90	103,023,228.56

(iii) Kenaf Seed Production and Profitability

Kenaf seed contain oils which are edible and non-toxic. They have high concentration of Omega polyunsaturated fatty acids which help keep the body healthy. However, seed yield of kenaf is low in Nigeria, 80kg/ha and 900-3000kg/ha has been reported in US and Mexico (Webber et al, 2002).

Productivity of kenaf and other crops in the family Malvaceaes are affected by foliage pests, nematodes and low nitrogen status in Nigeria (Agbaje and Daramola, 2000; Ogunlela and Adeoti, 1990) An integrated approach was used and seed yield increased with the use of fertilizer, insecticide and nematicide with a yield difference of 100% between control and best agronomic method applied (Tables 20, 21). The economic yield was highest and the difference from the control was almost doubled with the use of NPK 60-30-30, 4 spraying regimes and 100 kg/ha of Furadan (Table 22). Thus, seed yield of over 0.9 tonnes/ha could be achieved and net income could increase by over 200 % by using high inputs (Agbaje, 2010).

To improve the seed yield, different row spacing were tried. An inter-row spacing of 50cm and intra-row of 20cm was found to give the highest seed yield and recommended for seed production. For good seed production, genotypes were evaluated at Ibadan (rain forest), Kishi (Southern guinea savannah), and Ilora (derived savannah) for 2 years. It was observed that seed yield from the local kenaf and Ifeken 100 were outstanding among the varieties tried. However, the oil yield which is rich in Omega 3 and Omega 6 is yet to be assessed. (Agbaje, 2010; Agbaje et al, 2011; Olasoji et al, 2014).

Table 20: Treatment Combinations Indicating the Component Input.

	Fertilizer Rates (Kg/ha)		Number of Insecticide Sprays (no)		Furadan Rates (Kg/ha)	
Treatments	F_1	F_2	M_1	M_2	N_1	N_2
T_0	-	-	-	-	-	-
T_1	*	-	*	-	-	*
T_2	*	-	-	*	-	*
T_3	-	*	*	-	-	*
T_4	-	*	-	*	-	*
T_5	*	-	-	*	*	-
T_6	-		-	*	*	-
T_7	*	-	*	-	*	-
T_8	-	*	*	-	*	-

F_1- application of NPK 60-30-30 kg/ha; F_2- application of NPK 120-60-60 kg/ha; M_1 – insecticide application at 44 and 73 DAP; M_2 – insecticide application at 44, 58, 73 and 86 DAP; N_1 – application of Furadan at 50kg/ha; N_2 – application of Furadan at 100kg/ha.
* indicates that the input was applied to the treatment in the same row while – means that the input was not applied.

Table 21: Influence of Agronomic Practices on Kenaf Growth, Yield and Reaction to Pests Attack

Treatment	Height (m)	Mid-stem diameter (cm)	Capsule number (no/plant)	Seed yield (kg/ha)	100 Seed-weight (g)	Insect severity (no)	Nematode severity (no)	Nematode incidence (%)
T_0	1.90	0.81	19	429.41	2.28	3.66	5.0	60.31
T_1	2.26	1.05	19	804.18	2.14	2.50	1.5	34.32
T_2	2.56	1.11	22	945.63	2.09	2.16	2.3	40.14
T_3	2.60	1.17	23	620.44	2.05	2.00	2.0	31.91
T_4	2.57	1.12	21	808.36	2.24	1.83	2.2	38.18
T_5	2.54	1.03	20	786.27	2.28	1.50	2.8	46.83
T_6	2.63	1.16	23	634.42	2.08	1.50	2.6	44.13
T_7	2.63	1.06	20	642.08	1.98	2.33	3.5	47.05
T_8	2.62	1.19	20	729.65	2.02	2.33	2.5	44.07
SE	0.17	0.06	2.14	82.49	0.15	0.31	0.33	2.31

Table 22: Profitability of Different Agronomic Practices in Kenaf Seed Production

Treatment	Cost of production (N)	Gross income (N)	Net income (N)
T_0	60,375	193,234.50	132,859.50
T_1	114,775	361,881.00	247,106.00
T_2	119,175	425,533.50	306,358.50
T_3	129,775	297,198.00	149,423.00
T_4	134,175	363,762.00	229,587.00
T_5	104,175	353,821.50	249,646.50
T_6	119,775	285,489.00	166,314.00
T_7	99,775	288,936.00	189,161.00
T_8	114,775	238,342.50	213,567.50

Kenaf Biocomposite as Floor Tiles

Kenaf Plants

POP interior decoration from
Kenaf fiber + Plaster of paris(POP) powder

Rosas Interior Décor from Kenaf Powder and Pop Powder

Kenaf Fibre Woven into Fabric

Kenaf Fibre Extracted from Kenaf Bark

Conclusion and Recommendation

Conclusion

- The Chancellor Sir, the essence of these researches in crop production is to assist in improving crop productivity of smallholder farmers in Nigeria so that food and raw materials security can be attained and our dignity restored as a nation. Also, that farmers' income can increase significantly above and beyond poverty baseline.

- It has been established that the application of innovative research results and multidisciplinary research approach to food issues is the only way to drive a successful agrarian revolution particularly in Nigeria and in Africa at large. This will improve significantly the actual yield of cultivated food crops.

- The introduction of multiple diseases and pests resistant lines from advanced laboratories had tremendous impact on yield, pests and diseases control and cross border production of essential crop types and varieties. The cultivation of groundnut along the fringe of rain forest belt of southwestern Nigeria is a successful story of the use of biotechnology and multidisciplinary efforts towards cultivating crops in a non-traditional area of production. The use of biotechnology to develop nematode resistant yam varieties and other prevalent food crop diseases is long overdue.

- From our studies, the adoptions of simple cultural practices which can favourably improve the organic matter contents of soils and reduce significantly soil borne pests using appropriate food and non-food crop types as fallow are in-expensive production systems for small holder farmers which should be encouraged. This will promote the cultivation of healthy organic food that is less dependent on fertilizers and pesticides.

- The further improvement in cultural method of seed production in yam and the provision of certified seeds to farmers is another area that requires special attention so that enough good and treated seeds can be available to farmers.
- The introduction of hybrid yams have significantly improved yield on farmers' fields and more importantly, the selection for tolerance for non-staking production system has tremendous implications on profitability in yam production. The adoption of non-staking will eventually lend yam production into its complete mechanization from planting to weed management and final harvest.
- The introduction of green houses for all the year crop production under drip irrigation system will that ensure farmers earn income throughout the year.
- The production of fibre, seed and powder from kenaf and its profitability indices has shown that the earlier problem faced in the 1960s can be overcome and with the development of diverse products from kenaf, farmers' income and industrial development will be enhanced by the adoptions of our various findings on kenaf production. The use of locally produce kenaf powder for oil spill cleaning instead of importing same will reduce poverty among farmers. The production of healthy oil from kenaf seed will boost income of farmer and reduce the risk of hypertension.

Recommendations

I wish to make the following recommendations as the medicaments against farmers' poverty and national food insecurity:

Research groups should be resuscitated to find solutions to particular production problems in identified commodities in close collaboration with practicing farmer groups.

- Farmers should prompt the areas where research should be focused

- There is an urgent need to introduce diseases and pests resistant and early maturing varieties to reduce input cost in food production

- A biochemical improvement of the starch, fibre and mineral content of yam varieties to meet the modern taste and enhance its wide acceptability and enhance exportation is urgently required

- Farmers should be linked with industries or processors and a fair price should be determined before the beginning of the planting season. In case there is glut, government should buy back produce from farmers at fair price so that farmers are not producing at a loss. Thus an agricultural price stabilization policy should be developed for the country

- Infrastructural development and subsidized energy tariff in favour of agricultural estates should be embarked upon. This will lower the cost of capital expenditure and production cost of farmers and will increase the interest in investing into agriculture

- Government should make the purchase of locally produced raw materials mandatory. High import tax should be placed on agricultural commodities that can be produced within the country so as to discourage the dumping of food, food products, jute sacks/bags, pulp, oil spill absorbent, composite woods etc

- Increased support for Extension Services and establishment of demonstration plots of proven technologies should be financed by recipient industries.

This will bring farmers closer to industries and encourage contract farming in Nigeria.

- National Awards be granted annually to researchers and farmers in different areas of agricultural production to motivate others to invest in agriculture and be proud of being in agriculture

- Scholarship should be given to students who are interested in studying agriculture in Nigerian universities. Graduates of Agriculture should be encouraged and supported with soft loans to practice their profession instead of looking for white collar-jobs. This will stem the dwindling enrollment in our faculties of Agriculture and increase the number of educated farmers in our society.

- Production of crops under green houses and under drip irrigation should be encouraged to mitigate the effect of climate change.

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I was fortunate to be the Dean on seat when the College was presented for the first time for National University Commission accreditation in March, 2015 and a full accreditation was granted to the college.

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Professor Gideon O. Agbaje

Reference

Acquah, T.E. and Evange, W.H. (1991). An economic examination of constraints and opportunities in yam (Dioscorea spp.) production in Fako Division, Cameroon. In: Ofori, F. and Hahn, S.K. (eds). Tropical root crops in a developing economy. Proceedings of a 9th Symposium of the International Society for Tropical Root Crops (ISTRC) – AB, 20-26 October, 1991, Accra, Ghana. 367-372pp.

Adediran, J.A.; Adegbite, A.A.; Akinlosotu, T.A.; **Agbaje, G.O.**; Taiwo, L.B.; Owolade, B.F. and Oluwatosin, G.A. (2005). Evaluation of fallow and cover crops for nematode suppression in three agroecologies of south western Nigeria. African Journal of Biotechnology 8 : 1034 – 1039.

Adediran, J.A.; Taiwo, L.B.; Oluwatosin, G.A.; **Agbaje, G.O**. and Akinlosotu, T.A. (2003). Evaluation of different short fallows for sustainable soil management and food crop production in southwestern Nigeria. African Soils 33(1):117 – 130.

Adegbite, A.A. and **Agbaje, G.O**. (2007). Efficacy of Furadan (Cabofuran) in control of root-knot nematode (Meloidogyne incognita Race 2) in hybrid yam varieties in southwestern Nigeria. Electronic Journal of Environmental, Agricultural and Food Chemistry(EJEAFChe) 6(6) 2083 – 2094.

Adegbite, A.A.; Adesiyan, S.O.; **Agbaje, G.O.** and Omoloye, A.A. (2005). Host suitability of crops under yam intercrop to root-knot nematode (Meloidogyne incognita (Kofoid and White) Chitwood Race 2) in southwestern Nigeria. Journal of Agriculture and Rural Development in Tropics and Subtropics 106(2) : 113 – 118.

Adegbite, A.A; Amusa, N.A; **Agbaje, G.O**; Taiwo, L.B and Akande, M.O. (2005) Screening of cowpea (Vigna Unguiculata (L.) Walp) varieties for resistance to root knot nematode (Meloidogyne incognita) under field conditions. Nematropica 35(2): 155 – 159.

Adelana, B.O. (1970). The effect of fertilizers on the yield and components of yield in groundnut in Western Nigeria. Nig. J. Science. 10: 158-168.

Aderibigbe, S.O. (2013). Policy options for agricultural investments and governance of markets. In support of small scale agriculture in Nigeria Research Report. OXFAM.1-39 pp.

Adesiyan, S.O. and Odihirin,R.A.(1978) Root knot nematodes as pests of yams(Dioscorea spp.)in southern Nigeria. Nematologica 24:132 -134.

Agbaje G. O; Aluko, O. A. and Olasoji, J. O. (2011). Effect of plant spacing on seed yield and yield components in kenaf (Hibiscus cannabinus) variety, Ifeken 400. African Journal of Plant Science 5(12): 718-721.

Agbaje, G. O. (2010). Profitability of kenaf seed production as affected by different agronomic practices. Journal of Food, Agriculture & Environment 8 (1):229 - 233.

Agbaje, G. O. and Aluko, O. A. (2009). Analyses of hybrid yam(Dioscorea rotundata Poir) on-farm trials in southwestern Nigeria. African Journal of Agricultural Research 4(11): 1159-1164.

Agbaje, G. O. and Daramola, A. M. (2000). Influence of season and Tyrax (Pyrethrum-based) insecticide on Okra (Abelmoschus esculentus L. Moench) green capsule yields. Nigeria Journal of Pure & Applied Science 15: 1031 – 1036.

Agbaje, G.O. (2000). Selection of groundnut (Arachis hypogaea L.) cultivar for late season cultivation in south western Nigeria. Test of Agrochemicals and Cultivars 21 : 25 –26.

Agbaje, G.O. (2007). Influence of "milking date" on seed yield potential in hybrid yam varieties (D. rotundata) Moor Journal

of Agricultural Research 8 (1): 8 – 12.
Agbaje, G.O. and Adegbite, A. A. (2006). Comparison of yield performance and profitability in hybrid yam varieties cultivated under staked and unstaked production systems. Journal of Food, Agriculture & Environment 4(2): 183 – 187.
Agbaje, G.O. and Akinlosotu, T.A. (2004). Influence of NPK fertilizer on yield of early and late planted cassava in a forest alfisol of south western Nigeria. African Journal of Biotechnology 3(10): 547 – 551.
Agbaje, G.O. and Oyegbami, A. (2005).Survey on the adoption of yam minisett technology in southwestern Nigeria. Journal of Food, Agriculture & Environment 3(2): 134 – 137.
Agbaje, G.O. and Oyekan, P.O. (2001). Yield and stability of groundnut varieties in the derived savanna areas of southwestern Nigeria. Ghana Journal of Agricultural Sciences 34(1): 15 -19.
Agbaje, G.O. and Oyekan, P.O. (2001). Yield stability of groundnut (Arachis hypogea L.) varieties in the derived savanna area of Southwestern Nigeria. Ghana Inl. Agric. Sci. 34: 15-20.
Agbaje, G.O.; Adegbite, A.A.; Oluwatosin, G.A. and Akinlosotu, T.A(2004). Influence of NPK fertilizer on tuber yield and yield components of new hybrid yam varieties in southwestern Nigeria. African Journal of Root and Tuber Crops 6 (1): 47 - 51.
Agbaje, G.O.; Akinlosotu, T.A. and Daramola, A. M. (1999). Yield response of MS6 and TMS 30572 Cassava varieties under cassava/ maize intercrop. Nigeria Journal of Pure & Applied Science 14: 829 – 831.
Agbaje, G.O.; Adegbite, A.A. and Akinlosotu, T.A. (2003). Performance of new hybrid yam (D rotundata Poir)) varieties in the rain forest zone of Nigeria. Tropicultura 21(3) : 149 – 152.
Agbaje, G.O.; Ogunbodede, B.A.and Makinde, J.A. (2000). Biological and economic efficiency of maize + soybean intercrop patterns in rainforest and savanna areas of south western Nigeria. Moor Journal of Agricultural Research 3(1): 37 – 40.

Agbaje, G.O.; Ogunsumi, L.O; Oluokun, J.A. and Akinlosotu, T.A. (2005). Survey of yam production system and the impact of government policies in southwestern Nigeria. Journal of Food, Agriculture & Environment 3(2): 222 – 229.

Agbaje, G.O; Saka, J.O.; Adegbite, A.A. and Adeyeye, O.O. (2008). Influence of agronomic practices on yield and profitability in kenaf (Hibiscus cannabinus L) fibre cultivation. African Journal of Biotechnology 7(5) : 565 – 574.

Agbaje, G.O; Adegbite, A.A.; Akinlosotu, T.A. and Shoyinka, S.A. (2002). Performance of new hybrid yam (Dioscorea rotundata Poir) under different cropping systems. African Journal of Root and Tuber Crops 5 (1): 8 – 11.

Ajijola, S.; **Agbaje, G.O** and Ogunbodede, B.A. (2011). Economic feasibility of kenaf (Hibiscus cannabinus) powder production in southwestern Nigeria. Moor Journal of Agricultural Research 12 (2): 116 – 122.

Akinlosotu, T.A. (1984). Planococcus halli, a new mealy bug pest of white yam (D. rotundata) at Moor Plantation, Ibadan, Nigeria. Indian Journal of Root Crops 10 (1&2): 71-73.

Alston, J.M. (2010). "The benefits from Agricultural research, and development, innovation, and productivity growth Food, Agriculture and Fisheries papers, N0 31,OECD Publishing, Paris.

Brandt, K. and Molgaard, J.P. (2001). Organically agriculture: does it enhance or reduce the nutritional value of plant foods? J. Sci. Food Agric. 81: 924 – 931

Cao, X.V.; Ismail, H.; Rashid, A.A.; Takechi, T.; Vo-Huu, T.(2011). Mechanical properties and water absorption of kenaf powder, filled recycled high density polyethytene/natural rubber biocomposites using mape as a compatibilizer. Bio Resource. 6 (3); 3260 – 3271.

Carter, J.N. and Bosma, S.M. (1974). Effect of fertilizer and irrigation on nitrate – nitrogen and total nitrogen in potato tubers. Agronomy

Journal, 66: 263-266.
Donye, A.O., Jaafar-furo, M.R. and Obinne, C.P. (2013). Improving small holder farming and extension in Nigeria: the Sasakawa Africa fund for extension education strategy. Agriculture and Biology Journal of North America Agric. Biol. J.N.Am., 4 (2): 97-102.
Egunjobi, O.A.; Akande, P.T. and Caveness, F.E. (1986). Interaction between Pratylenchus sefaensis, Meleidogyne javanica and Rotylenchulus reniformis in sole and mixed crops of maize and cowpea. Revue Nematol 9: 61-70.
Emehute, J.K.U.; Ikotun, T.; Nwauzor, E.C. and Nwokocha, H.N. (1998). Crop Protection. In: Food Yams. 141-186 pp.
Emery, N.C.; Manning, H.B. and Gene, N.A. (1987). Farm Business Management. The Decision making process. 3rd Edition Macmillan Publishing Company, New York. 158 pp.
FAO (2008). Food and agriculture Commodities production. FAOstat, Food and Agriculture organization of the United Nations, Rome. www.faostat.fao.org/site/339/default.aspx
Green, K.R. and Florini, D.A. (1996). Pests and pathogens of yams in storage. Ameeting report. African Journal of Root and Tuber Crops 1(2): 38-42.
Idachaba, F.S, (1993). Agricultural and rural development under the Babangida Administration. In: Osakwe, J.O. (Ed.). Seven years of IBB.. Vol 2: 84 – 118. Times of Nigeria. PLC, Lagos.

Ingrid, G.H. (2000). Agriculture and Rural Development. The United Nations Convention to Combat Desertification (UNCCD) Bonn Germany, December, 2000. 49 – 52pp.
Jansens, M. (2001). Yam (Dioscorea spp.). In: Raemaekers, R.H. (ed) Food Crop Production in Tropical Africa. Publ. DGIC, Brussels, Belgium, 229-245 pp.
Kang, B.T. and Wilson,J.E.(1981). Effect of mound size and fertilizer on white guinea yam(D. rotundata) in southern Nigeria. Plant

and Soil 61:327-391.
Kayode, O.(1985). Effects of NPK fertilizer on tuber yield, starchcontent and dry matter accumulation of white guinea yam (D. rotundata) in a forest alfisol of South Western Nigeria. Experimental Agric. 21: 389 – 393.
Law-Ogbomo, K.E and Remison, S.U. (2009). Yield and distribution/ uptake of nutrients of Dioscorea rotandata infliuenced by NPK fertilizer application. Not. Bot. Hort. Agrobot Cluj 37(1): 165 – 170.
Lundegardh, B. and Martensson, A. (2003). Organic produced plant foods – Evidence of health benefits. Acta Agric. Scand., Secr B, Soil and Plant Sci. 53:3-15.
Midega, C.A.O.; Salifu, D.; Bruce, T.J.; Pittchar, J.; Pickett, J.A. and Khan, Z.R. (2014). Cumulative effects and economic benefits of intercropping maize with food legumes on S. hemontica infection. Field Crop Research, 155: 144-152.
Mohd, H.A.B.; Arifin, A.; Nasima, J.; Hazandy, A. H. and Khalil, A. (2014). Journey of Kenaf in Malaysia: A review. Scientific Research and Essays. 9 (11): 458 – 470.
Mossello, A.A.; Harun, J.; Resalati, H.; Ibrahim, R.; Shnas, S.R.F and Tahir, P.M. (2010) New approach to use of Kenaf for paper and paper board production.Bio Resource 5 (4): 2114 – 2122
NBS (2012). The review of the Nigeria Economy. 2010. 58PP.
NBS (2012). The review of the Nigerian Economy 2010 . 58 PP
Ndegwe, N.A.; Ikpe, F.N.; Gbosi, S.D. and Jaja, E.T. (1990). Effect of staking method on yield and its component in sole cropped white Guinea yam (Dioscorea rotundata Poir) in high rainfall areas of Nigeria. Trop Agric. (Trin) 67(1): 29-32.
Obiazi, C.O. (1995). Supply of stakes for yam production. Journal of Sustainable Agriculture 5(3): 133-138.
Obigbesan, G.O; Agboola, A.A. and Fayemi, A.A. (1982). Nitrogen and phosphate fertilizer needs of cultivated yams. Dioscorea species in the savanna zone of Western Nigeria. Niger Agric. J. 17/18: 129-140.

Odurukwe, S.O.(1986). Yam-Maize intercropping investigation in Nigeria. Tropical Agriculture(Trinidad) 63: 17 – 21.

OECD(2015). Agricultural policy monitoring and evaluation, 2015. OECD Publishing, Paris.

Ogunlela, V.B. and Adeoti, A.A. (1990). Kenaf Production in the Nigeria Savanna: prospects and constraints. In: Shoyinka, S.A.; Ogunbodede, B.A. and Raji, J.A. (Eds). Production, protection, processing and Utilization of Kenaf in Nigeria. Processings of the 1st National Wprkshop on Kenaf. 4-6 Dec., 1990, Ilorin, Nigeria. 76-93 PP.

Ogunlela, V.B. and Adeoti, A.A., 1990. Kenaf production in the Nigeria Savannah: Prospects and Constraint. In: Shoyinka, S.A., Ogunbodede, B.A. and Raji, J.A. (eds). Production, Protection, Processing and Utilization of Kenaf in Nigeria. Proceedings of the !st National Workshop on Kenaf, 4-6 December, 1990. Ilorin, Nigeria, pp 76-93).

Ojomo, A.O. and Adelana, B.O. (1970). Variety and environment interactions in groundnut variety tests in Western Nigeria. Journal of Agric. Science (Camb). 75: 419-420.

Okereke, C.O. (2012) Challenges of risk Management among small holder farmers in Ebonyi State, Nigeria; Implications for National Food Security. Internationl of Agricultural Economics and Rural Development. 5(1): 18 – 27

Okwo, G.C. (1998). Importance of yam. In: Orkwo, G.C., R. Asiedu and I.J. Ekanayake, (eds) Research. IITA and NCRI, Nigeria. Pp 1-12.

Olasoji, J.O.; Aluko, O.A.; **Agbaje**, G.O.; Adeniyan, O.N.; Kareem, K.O. and Olanipekun, S.O. (2014). Studies on Seed Yield Potential of some selected Kenaf (Hibiscus cannabinus L.) genotypes. African Journal of Biotechnology 13(24): 2420-2424.

Oloyede, F. M.; Obisesan, I. O.; **Agbaje**, G. O. and Obuotor, E. M. (2012). Effect of NPK fertilizer on chemical composition of Pumpkin (Cucurbita pepo Linn.) seeds. The Scientific World Journal 2012: Article ID 808196, 6 pages.

Otoo, J.A.; Okoli, O.O. and Ilona, P. (2001). Improved production of seed yam. IITA Research Guide 63. Pp 21.

Oyekan, P.O. (1992). Evaluation of performance of improved groundnut varieties in Southern Guinea Savanna zones of Oyo State. In: IAR&T 1992 In-house review of Crop Production and Utilization programme. 10-11pp.

Oyekan, P.O. and **Agbaje**, G.O (1996). Groundnut production in south-western Nigeria. In: P.E. Olorunju, B.R. Ntare, O.A. Babalola and O. Alabi (Eds) Nationally Coordinated Groundnut Research Workshop. Proceedings held between 25 - 29 September, 1995 at IAR, Samaru, Zaria, Nigeria. Pp 39-40.

Oyekan, P.O. and **Agbaje**, G.O.(1999). Performance of new improved groundnut varieties in derived savanna of southwestern, Nigeria. Tropical Oilseeds Journal 4: 29 - 34.

Pest Articles and News Summaries (PANS). (1978). Pest control in Tropical Root Crops. PANS Manual No4, Centre for Overseas Pest Research. Hobbs Printers, London. 234pp.

Schilling, R and Misari, S.M. (1991). Assessment of groundnut research achievements in savanna region of West Africa. Paper presented at an ICRISAT international workshop, 25-29 November, 1991. ICRISAT Centre Patancheru, Andra Pradesh (India).

Tarawali, S.A.; Singh, B.B.; Peters, M. and Blade, S.F. (1997). Cowpea haulms fodder. In: Advances in cowpea research. Singh,

B.B.; Mohan, Raj, D.R.; Dashiell, K.E. and Jackai, L.E.N. (Eds). IITA, JIRCAS Publication, IITA, Ibadan, Nigeria.

Trenbath, B.R. (1993). Intercropping for the management of pests and diseases. Field Crops research, 34(3): 381-405.

Ukom, A.N.; Ojimelukwe, P.C.; Ezeama, C.F.; Ortiz, D.O. and Argon, I.T. (2014). Proximate composition and carotenoid profile of yams (Discorea spp.) and cocoyam (Xanthosoma maffa (scoth)) root tubers from Nigeria. Am. J. Food, Nutr; 4(1) 1-10.

Vaughan, I.O., Afolabi, C.A.; Oyekale, T.O. and Ayegbokiki, A.O. (2014) An analysis of Nigeria food imports and bills. International Journal of Economics, Commerce and management. Vol. 11(9): 1 – 4.

Webber, C.L. III.; Bhardwaji, H.L. and Blesdoe, V.K. 2002. Kenaf Production: Fibre, Feed and seed. In: Janick, J and whipkey, A. (Eds.). Trends in New Crops and New Uses. A SHS Press. Alexandra, VA. 327 – 339 PP

World Bank (1996). "Nigeria: Poverty in the most of plant."The challenges of growth with inclusions." A world Bank poverty assessment, Washington DC. World Bank.

NOTE

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