FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

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INAUGURAL LECTURE SERIES 16

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1.0 INTRODUCTION

In a keynote address presented at the 44th meeting of the Association of Deans of Agriculture in Nigerian Universities (ADANS) at Minna in 2002, Professor Ango Abdullahi, the then Special Adviser to Chief Olusegun Obasanjo, the former President of the Federal Republic of Nigeria, reminded participants of the role that agriculture plays at all times. He referred to agriculture as "the main anchor of the Nigerian economy, not withstanding the acknowledged role of the petroleum sector".

NO FARMER, NO FOOD, NO FUTURE!

1.1 What is food security?

One World Guides (2009a) defined food security simply as "access to sufficient and affordable food". They stated further that food security has become the most intractable challenge for development agencies and that almost one billion people experience the hardship that hunger imposes, a figure which continues to rise even amidst the riches of the 21st century; incidence of hunger exceeds 35% of the population in 15 countries of Africa. Net cereal imports of developing countries are expected to increase from 90 million tons in 1990 to 190 million by 2020 (Pinstrup-Anderson, 1996).

1.2 Are we food secure?

Amaza *et al.* (2008) did a study of food security in some rural households in Borno State and reported that over 58% of the sampled households were food insecure. They further reported that larger households were more food–insecure than smaller ones; they recommended provision of better family planning programme to stem the tide of food–insecurity among large–size households. Recently One World Guides (2009b) reported that Nigeria is substantially dependent on imported staples of rice and wheat and that in 2006 it was the largest customer in the world for US wheat exports. They further reported that the Ministry of Agriculture

estimated that 65% of the population is food insecure and that the real test would come whenever inadequate rainfall or flood impacts the harvest. In the food security update reported for Nigeria by FEWS NET (2009) Katsina, Jigawa, Borno and parts of Yobe States as well as Delta region States such as Delta, Bayelsa and Rivers were indicated to be moderately food–insecure as at November 2008. By February 2010 however, all the states named above in addition to Sokoto, Zamfara, Bauchi and Cross–River States were all classified as being moderately food–insecure (FEWS NET, 2010). FEWS NET (2010) quoted Dutch Agriculture Development and Trading Company, which estimated that Nigeria will import about 2.2 billon kg of rice this year to meet local requirements.

In a special report by FAO (2008), it was indicated that a 20% decline in sorghum production was recorded in 2007 and that predicted losses of maize, rice and groundnut would stand at about 20, 10 and 10% respectively. As a result of poor production, commodity prices were on the increase pushing the item out of the reach of the poor. For maize, price increases in 2008 compared to 2007 was put at about 165%. The report further pointed out that the complication in price hike was brought about by the demands for the popular grains by the poultry, food processing industries in breweries. Production of cereals is said to be on a decline because of inadequate supply of fertilizers and improved seeds as well as the poor timeliness of supply and distribution of agricultural inputs. Definitely, we are not food secure. It is however note worthy that the Chief Servant and Executive Governor of Niger State, Dr Muazu Babangida Aliyu, flagged off the distribution of 30,000 MT of fertilizer in the State, as early as April this year! We should be able to do for seed what we do for fertilizer.

2.0 SEED SECURITY

2.1 What is Seed?

God Almighty in Genesis 1:11 said "Let the earth bring forth grass, the

herb yielding seed, and the fruit tree yielding fruit after it's kind, whose seed is in itself, upon the earth and it was so". This verse, quoted from the Holy Bible, reminds us that God, from the beginning programmed the ability to produce seeds in plants and that a plant would always produce seeds of its kind. Generally speaking, seed could mean any part of a plant that is used in producing the next generation so that food may be available always. This would include both vegetative (stem, root, bulb, tuber, etc) and generative (true seed arising from pollination and fertilization) parts. However, even the generative seed that does not meet required quality standards is only a grain. Grains are produced to be eaten by man, fed to livestock or as raw materials in industries, whereas seeds are carefully produced, handled and stored in ways that would ensure high quality genetically, analytically and physiologically (in terms of germination, high seedling/plant vigour and optimum yield) for high crop productivity. Therefore, following careful production and harvest, seeds must be processed and stored in such a way that the embryo would remain viable and vigorous for a long time. Macleod (2007) pointed out that seeds are a means of transformation/evolution from generation to generation, in addition to the essential nutrition and energy for germination, emergence and plant development. Fatula (1985) stressed that availability of good seeds and other propagating materials represents a serious constraint in crop production in Nigeria and that seed sets a limit of realizable yield. Reasoning along this same line Maredia *et al.* (1999) see seed together with environment as a determining factor of the upper limit of crop yields and the productivity of all other agricultural inputs to the farming system. Seed is the starting point for all crop cultivation and if poor quality seed is used crop productivity is reduced; spread of diseases is also encouraged (CTA, 2010).

2.2 What is Seed Security?

Many definitions of the term "seed security" abound, with one expanding on the other. Karling (1999) defined seed security as "a series of activities developed to ensure access by farming household to adequate quantities

of good quality seeds and plant materials of adapted crop variety at all time-good or bad". He stressed that access implies that the source of these seeds should be within an acceptable distance and at an affordable prices, while at all times refers to the availability of appropriate seed stocked for each and every growing season regardless of good or bad growing condition and/or natural or man-made calamities. FAO (2010) also defined seed security as "ready access by rural, household, particularly farmers and farming communities, to adequate quantities of quality seed and planting materials of crop varieties, adapted to their agro-ecological conditions and socioeconomic needs, at planting time, under normal and abnormal weather conditions". Karling (1999) stated further that seed security for food security can only be achieved in the developing countries if strategies and mechanism are designed to protect the local crop diversity and improve or strengthen the seed supply sector. He concluded that if seed security is achieved, it would be a considerable asset in the fight against food insecurity and hunger throughout the developing world. Joost van der Burg (1998) defined seed security thus: the state in which all farmers in a region or farming system have ready access to sufficient quantities of seed on adequate genetic and physical quality, at the right moment, year after year. He then went ahead to describe the relationship between the three main classes of agriculture and three seed security levels. In low (external)–input agriculture, a farmer is seed secured when he is capable of producing enough crops so he can reserve some seed for next planting season. However, this group hardly produces enough to feed the family and so does not save seed and may depend of seed gift. Farmers in this group are not seed secured. In medium-input agriculture, a farmer has some money to buy some farming inputs including seed, more or less frequently. The farmer is able to produce enough seed for himself, exchange with neighbours and buys seed of local and or improved varieties. In the high external input agricultural system, farmers usually sell all their produce and buy new seed every year or every second or third year. This group of farmers only uses its farm-produced resources if there is seed supply crisis.

organizations and institutions involved in specialized tasks related to producing and marketing seed for sale to seed users.

Farmers in Nigeria source seeds from both the informal and formal sectors. Operations in the informal seed sector are usually unregulated. In this sector, farmers usually source seeds from their own savings, from other farmers, relative /friends and from local markets. About 80% of the seed by farmers in this country are obtained through this system. Furthermore, most of the farmers' varieties are of untraceable origin and are not certified. In the report of a study visit to Zimbabwe published by (CTA 2000), it was stated that the informal sector is normally made up of unregulated and uncontrolled seed operations, that it depends mainly on indigenous cultivars and that it lacks any sophisticated infrastructure. Seed quality may therefore be questionable.

The formal seed system on the other hand, is well organized and produces improved seed. It is composed of both the public and private sectors. In Nigeria, researches in respect of the development and maintenances of cereal and grain legume, crop varieties are conducted by Universities (government and private), National Agricultural Research Institutes, the International Institute of Tropical Agriculture (IITA), the International Crop Research Institute for Semi-Arid Tropics (ICRISAT). The State Agricultural Development Projects (ADPs) procure Foundation Seed from the NASC from which they produce Certified Seed through either direct production or the engagement of contract growers to boost seed production. The National Agricultural Extension Research and Liaison Services (NAERLS), is involved in seed extension technology and information dissemination. Private companies and other establishments are also a very important integral part of the seed industry in Nigeria. They produce and market Certified Seeds of various crops.

According to Olonilua (2009), the first seed law was enacted in Switzerland in 1819, in North America (Connecticut) in 1821 and in Britain in 1870. George (2009) reported that a wide range of schemes providing

verification of sowing and planting materials of vegetables had been operating in some countries since the 1920s and that it was not until 1950s that there were steps towards coordinated efforts between countries. The establishment of an organized seed industry is relatively new in Nigeria. Shobowale (2009) gave an account of the development of seed industry in Nigeria. Organized seed programme did not commence until 1975 when the National Seed Service (NSS) was established to oversee the development of the emerging national seed programme in a bid to ensure that quality seeds are made available to farmers. A national seed policy was formulated in 1992 aimed at strengthening the institutional support to achieve the objective of the Nigerian seed industry. The National Agricultural Seed Act 72 was put in place in 1992 to give legal backing to the policy earlier formulated. The act paved way for the establishment of the National Agricultural Seed Council (NASC) in December, 2007. The NASC is statutorily responsible for the following:

(i) the development, certification and control of quality;
(ii) seed technology development, technical support services, seed industry development, coordination of Breeder and Foundation Seeds;
(iii) Foundation Seed production, distribution and monitoring of Certified Seed;
(iv) planning and monitoring of the national seed programme;
(v) the publication of the list of registered, released or notified seed varieties approved for commercialization in Nigeria;
(vi) assisting the development of private seed industry and
(vii) receiving and processing of applications for seed import and export.

Considerable improvement has been recorded in the involvement of private companies in seed production activities in this country. Whereas FAO (1999) listed only four private sector seed companies (Premier Seed Nig. Limited, UAC Seed, UT Seed and Tenti Seed) in 1999, the 2008 Annual Report of NASC (NASC, 2008) showed that 12 companies were

3.0 ARE WE MEETING OR MISSING THE MARK?

Participants at the second World Seed Conference held in Rome in 2009 were unanimous in their advising world governments to take urgent measures and increase public and private investment in the seed sector on long-term basis. This is needed if agriculture is to meet the challenge of food security in the context of population growth and climate change (FAO *et al.*, 2009). The conference highlighted the critical role of new plant varieties and high quality seed in providing a dynamic and sustainable agriculture that can meet the challenges of sustainable food security and economic development now and in the future. On the importance of quality seed in agriculture, the conference concluded thus:

(i) This session demonstrated the importance of seed quality for crop productivity and agricultural and agricultural production. It has underlined, that a lack of information on seed quality could result in crop failures and has the potential to threaten food security for whole countries.

(ii) *The determination of seed quality parameters requires a broad knowledge of plant and seed physiology, taxonomy and botany and requires intensive scientific studies and research.

(iii) The application of seed quality evaluation requires a detailed knowledge regarding seed production, seed marketing, seed regulations and the seed sector.

(iv) Since 1924 the international seed testing association (ISTA) has been the impartial and objective platform where leading seed technologists and researchers have come together to discuss relevant scientific progress and make the necessary definitions regarding seed quality and how to measure it.

(v) *Currently in developing countries there is not an adequate seed quality assurance infrastructure with respect to seed testing and this is required to increase crop productivity and provide enhanced food security in these countries.

(vi) The evolution of seed quality determination has not reached an end point and there are interesting developments in the pipeline that take account of the changing need of the market. These will make tests and their applications more relevant, effective, robust, quicker and cheaper.

(vii) *Significant cuts in scientific research and education fund have reduced the possibility for young academics to acquire the necessary seed technology skills.

(viii) In seed technology area, transparency in any scientific exchange of the latest research results remains of crucial importance for continued progress.

(ix) *Uncompetitive salaries for seed analysts in developed countries make a career in seed quality control unattractive for young people.

The meeting stressed that benefits from plant breeding can only be transferred to the farmer if good quality seed is released.

3.1 Seed Industry, its Development and Operations in Nigeria

Seed system refers to the entire complex of organizations, institutions and individuals associated with the seed programme of a country (Maredia, *et. al.*, 1999). It comprises of the traditional or informal system of a farmer-selected/developed, -multiplied, -processed, -exchanged and –retained seeds, and non-traditional or formal system of individuals,

organizations and institutions involved in specialized tasks related to producing and marketing seed for sale to seed users.

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involved in the certification activities of crops such as rice, maize sorghum, millet, soybean, groundnut and cowpea in 2008. Going by the increase in the number of such private companies, one might say that some robustness is coming into the industry.

4.0 ARE OUR FARMERS' NEEDS BEING MET WITHIN THE CONTEXT OF SEED SECURITY?

According to GRAIN (2005), Nigeria is seen as a big seed market. The country was ranked fourth behind South Africa, Morocco and Egypt on the list of the biggest commercial seed markets in Africa. The source (FIS), put the annual domestic seed sales in Nigeria at US$120 m. The message one can gather from this information is that seed trade is very lucrative if the nation would seriously encourage our farmers to adopt the use of improved seed. It can even serve as a source of foreign exchange if after adequately satisfying local needs, the excess is exported to other developing countries.

Utoh (1999) gave a year-wise seed production target spanning 1994 to 2000 in respect of some selected crops as shown in Table 1 perhaps bearing in mind that all things would be equal and that the enthusiasm of farmers would be aroused and sustained. This author does not however, have information as to whether the targets set were met or not.

Table 1. Year-wise Production Target (MT) of Certified Seed for Various Crops

	Year						
Crop	1994	1995	1996	1997	1998	1999	2000
Maize (OP)	4000	5000	6000	7000	8000	9000	10000
Rice	4000	5000	6000	7000	8000	9000	10000
Sorghum (OP)	600	1000	1400	1800	2200	2600	3000
Millet	200	300	400	500	600	700	800
Cowpea	800	1000	1200	1400	1600	1800	2000
Groundnut	800	1000	1200	1400	1600	1800	2000
Soybean	800	1000	1200	1400	1600	1800	2000
Wheat	200	400	600	800	1000	1200	1600
Cotton	1300	1500	1700	1900	2100	2300	2500

Source: Adapted from Utoh (1999)

Table 2 shows the quantity of seeds distributed by NASC from 2005 through 2009 while Table 3 gives the production levels of the private seed companies during the same period.

Table 2: Certified Seed (MT) distributed by NASC from 2006 to 2009.

Crop	Year			
	2006	2007	2008	2009
Maize	2612.4	2811.8	3546.4	2615.4
Rice	1187.9	1715.5	3100.9	1406.9
Sorghum (OP)	253.0	656.9	177.8	794.5
Millet	53.4	88.5	140.8	216.8
Cowpea	86.5	89.6	123.4	41.9
Soybean	291.7	307.6	471.0	183.0
Groundnut	120.5	108.5	146.0	8.3

Source: NASC

Table 3: Certified seed production levels (MT) of some cereal and grain legume crops by seed companies in Nigeria during 2005 to 2009.

Crop	Year				
	2005	2006	2007	2008	2009
Maize	NA	NA	NA	NA	NA
Rice	415.3	1,108.2	2,591.2	1,806.1	936.4
Sorghum	240.8	641.5	117.3	2,186.0	492.0
Millet	-	-	-	295.2	763.6
Soybean	61.2	78.3	138.0	128.8	191.0
Cowpea	24.0	36.7	61.8	83.8	49.0
Groundnut	15.5	14.0	23.0	12.3	47.5
Sesame	-	-	-	11.9	00.0

Source: NASC

The pieces of information on the Table 2 might erroneously give the impression that the country is lagging behind. For example, if we had met the target of 10,000 t in 2000 as planned according to Utoh (1999) in Table 1, one would expect, by simple arithmetic progression, that the production for 2006, 2007, 2008, and 2009 should have been about 10600, 10700, 10800, and 10900 mt respectively. However, a look at Table 2 shows that only about 2,615 mt of maize was distributed in 2009.

Seed production is a commercial venture and it therefore makes economic sense to allow supply to be driven by demand in this sector as well. The information from a seed company (name withheld) presented in Table 4 below may shed some light on why a seed company may have to tread softly in its enthusiasm to increase seed production level, perhaps, in response to a sudden unprecedented high demand for improved seed of a crop in a particular year. Using hybrid maize as an example again, of about 634 MT produced between 2005 and 2007 about 404 MT was distributed between 2006 and 2008. This left a carry over of about 230 MT! This is an indication of poor patronage of improved seed by farmers. According to FAO (1999), the unorganized Nigerian seed marketing institution component of the Nigerian private seed sector controls over 80% of the seed trade which largely, if not wholly, comprises of unimproved seed commodities and is inefficient. The organized Nigeria seed marketing institution and the public seed sector control less than 20% of the seed trade which is largely of the improved seed stock. Shobowale (2009) put the adoption of improved seed used by Nigerian farmers for many crops at below 10%. Crop production and supply can only record tremendous progress when the situation is reversed.

Table 4: Production and distribution figures of a seed company (anonymous) in the country in respect of maize and rice from 2005 to 2008

	Quantity produced (MT)			Quantity distributed (MT)		
Crop	2005	2006	2007	2006	2007	2008
Maize (hybrid)	205.0	350.0	78.8	93.9	239.3	7.1
Maize (OPV)	50.0	200.0	11.3	14.0	40.5	7.3
Rice	0.3	80.0	40.2	-	76.4	34.3

Source: Anonymous

Table 5 shows the prices at which seed companies sold their produce during 2005 to 2009. Obviously, there were some upward reviews in prices from year to year. This is expected as the companies have to meet the costs of production inputs (including labour) which are always on the upward swing. It however, remains to be seen if 'high seed price' was responsible for the discouraging level of patronage of improved seed by farmers.

Table 5: Mean Companies' prices (#/kg) of Certified Seed during 2006 to 2009.

	Year			
Crop	2006	2007	2008	2009
Rice	160.0	166.0	191.0	167.0
Maize	132.0	138.0	152.0	163.0
Sorghum	105.0	111.0	129.0	150.0
Millet	-	-	-	155.0
Soybean	127	133.0	145.0	170.0
Cowpea	155	171.0	190.0	188.0
Groundnut	215	225.0	225.0	350.0*
Sesame	-	-	-	325.0
Cotton	-	-	-	120.0

* only one company's record was available.
Source: NASC

Apart from the production figures shown above, it should be noted that some crop-based Research Institutes such as the National Cereal Research Institute, Badeggi in Niger State, Institute of Agricultural Research, Samaru, Zaria, Lake Chad Research Institute, Maiduguri and the Institute of Agricultural Research and Training, Moor-Plantation, Ibadan, also sell improved seeds of various grain crops to farmers. Moreover some other NGOs also engage in seed production and distribution.

5.0 FOCUS ON NIGER STATE

In 2004, the Niger State Government released N1,000,000 as special intervention in her bid to make quality seeds available to farmers. Table 6 shows the results of the seed production efforts for the various crops involved in the programme.

Table 6: Niger State ADP Certified Seed production effort in 2004

Crop	Field location	Area cropped (Ha)	Yield (Kg)
Maize	Tungan Wawa and T/Samani	1.5	1200
Rice	Badeggi	1.0	473
Soybean	Mokwa and Tegina	3.9	849
Groundnut	Tungan Wawa	2.0	840
Yam	Tungan Mallam	0.3	1150 tubers

Source: Niger State ADP, Minna

In 2005, seed farms of groundnut were established at Bobi Gari, Duku, Utachu, Tungan Wawa, and Masaha. Soybean seed was produced at Masaha and Masamagu while lowland rice seeds were produced at Masaha and Warari.

Sequel to the Presidential Initiative on Rapid Rice Production and Processing Programme, NSADP was involved in the Certified and Community Seed Production Programmes in 2006. The varieties grown and the yields obtained are as shown in Tables 7 and 8.

Table 7: Certified Seed production by NSADP in 2006

Contract farmers' location	Farm size (Ha)	Crop variety	Yield (Kg)
Emitsu-Bida	2.0	FARO 52 (WITA-4)	3600
Mariga	2.0	FARO 44 (SIPPI)	3400

Source: Niger State ADP, Minna

Table 8: Community seed production effort of NSADP in 2006

Contact farmers' location	Farm size (Ha)	Crop variety	Yield (Kg)
Emitsu-Bida	0.25	FARO 55 (NERICA-1)	300
Kuta	0.25	FARO 52 (WITA-4)	430
Kuta	0.25	FARO 44 (SIPPI)	450

Source:Niger State ADP, Minna

Despite the efforts reflected above in addition to receipts from NASC, there appears to be poor patronage of improved seed by Niger State farmers. For instance of the total of 8.00 MT of lowland (FARO 52 and 44) and 2.66 MT of upland (NERICA 1 and WAB 189) rice received by ADP from seed companies at the instance of NASC in 2006, only about 0.09 and 1.4 MT respectively were utilized. In the same year NSADP received 6.0 MT of upland rice varieties from the National Seed Service (NSS now NASC).

In line with Federal Government's desire to boost production of food crops, Certified Seeds of some grain crops were distributed to State ADPs in 2008. Table 9 shows the quantity of seeds delivered to the Niger State ADP by Alheri and Maslaha Seed Companies under the National Food Reserve Agency Programme for Food Security (NFRAPFS) meant for sale to farmers during the 2008 cropping season.

Again, and as lamented earlier, despite what appears to be an abundant availability of improved seed, it is glaring from the Table 10 that, except for FARO 55 variety of rice, farmers' responses to the use improved seed was not encouraging despite the low prices. Information gathered also showed that farmers might have relied on their farm-saved seeds.

Table 9: Improved Seed of the various crops supplied to Niger State ADP in 2008.

Crop	Variety	Seed Company		
		Alheri	**Maslaha**	
Maize	(i) Hybrid	(kg)	(kg)	Total
	JO2 (yellow)	2000	-	2000
	SDM 2	-	4000	4000
	(ii) OPV			
	Across97	-	5000	5000
Rice				
	FARO 55 (NERICA 1)	-	5000	5000
	FARO 44 (SIPPI)	2000	-	2000
Sorghum				
	KSV8 (Farafara)	4000	-	4000
	TOTAL	8,000	14000	22000

Source: Niger State ADP, Minna

Table 10: The opening and closing seed balances of NSADP in 2008.

Crop	Variety	Seed opening balance (kg)	Quantity sold (kg)	Seed price (N) /kg	Seed closing balance (kg)
Maize	(i) Hybrid				
	JO2	2000	Nil	No sale	2000
	SDM 2	4000	820	80.0	3180
	(ii) OPV				
	Across 97	5000	1320	72.5	3680
Rice					
	FARO 55 (NERCA 1)	8125	3750	85.0	4375
	FARO 52 (WITA-4)	5000	4050	85.0	950
	FARO 44 (SIPPI)	3420	1740	85.0	1680
Sorghum					
	KSV 8	4000	710	65.0	3290

Source: Niger State ADP, Minna.

In 2009, the Federal Ministry of Agriculture and Water Resources through the Nation Food Reserve Agency again made some quantities of certified seeds totaling 41.5t available for sale to farmers. Supplies included seeds of assorted varieties of maize, rice, sorghum, millet, cowpea and soybean and the recommended prices per kg were as indicated in Table 11. Some of these prices are either lower than or close to the current prices of grains in the market. Our farmers have a lukewarm attitude towards embracing the adoption of improved seed.

Table 11: National Agricultural Seed Council's Recommended Prices/kg of the Various Seed Types Supplied to Niger State ADP in 2009.

Crop/Variety	Recommended price (N)/kg
Maize	
Hybrid	97.5
OPV	90.0
Rice	110.0
Sorghum	90.0
Millet	86.3
Cowpea	130.0
Soybean	92.5

Source: Niger State ADP

A study conducted by Zubairu *et al* (2003) revealed that about 86% of the farmers in Niger State relied on self-selected seeds. Unpublished results of another state-wide survey conducted in 2006 indicated that most farmers in the state obtained seeds from the crops grown in the previous year and this source was followed by 'market' and 'friends' sources. More recently, Gana and Amatu (2010) also reported that farmers at Gidan Mangoro, a village in the immediate vicinity of Minna, mostly used seeds from the market and previous year's harvest. The trends reported above is not too far from those that have been reported to be the case in Africa. Granquit (2009) reported that small scale farmers in Africa use 90–95 % farmer-saved seed for their crop production.

6.0 WHAT THEN IS RESPONSIBLE FOR POOR PATRONAGE OF IMPROVED SEEDS AND WHAT IS THE SOLUTION?

One of the greatest problems being faced by farmers in developing countries is the poor access to quality seeds. van den Burg (2004) listed some reasons farmers use their own seed. One of such is that modern seed industries concentrate on only certain crops for which there is a steady, large market and not small crops. That the varieties that these companies produce are often only suitable for certain group of farmers is also given as a reason. Furthermore the seed may be expensive or may be of the cultivar that may not have the characteristics that the small farmers are looking for. In the survey conducted by Zubairu *et al.* (2003), most farmers interviewed preferred growing rice variety that are good for 'tuwo' and that only 46% considered yield as an important function. The selection of millet variety was based on suitability for porridge, 'tuwo', and 'kunu' followed by grain yield; cowpea varieties with big and white seeds are preferred by farmers as women (the end users) say such are better in the preparation of cake ('kosai') and 'moin'-'moin' ('alele'). The study also revealed that most farmers grow sorghum varieties that are good for 'tuwo' and porridge. Recently it was gathered that farmers prefer tall varieties of sorghum to shorter ones because corn stalks are very useful in thatching houses and in building other structures. The absence of this attribute in a variety may militate against its acceptance by farmers. Mulila-Mitti (2007) reported that Zambian farmers still cultivate local varieties of maize and cowpea despite adoption of improved varieties. According to her, this is because the local varieties possess some cherished characteristics which meet some specific objectives and which are not found in improved varieties. In the case of cowpea, the local varieties have larger grain sizes and offer wide variety in colour. In maize, cherished characteristics include better storability, ease of pounding and larger kernel size. Some local varieties of maize were also reported to be very good as green maize and fetch a very high price on the market. Among such characteristics are maturation, drought resistance, good storage qualities and consistency with rational needs. Daniel, et al (2002)

also reported that over 60% of vegetable farmers in the area covered by a survey conducted in the South Western Nigeria based their selection of the variety to cultivate on consumer preference while 33% of the respondent selected varieties based on yield.

The cost of seed could not be used as a reason for not embracing the use of improved seed by farmers in Niger State. It is apparent from Tables 10 and 11 that the subsidized prices at which seeds were offered to farmers by ADP/NASC were even lower than the prices of the grains of the various crops in the market and much lower than companies' prices (Table 5). Perhaps, a most tenable reason may just be the distance a farmer would need to travel to get the seeds. If improved seeds were only available at the Zonal Headquarters of the State ADPs, farmers in the interior may be reluctant to travel that far. The report of Zubairu *et al.* (2003) again showed that over 75% of the respondents obtained their seeds within the village and 2 km radius of the village. It is perhaps a combination of transportation and seed costs that may reduce the enthusiasm of a farmer to want to embrace the use of quality seeds. Venkatesan (1994) in grouping farmers on the basis of climatic and resources endowment factors suggested that farmers that cannot afford the cash outlay involved in purchasing seed could be encouraged to increase food production through better use of their own saved seeds.

Community-based seed production schemes appear to hold all the aces in proffering solution to the low-key utilization of improved seeds. In this respect, attempt has been made in this country to increase the use of quality seed by rural farmers through some seed production programmes in locations that are close to rural dwellers. The Community Seed Development Programme (CSDP) is one of such which began in 1995 covering 13 selected pilot States. In 1998, the National Council on Agriculture (NCA) approved that all the States of the Federation (including FCT) be covered by the scheme. The plan was to select a suitable community in each L.G.A. for the establishment of seed farms using one reputable farmer in the community as contact. The farmer was to

establish one hectare (1 ha) of a crop variety and with support from the respective State ADP. The Foundation Seed is normally sold to the contact farmer at 50% subsidy. The variety to be multiplied by a farmer is that recommended for the area based on adoptive research trials. The broad objective was therefore to make quality seeds of acceptable varieties easily accessible and at the farmers' door step (FAO, 1999). Such varieties would be more acceptable by farmers because they might have had the opportunity of observing the performance of such candidates during the multiplication process on their neighbours' farms and would be able to personally assess the superiority or otherwise, of improved seed over that of the farmer's. Furthermore, because the contact farmer is a member of the locality, he would always fix prices that would be affordable by members of his community. The CSDP was said to be a huge success in the adoption of NERICA and other rice varieties. Eighteen states were said to have participated in the scheme in 2005; more States (including Niger) joined in 2006. The shortcoming of this programme as I see it, however, is that only farmers close to the point of production within each L.G.A may benefit. Another scheme that looked promising was that referred to as Small/Medium Seed Enterprises (FAO, 1999). As in the CSDP, only dependable contract growers were engaged in this scheme to multiply quality seed and they were also at liberty to fix prices and sell the seed so produced. A total of 64 Enterprises were involved and they produced a total of 2,035, 2,352, 1,200, and 5,491 in 1993, 1994, 1995 and 1996 respectively.

The two programmers' described above were initiated to encourage especially resource- poor farmers, to use quality seeds of improved varieties for increased food crop production. However, both schemes do not appear to be functioning at the moment and this might have been responsible for the poor patronage of improved seed by small scale farmers.

Lessons from within and outside the country

CTA reported very recently that some farmers in Borno State who have

been given some training in seed production within the context of the Community Seed Scheme are reaping some benefits: earning some revenue as seed producers, creating access to good quality seeds suited to local needs and conditions and selling such seeds to fellow farmers (CTA, 2010). The farmers were reported to have been trained by staff of the International Institute of Tropical Agriculture (IITA), Ibadan and that the monitoring and certification was done by the NASC.

Another community-based seed production system known as the Quality Declared Seed system (QDS) was introduced by FAO (1993) with a revised edition published by FAO (2006). This system is not to replace a fully developed seed certification programme but according to Granqvist (2009) makes less demand on government resources while increasing access to improved seed by resource-poor or small scale farmers. QDS can only be produced by registered trained small-scale farmers producing seed for their own use; farmers that produce more than they require can sell the excess to neighbouring farmers within the ward. The scheme is of particular value in countries where there are insufficient resources or lack of infrastructure for the establishment of highly evolved seed monitoring systems such as seed certification. It was introduced into Tanzania under the "On-farm Seed Production" programme supported by the Danish Government (Granqvist, 2009). It was put in place to improve seed trade and so boost food production.

District Extension Officers/Supervisors (perhaps the equivalent of our own Village Extension Agents-VEAs) were trained to act as Authorised District Seed Inspectors/Samplers. These officers sample seeds in accordance with QDS and International Seed Testing Association (ISTA) rules and procedures. Only seed lots that pass quality test are registered and sold as QDS. On crossing this hurdle, the farmer is now expected to label the QDS bags. The minimal costs incurred in the registration, control inspection and seed lot test would, no doubt, reduce the cost at which seeds are offered for sale to non-seed producing farmers, making improved seed more affordable. The initiative has been incorporated into

the formal seed system in Tanzania. It is however stressed that farmers involved in the scheme would have to be trained in agronomic practices required for optimum seed quality. They would also need advice on selection of seed from healthy plant as well as on harvest and post-harvest (including storage) handling of seed to ensure adequate seed viability, and vigour maintenance. The advantage of this scheme is that small-scale farmers have the opportunity of choosing their crop of interest for their local markets and target areas which would be based on potential uses of the grains they want to produce. The QDS has also been found to be effective in the dissemination of quality vegetable seeds. The scheme which has been in use since 1999 according to Zulu (2002) may only, in many cases, require germination and analytical purity test (that is, may not necessarily undergo field inspection) before being offered for sale.

To improve the seed supply system in Zambia using the QDS scheme, the 'Seed Garden' concept was initiated by SADC/GTZ in 1997/98 (Mulila-Mitti 2002). It is a project designed to promote farmers' access to quality seeds. This scheme is not all that different from the Small/Medium Seed Enterprise Scheme referred to above and which was operational in Nigeria in 1993 to 1999. However, the Seed Garden concept has built into it participatory variety selection in combination with the participatory seed production. Seed gardens are meant to act as a source of fresh and healthy seed at the start of the normal planting season by producing seed during the off (dry season) by using wetland (Fadama) or other sources of irrigation. The area per farmer is usually very small and may require fencing to prevent damage by livestock. Since production is done during the off season, growers are few and areas to be planted are small allowing for the required isolation distance to be observed, there will be less chances of conformation; seeds produced are therefore very high in genetic purity. Seeds are also healthier because disease and pest incidence are also reduced during this period. Furthermore, because seeds are harvested close to the main planting season, the need for elaborate storage facility is eliminated. Another advantage is that farmers in a position to estimate what the yield from the seed garden would be and

when it would be available. It should however be noted that the scheme requires that farmers be trained in seed quality maintenance. Through the scheme yield of 2 to 3 t/ha were obtained for maize and cowpea respectively with fertilizer application. Furthermore, for minimal contamination, cooperation among participating communities is very essential. In Zambia for example, where more than one variety is to be multiplied each zone handled a variety and exchanged seeds after harvest. This way, contamination within a zone is eliminated. However, one problem that may arise is that of dormancy in freshly harvested seeds of crops such as okra, beniseed, pepper, etc which are examples of crops which seeds may require some period of after-ripening before high germination percentage would be obtained (Oladiran and Almasiah, 2001; Oladiran *et al.*, 2002; Oladiran and Haruna, 2002; Oladiran and Kortse, 2002) . Another problem is that only varieties that would mature early enough for seed use can be accommodated by this scheme and not the long duration varieties. Also, Foundation Seeds and of adequate quantities must be readily available to participating farmers.

7.0 FROM VARIETY DEVELOPMENT TO THE FARMER

It takes quite some time to develop a variety using several methods that may include introduction, selection, hybridization and others such as irradiation, backcrossing etc. Another couple of years are required to assess the performance of promising lines on-station and on-farm. It would therefore be disastrous if after so much time and money might have been expended on the development of a variety, a seed crop is poorly handled during and after production. About 50% of a seed crop is said to be usually lost during harvesting, drying, cleaning and storage (Joost van der Burg, 1998). Seed and grain crops are not managed the same way. The process involved in seed production maybe rather cumbersome and expensive. Seed production in the formal seed system involves certification. According to Joshua *et al.* (undated), a variety is eligible for consideration by the National Release Committee, when through trial data; it has been proved to be distinctly superior to existing commercial

varieties, in at least one or more characteristics, and at least satisfactory in all important aspects. The released variety is then given a popular name by the breeder and registered as a distinct agricultural variety for distribution to farmers. The area of adaptability of the new variety is also made known to the public during the release. Only released varieties are brought into the seed certification scheme.

The breeder or the institution which the breeder represents keeps the parent material (Nucleus seed) of a variety that has been approved for release and from it grows a small sample to produce the class of seed known as the Breeder Seed (BS). The multiplication is under the direct control of the breeder and this is the purest representative of the variety. It is from the Breeder Seed that Foundation Seed which may be in two stages (FS I and II) is produced. This class of seed is produced under contract by a Foundation Seed farmer. The progeny of the FS is known as Certified Seed (CS) and it represents the final class of seed in the certification process except in unavoidable circumstances in which Certified II may be obtained from the multiplication of Certified I seed. It is the Certified Seed that is normally sold to farmers for the purpose of grain production. Through all the stages of multiplication, adherence to both field and seed standards are enforced. This is to ensure that genetic purity/varietal identity is maintained. Inspections or visits by authorized personnel are conducted on Foundation and Certified Seed crops on field, as well as during and after harvest. Equipment and storage facilities are also inspected for compliance to standards. Items watched out for on the field include for example, isolation distance, presence of other cultivar or crop plants, plants classified as weed and disease incidence. In the laboratory, seed analysis is done to determine the percentage of other crop seeds, weed seeds, inert matter, diseased seed (by weight or number), seed moisture content and germination. It can be seen from the brief description given above that the certification procedure in the formal seed system is quite time consuming and laborious. This is justifiably so to ensure that it is what the breeder labours to produce and as approved for release by the National Seed Release Committee that eventually gets to

the farmers as certified seeds. However, as stated earlier the procedure maybe relaxed through the QDS scheme to enable Community-based seed production scheme flourish as a way of producing a temporary bridge between the formal and informal seed systems.

8.0 A NEGLECTED AREA IN THE FORMAL SEED SUPPLY SYSTEM

Vegetables are very important sources of vitamins and minerals which are required for the efficient running of the human body systems. In most developing countries, required attention is not given to vegetable seed production and supply in the formal seed supply system. Most farmers do not therefore use improved seeds of this important group of crops. This fact is accepted worldwide and the developed countries seem to take this seriously than the developing countries. The result of a study conducted among countries within the European Union (EU) revealed that 26,000 deaths before the age of 65 years and about double this number of death before the age of 75 years would be prevented annually in the EU if intake of vegetables and fruit was levelled up to the highest consumption levels (Joffe and Robertson, 2001). In a related study conducted among Irish adults O'Brien *et al.* (2003) concluded that intakes of vegetables and fruit were low compared with current dietary recommendations particularly in those of lower levels of educational attainment and social class. The total worldwide death currently attributed to inadequate consumption of fruits and vegetables according to Lock *et al.* (2005) was estimated to be up to 2.635 million per year. Schneider *et al.* (2007) concluded based on study conducted in South Africa that high intake of fruits and vegetables can make a sufficient contribution to the decreasing mortality from certain diseases. They opined that environment should be made conducive for positive dietary change and this should include increased intake of fruits and vegetable. Studies in Ethiopia, Malawi, Mozambique, South Africa, Tanzania, Uganda, Zambia and Zimbabwe showed that vegetable seed production was neglected resulting in massive importation of seed of crops such as tomato, cucumber, pepper, watermelon, onion, *Amaranthus*, okra, etc, by private companies. To address this problem,

publicly funded research in these countries has been mandated to cater for the research needs of all the crops not covered by private research (CTA, 2000).

According to the publication of the National Centre for Genetic Resources and Biotechnology (NACGRAB), Moor-Plantation, Ibadan, 14 varieties of tomato, six of *Amaranthus*, five of pepper, two of *Celosia* and two of 'egusi' melon have been released for farmers' use (NACGRAB, 2004). This author believes that there would be no reasonable conducive environment for improved vegetable production and so higher intake in Nigeria when the factors militating against production of the seeds of this important group of crops are being handled with 'kid gloves'. Vegetable seed production is largely in the hands of rural farmers with little or no distinction between seed and grain crop production. Adebooye *et al.* (2005) pointed out that non-availability of improved seeds is known to constitute a major constraint to the cultivation and productivity of most indigenous leafy vegetables in Africa. They stated further that farmers rely more on volunteer plants and farm-saved seeds. A survey conducted in Kenya revealed that African leafy vegetables contributed 10% of the income generated by commodities in the markets in the Western parts of the country (Abuktsa-Oyango, 2002). Substantial quantity of packaged seed of some vegetables such as carrot, cabbage, lettuce, onion, pepper, tomato, etc found their way into Nigeria through various routes. Much of the seed remain on the peddler's shelves for months or years. This might therefore be dead or of poor vigour by the time they with attendant poor field performance. As lamented by CTA (2010), fake seeds are a major problem in many parts of Africa with unscrupulous dealers selling poor quality substitutes to farmers. Imported varieties might not even have been bred for a tropical environment or for a particular agro-ecological zone. Gorin and Sarr (1998) warned that vegetable crop varieties selected under temperate, sub-tropical and Mediterranean climate, are less adapted and less efficient in altitude areas of West and Central Africa than in high altitude areas. They therefore stressed that the formal seed sector should invest in creative variety development programmes. It is

however doubtful if seed companies would show much interest in vegetable seed production in this country since most vegetable farmers rely on farm-saved seeds. Results of a survey conducted in South Western Nigeria by Daniel *et al.* (2002), revealed that in Oyo State, 60% of tomato farmers sourced improved seed from the market in the first year of study but in the following two years, only 13% of the farmers still bought seeds. In Oshun State, majority of the okro farmers saved seed from the previous harvests. The NASC should properly integrate the nation's Universities in to the seed supply system. To encourage the use improved seeds by vegetable farmers in Kenya, Abukutsa-Oyango (2007) reported that Maseno University Botanic Garden produced seeds of selected vegetable species to support the already existing seed support system. Selected Faculties of Agriculture in some Nigerian Universities that have relevant and experienced personnel may have to be co-opted by the NASC to produce seeds of some selected improved vegetable varieties for distribution to farmers in addition to the production from the National Horticultural Research Institute (NIHORT), Ibadan, IAR, Zaria and others.

9.0 PRODUCTION AND MAINTENANCE OF HIGH QUALITY SEEDS

The monitoring of seed production, harvest and post-harvest handling of seed (including storage) as well as facility inspection has as its aim, to make sure that the Certified Seed that eventually gets to the farmers, from which he eventually produces a grain crop, is as high in quality (genetic and physiological) as possible. Most often, it is erroneously believed that high seed quality is ensured by keeping the field free from weed, diseases, pest and other crop plants as well as adequate supply of fertilizers, etc. Studies have however shown that these might not be all that are needed. Some steps to be taken might be glaring while others might not be striking. For example, whereas in some crops species the highest quality is normally obtained at the end of the seed-filling period as reported by Harrington (1972) and Rasyad *et al.* (1990), maximum quality might not be obtained until some time after in others (Kameswara *et al.*, 1991). Delayed harvesting has been reported to reduce seed quality in

Toria (*Brassica campestris var. toria*) by Singh, *et al.* (1976) and tomato by Valdes and Gray (1998). Nkang and Umoh (1996) recommended that a seed crop of soybean should be harvested at agronomic maturity, that is, when pods are completely brown and dry. Even though seed germination was equally high when fruit were harvested at physiological maturity (that is, when pods were turning yellow) and at two weeks after agronomic maturity, subsequent storability was poor. High temperature during development reduced soybean seed quality even in the absence of mechanical damage (Spears *et al.*, 1997). Seeds produced at 33/28°C and 38/33°C were smaller, wrinkled and shrivel and had poor quality compared to those produced at 27/22°C. Even the non-wrinkled seed at 33/28°C which germinated 98% at harvest had reduced vigour during accelerated ageing. Both germination and vigour of normal seeds that developed at 38/33°C were low. Oladiran *et al.* (2002) also reported that production environment significantly affected soybean seed vigour. Following seven months storage, viability was better in seeds produced at Kontagora than in seeds from Mokwa location. The stage at which a pepper fruit is harvested has also been shown to significantly affect the quality of pepper seeds (Oladiran and Haruna, 2002). It is obvious from Figure 1 that even though all the seed lots germinated poorly when freshly harvested due to dormancy which was broken to some extent during storage, those extracted from red-ripe (RR) fruits stored better than those from yellow (Y) and yellowish green (YG) fruits.

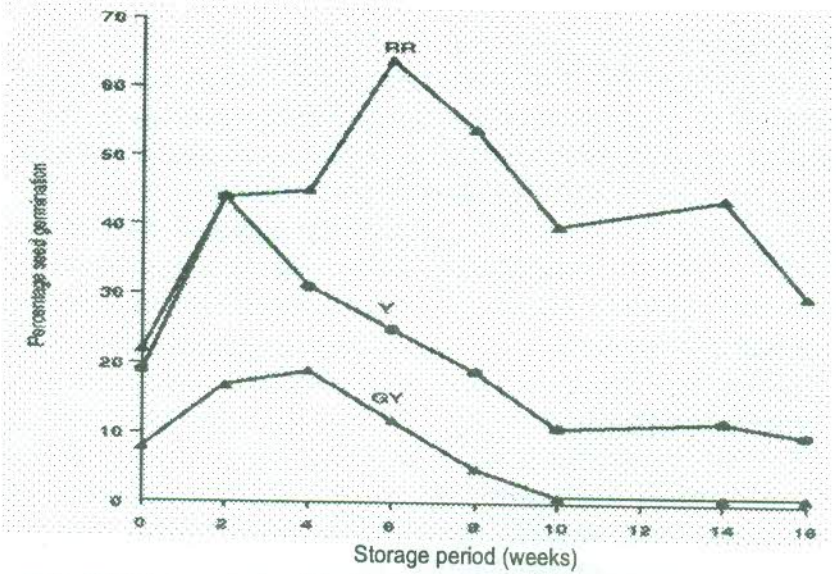

Fig. 1: Percentage germination of freshly harvested and stored cv. 'Rodo' seeds extracted from red (RR), yellow (Y) and greenish yellow (GY) fruits

Oladiran and Kortse (2002) also reported that though pepper (*Capsicum annuum*) seed dry weight was maximum when fruits turned red-ripe, viability and longevity of cv. 'Tatashe' were best from over-ripe (10 days after turning fully ripe) compared to the result obtained from colour breaking and ripe-fruits (Figs. 2 and 3).

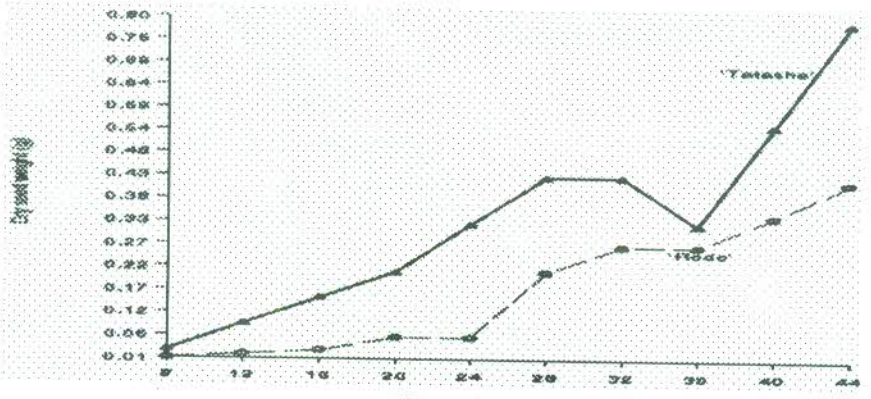

Fig. 2: Dry seed weight (g) fruit in cvs. 'Tatashe' and 'Rodo' at different stages of maturation

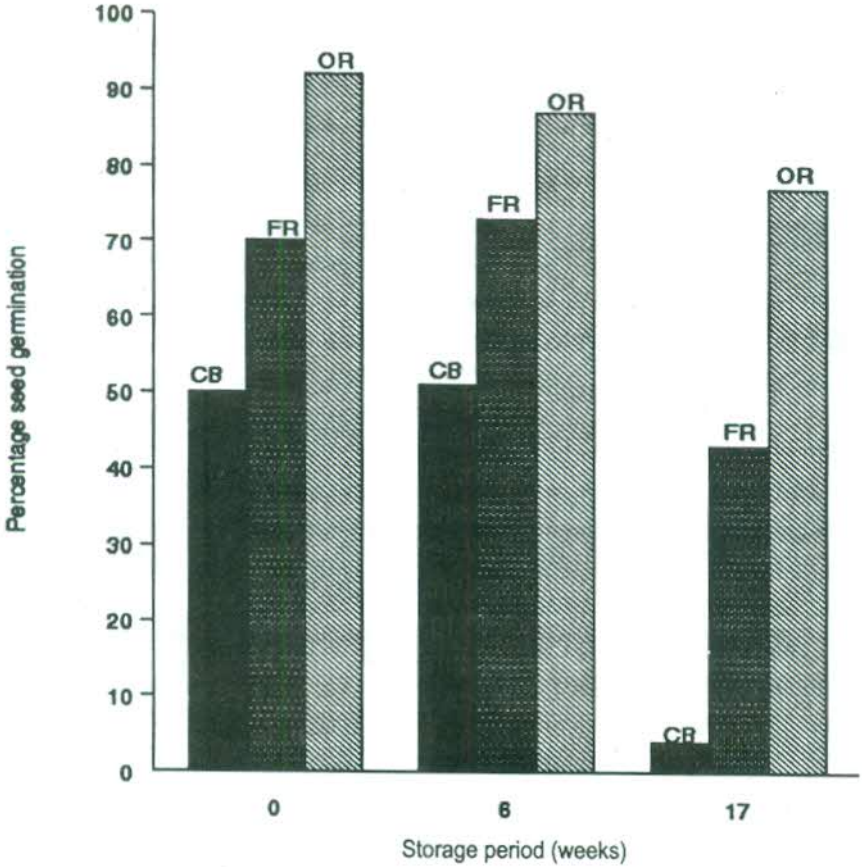

Fig. 3: Germination of fresh and stored seeds s of cv. 'Tatashe' extracted from fruits at colour breaking (CB), fully ripe (FR) and over-ripe (OR) stages

They recommended that pepper fruits be harvested at over-ripe phase but should not be allowed to rot as Valdes and Gray (1998) have reported that delayed harvesting of tomato fruit led to seed deterioration. Results (unpublished) from a study concluded recently in our Department by one of our Post-graduate students and illustrated in Figs. 4 and 5 showed 'Tatashe' and 'Rodo' seeds extracted from post-harvest dried fruits germinated higher and stored longer than those from red-ripe and field-dried fruits.

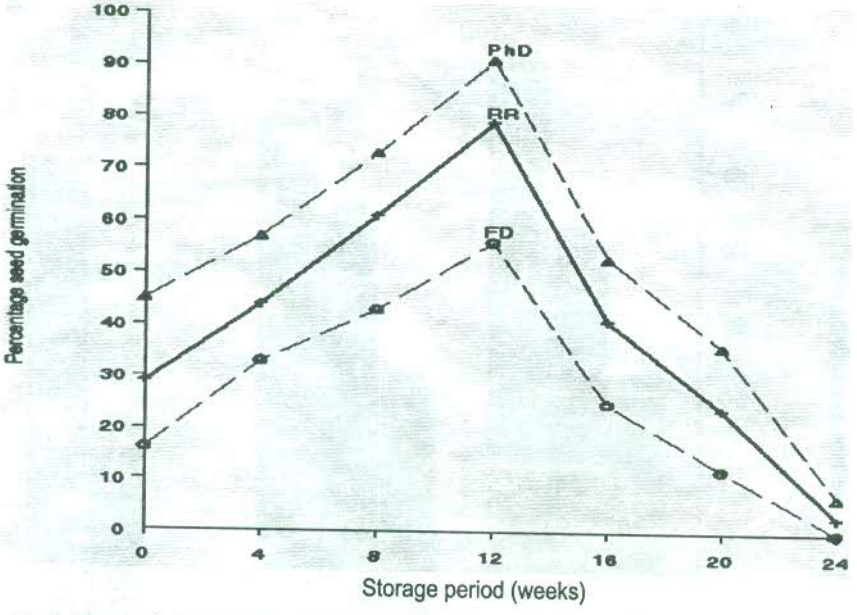

Fig. 4: The germination percentage of freshly harvested and stored cv. 'Tatashe' seeds extracted from red-ripe (RR), post-harvest dried (PhD) and field-dried (FD) fruits

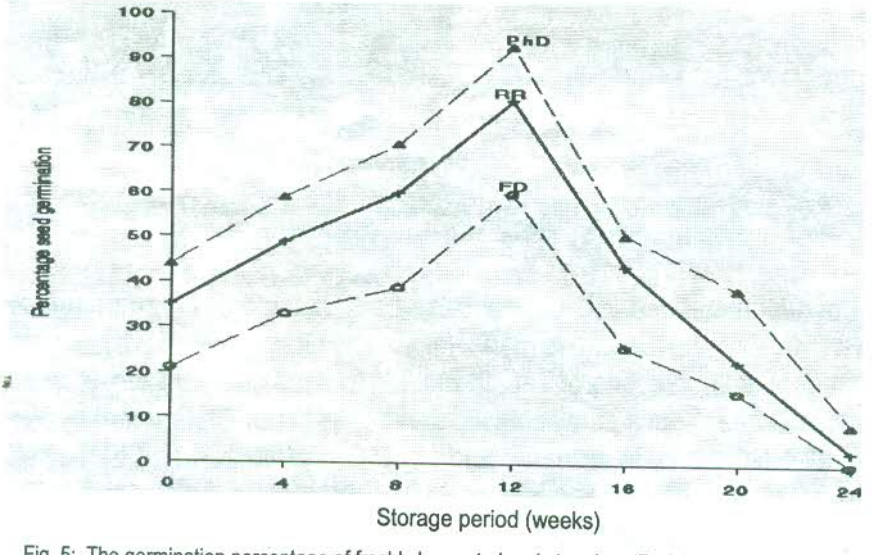

Fig. 5: The germination percentage of freshly harvested and stored cv. 'Rodo' seeds extracted from red-ripe (RR), post-harvest dried (PhD) and field-dried (FD) fruits

The superiority of the seeds extracted from post-harvest dried fruits over those extracted from fully ripe fruit is tandem with the recommendation of Oladiran and Kortse (2002).

Small scale vegetable farmers do not normally set aside certain plants or an area of the farm for seeds. Adebooye *et al.* (2005) in cataloguing the constraints to cultivation and productivity of African leafy vegetables stated that they normally save seeds from remnant of the current crop for the next year planting. Oladiran *et al.* (2002) reported that okra fruits of cv. FUTM2 that developed earlier on the mother-plant contained more seed and that the seeds were heavier (Table 12) and survived better (Fig. 6) than those from the fruits that developed later. Ibrahim (2006) obtained a similar result. The same trend has been reported by Zubairu *et al.* (2009) whose result also showed that even at the highest fertilizer rate of 120 kg N/ha, seed extracted from fruits in the upper position on the mother-plant were still poor in quality. It is postulated that fruits at lower positions on the mother plant developed at a time when metabolites were not limiting, the seeds accumulated more nutrients and were therefore more vigorous. It is recommended that for optimum quality, seed should be collected from earlier formed okra fruits and that fruits from positions 7 and above could be harvested for green consumption. Therefore, seeds saved from the remnant of a crop would, when sown (if they germinate at all), would produce a poor stand with attendant poor yield.

Table 12: The influence of the period of fruit formation during the cropping season and the number of days between anthesis and fruit harvest on 100 -seed weight.

Genotype	Period of fruit formation	Number of days between anthesis and fruit harvest	100-seed weight (g)
LD 27	1st -8th September	93	4.5
	9th-16th September	86	4.3
	17th-23rd September	77	4.3
	24th-30th September	69	3.9
	1st-10th September	61	3.7
FUTM2	20th-30th September	78	5.2
	1st- 10th October	68	5.2
	13th-23rd October	61	4.3
	24th-31st October	46	4.5
	1st-10th November	37	2.3
FUTM1	6th-20th September	88	4.2
	21st Sept.-5th Oct.	75	5.2
	6th-20th October	60	4.7
	21st-30th October	48	4.3

Source: Adapted from Oladiran, *et al*. (2002)

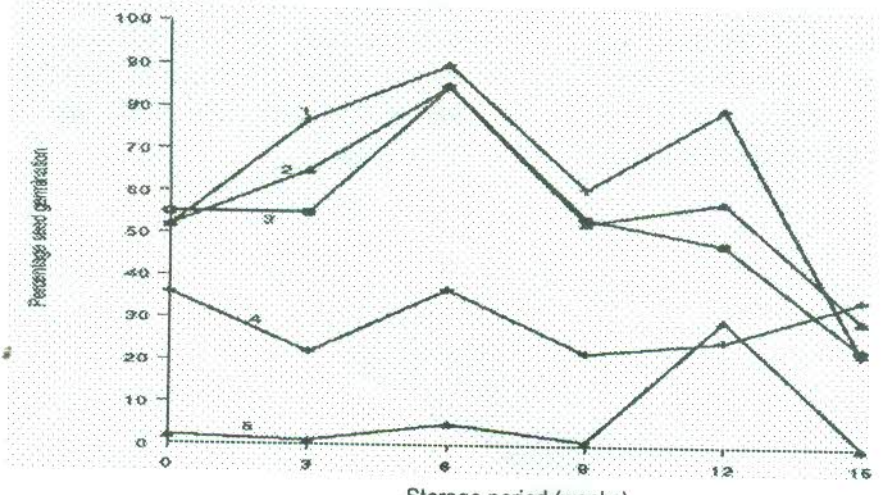

Fig. 6: Percentage germination of fresh and aged okra (cv. FUTM2) seeds extracted from fruits produced at different periods of the cropping season 1: 20-30 Sept: 2: 1-10. 3: 13-23. 4: 24-31 October and 5: 1-10 Nov.

Along the same line, Oladiran (1994) reported that the seeds of 'Ibadan Local' variety of tomato, extracted from earlier formed fruits were heavier (Fig. 7) and the progeny from bigger seeds also produced higher fruit yield (Fig. 8).

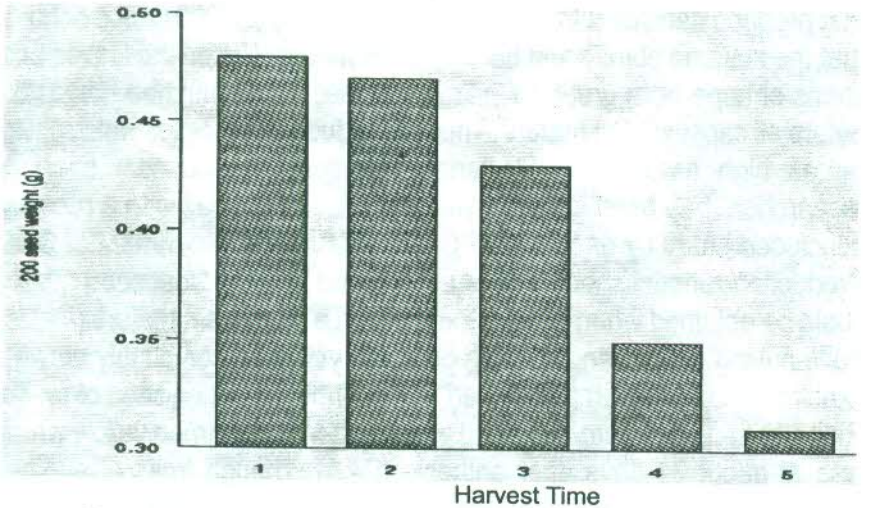

Fig. 7: Effect of tomato (cv. 'Ibadan Local') fruit harvest time on 200-seed weight (g)

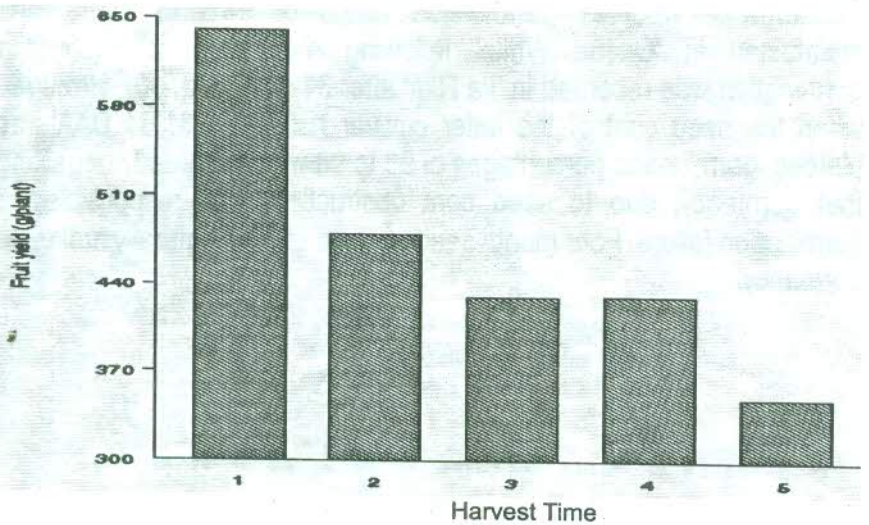

Fig. 8: Effect of seed harvest time on fruit yield per plant of the 'Ibadan Local' cv. of tomato

In the context of grain production, a sesame (*Sesamum indicum*) plant is considered matured when its lower leaves are drying and the lowest capsules are about to split open (Weiss, 1984). Busari *et al* (2002) reported that much seed is lost during harvesting especially in varieties that produce dehiscent fruits. Mkamilo and Bedigian (2007) also echoed that the sesame plant could be said to be matured when the leaves and stems change from green to yellow and that plants must be harvested before all capsules are mature. This is to reduce seed losses which could be as high as 75% in shattering varieties. The concern of most researchers has been on grain yield and not seed quality. In a recently concluded study by one of the PG students in the Department of Crop Production (unpublished), it was established that the best seed quality could be obtained when 75% of the fruits on a plant were mature (that is, fruits having colour ranging from greenish yellow to completely brown). Oladiran and Almasiah (2001) had earlier shown that beniseed of cv. 'Ija Ridi' attained maximum 100-seed weight when fruits turned yellow which was at about 31 days after anthesis (DAA). Though fruits of another cultivar ('Okene White') also turned yellow at the same DAA, maximum 100-seed weight was not attained until about 34DAA (Fig. 9). Furthermore, whereas germination range of 94.5 to 100% was maintained in 'Okene White' following maturation, a decline in germination was recorded in 'Ija Ridi' after 31 DAA (Fig. 10). However, when the seed coat of the latter cultivar harvested 31-61 DAA was pierced, germination percentages of 96 to 98 were recorded suggesting that dormancy, due to seed coat obstruction, was responsible for germination failure. Four month seed storage at 32°C naturally broke the dormancy.

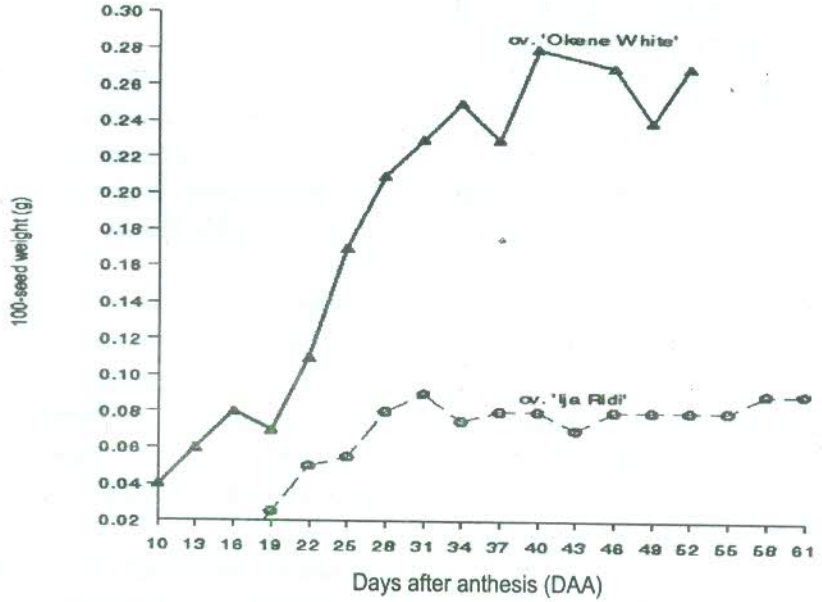

Fig. 9: 100-seed weight (g) from fruits at different stages of maturation

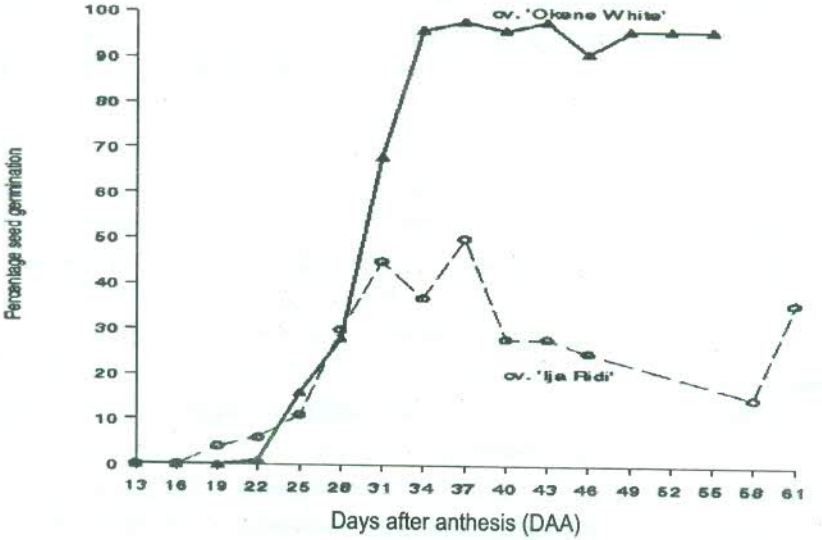

Fig. 10: Percentage germination of seeds from fruits harvested at different stages of maturation

Apart from production practices, storage methods are also known to affect seed longevity Seed stores longer at low moisture content or relative humidity and temperature (Oladiran and Baba 1999; Oladiran *et al.*, 2002; Daniel *et al.* 2008). Faster decline in seed viability at higher moisture and temperature has been attributed to the higher accumulation of free radicals due to cell ageing which are capable of disrupting the membranes of macromolecules within the embryonic tissue resulting in seed death (Berjak and Villiers, 1972; Oladiran and Mumford, 1990). The type of storage container also plays a significant role in the maintenance of viability. Moisture-proof materials are preferable as they keep seed at low moisture if they had been well dried prior to packaging. Even though laminated aluminum or tin foils preserve seed viability best (Oladiran and Baba, 1999; Oladiran and Agunbiade, 2000) they are out of the reach of resource-poor farmers, who could safely make use of plastic bottles or polythene bags provided seeds are well dried and stored in a dry environment that is well ventilated. Poor seed storage would result in poor germination, seedling emergence and crop yield.

The storage of soybean in the hot humid tropics is known to be a bottleneck in the production of the crop (Linnemann and Siemonsma, 1989) as a stored seed lot deteriorates rapidly. Farmers in Niger State also complain of poor storability. A PVC co-polymer coating ('plastic wrapping') of individual seed has been reported by Henning and West (1993) to prolong soybean seed life. van den Burg (2004) viewed soybean as about the most difficult to store (in that they lose viability quickly) among the cereals and pulses and suggested that soybean be planted under irrigation and the seed crop harvested just before the planting of the commercial crop which amounts to 'storing in the field'. Early-maturing soybean cultivars could be harvested 65 days after planting (Giller and Dashiell, 2006). To solve the seed storage problem of this crop therefore, and as it is suggested for cowpea below, a soybean seed crop could be started in December to be able to harvest around February/March of the following year and get high quality and fresh seeds ready for farmers who may want to raise a commercial crop by June/July. The crop is therefore a

good candidate for the Seed Garden scheme. Soybean varieties that are known to be early maturing, high yielding and resistant to frogeye leaf spot are TGX 1019-2EB, TGX 1019-2EN and TGX 1485-ID (Idowu *et al.*, 2005).

10.0 A SPECIAL CASE FOR SOYBEAN AND COWPEA PRODUCTION

Greater effort needs to put into seed production of both soybean and cowpea which are a cheaper source of protein, vitamins and minerals. Majority of the country's population cannot afford adequate supply of protein from animal sources. In addition, plant products are cholesterol-free and the fats they contain are mostly polyunsaturated and therefore, nutritionally safer than animal-based products.

Some varieties of soybean are capable of fixing 44 to 103 kgN/ha annually (Sanginga, *et al.*, 2003) and are capable of producing a yield of over 3 t/ha with good management (Chianu, *et al.*, 2009). Farmers that grow this crop are at a vantage point as the high amount of nitrogen fixed during a cropping season will be of immense benefit to succeeding crops grown in rotation with soybean. According to Myaka, *et al.* (2005), the grains are used as human food, in compounding livestock feeds and as a source of bio – energy. In the industries, oil and milk among others are produced from the grain and its products, like those of other plants are cholesterol–free and are very low levels of saturated fat (BIDCO, 2005). The grain contains up to 40% protein Greenberg and Hartung (1998). Though Nigeria presently produces about 850,000 t/year, the quantity is still not enough to meet local demands and thus the nation still imports to meet shortfalls (Chianu, *et al.*, 2009). Soybeans–based products that are commonly sold to the public include 'soy milk', 'soy egg', 'soy bread', 'soy yoghurt', granula, 'soy wara', 'soy beverage', etc. (Chianu, *et al.*,2009). Others that are being tried at home fronts are 'soy puff – puff', 'soy ogi', soy akara', 'soy moin-moin', 'dadawa', nutrend, a baby food made in Lagos by Food Specialists (Nigeria) Ltd. etc. The composition of mature raw

soybean seed per 100 mg edible portion is 8.5g water, 1742 KJ (416 kcal) energy, 36.6 g protein, 19.9g fat, 30.2g carbohydrate, 9.3 g dietary fibre, 227 mg Ca, 0.87 mg thiamine, 0.87 mg riboflavin, 1.6 mg niacin, 0.38 mg Vitamin B_6, 375 µg folate and 6.0 mg ascorbic acid. Consumption of soybean is associated with decreased risk of atheriosclerosis and cardiovascular diseases (Giller and Dashiell, 2006).

Studies by IITA have shown that after harvesting from fadama areas, enough moisture still remains (to last about 40 – 45 days) in the soil to grow a crop of early–maturing cowpea ((IITA – undated). In one of such trials when rice was harvested in November and cowpea was planted and sustained on residual moisture without irrigation on November 30, a yield of 1.7 t/ha was obtained within 60 days. Insect pressure was also reported to be low at this period necessitating only one or two spraying as against about five in a wet season crop. To further demonstrate the above initiative, two preliminary trials were conducted on farmers fields in Bida area in 1983 from which an average yield of 1.0 t/ha was produced. Many more farmers (about 300) embraced the practice in 1984. Singh *et al.* (undated) stated that cowpea will germinate very well if there is no standing water on the planting hill in rice fallows. They recommended IT 82E – 60 (with white, rough seed coat) as one that tolerates excess moisture as well as low moisture and therefore one of the best varieties for rice fallows in Africa and stated that a large number of farmers in Bida were growing the variety. IT84E – 124 with brown rough seed coat is also a good catch crop in rice fallows. In a study conducted in Niger State in 2006, a farmer at Dabban (Lavun Local Government Area of Niger State) volunteered that farmers in the area used to plant brown varieties of cowpea after a rice harvest and that reasonable yields were always obtained. He however stated that the practice had stopped but would give no reason (unpublished). This practice should be resuscitated under the QDS scheme as this gives gainful employment to the farmers' families and provides nutritious food and higher income from the same piece of land.

According to Madamba, *et al.* (2006) mature cowpea seeds contain per 100 g edible portion : water 12.0 g; energy 1407 KJ (336Kcal); protein 23.5 g; fat 1.3 g; carbohydrate 60.0 g; fibre 10.6 g; Ca 110 mg; Mg 184 mg; P 424 mg; Fe 8.3 mg; Zn 3.4 mg; vitamin A 50 IU; Thaimine 0.85 mg; Riboflavine 0.23 mg; Niacin 2.1 mg; vitamin B6 0.36 mg; Folate 633 µm; Ascorbic acid 1.5 mg. Cowpea protein it is said to be very rich in lysine though poor in S-containing amino acid.

Madamba *et al.* (2006) quoting from FAO Statistics of 1999-2003 reported that 3.3mg + was produced annually from 9.3 million ha in sub-Sahara Africa mainly from West Africa (with 3 m t/yr from 8.8 million ha). Nigeria produced 2.2 million t/yr (from 5.5 million ha) of this estimate. Nigeria is said to be importing large quantity of cowpea from Niger Republic. Adequate utilization of the Fadamas in Nigeria by putting the area to cowpea and or soybean after a rice harvest will reduce the nation's dependence or importation to bridge the gap between supply and demand.

11.0 RECOMMENDATIONS FOR IMPROVED AND VIBRANT SEED SYSTEM

For the Nigerian seed industry to be vibrant, the following are suggested:

i. Encouragement of Faculties/Schools of Agriculture in some Universities with relevant and trained personnels and appropriate facilities to embark on germplasm collection, characterization, evaluation and conservation of cereal, legumes and vegetable accessions. Our crop germplasm pool is being eroded due to disasters caused by flooding, bushfire, as well as construction of dams, roads, new cities, etc. Crop germplasm conservation protects local genepool against genetic erosion and ensures food security for the present generation and those yet unborn.

ii. Revitalization of the Community Seed Production Programme.

iii. Encouragement of the establishment of seed gardens under the QDS scheme.

iv. NASC could use, in addition to the already established centres in their six zones, Crop Department laboratories in the Faculty/School of Agriculture in some selected Universities with adequate facilities for seed quality tests so as to obtain quick results.

v. Seed production at the secondary school level, especially in the rural areas, should be introduced to facilitate the rapid diffusion of quality seed among farmers.

vi. Farmers that are interested in seed production should be given special access to credits for inputs and that such credit should be deducted from the sale of their seeds following harvest.

vii. To get improved seed closer to the farmers, State ADPs should rent shops in each important village markets from which farmers can buy seed on each market day.

viii. A Department, solely for seed production and distribution, should be created in all State ADPs.

ix. Flagging off of seed distribution by State Governors should be introduced (early enough before the cropping commences), as is being done for fertilizer, to ensure timely seed release and also to encourage the use of improved seed by farmers.

x. NASC should police unscrupulous seed peddlers with all seriousness and vigour.

If the above suggestions are given serious consideration and could be adopted or adapted, farmers would get accustomed get to the use of improved seed and the seed companies would be the best for it. However, nothing comes easy. The seed companies for now may have to co-sponsor the community-based seed production programmes to indicate their seriousness in ensuring robustness and vibrancy of the system. The system can not be viable and vibrant if the interest of the rural farmers is not adequately catered for because experience has shown that they would not just take anything tossed at them. They have to be involved in variety selection from the onset and not just in varietal trials.

12.0 CONCLUSION

The Chief Servant and Executive Governor of Niger State, Dr Muazu Babangida Aliyu, his Deputy. Alhaji Musa Ibeto, the Vice-Chancellor of our great University, Professor M.S. Audu, his crop of Principal Officers, Deans, HODs, Professors and other fellow lecturers, traditional rulers (present or represented), invited guests, ladies and gentlemen, I thank you all. Please permit me to close this presentation with a quotation from Boswell (1961): "Seeds are many things. Above all else, they are way of survival of their species. They are way by which embryonic life can be almost suspended and then revived to new development even years after parents are dead and gone. Seeds protect and sustain life. They are highly organized fortresses, well stocked with special supplies of food against long siege. Seeds are vehicles for the spread of new life from place to place by the element and by the animals and people. Seeds are food for man and animals and other living things. Seeds are raw materials for the fashioning of myriad products by people. They are a symbol-a symbol of beginning. They are carriers of aid, of friendship, of good will.....seeds are containers of embryonic plant, the embryos of new generation. Seeds are many things".

BUT GOD MADE EVERYTHING!

13.0 APPRECIATION

I give glory to God, the Almighty One who has made everything in heaven and on earth and keeps sustaining all things. He lifts and abases, He enthrones and dethrones; the Fountain of knowledge, understanding and wisdom. He is the Giver of all good gifts. I praise You oh Lord. He is the One that brings from obscurity into limelight. He lifts from miry clay in the valley and plants on higher and solid ground. The Lord Almighty is His Name!

I want to appreciate the efforts of my late parents, Pa Joseph Adigun Oladiran and Mrs. Esther Amope Oladiran ('Mama Alugbo'). They did all that was in their power to give me Western education despite the fact that my father attended only adult education classes to learn to write and read the Yoruba language. My uncle, Pa Timothy Alade Oyedeji was the arrow head of my educational pursuit. He took me in at age of nine years and not only trained me but also made sure I was always well fed. Whenever he returned from work at night and food was set before him, his first question would be "has Johnson eaten?" May God continue to bless him abundantly, Amen. His wife, Mrs. Julianah Olayonu Oyedeji of blessed memory was also a mother to me.

My wife, Bolanle Abiola Oladiran, here with me today, has been my human pillar of support. Together we have been wobbling, stumbling, falling and rising as we continue in the race of the institution called marriage. Thanks for patiently bearing with my excesses and inadequacies. We signed "for better for worse until death would part us". We want to appreciate God for helping us to keeping the vow.

To our children, Ajibola, Tofunmi (daughter-in-law), Olayinka, Olamide, Olayiwola and Temilola, I say thank you so much. You bore with us when times were hard and the going was pretty rough. I thank God who has made all things new and well. To our grand children- Oluwaseun and Ase-Oluwa, may God bless you.

So many friends helped me in estimable ways and prodded me along my path of education. The likes of Mr. Julius Olusegun Adegbenjo, Babatunde Akanbi ('Labule e'), Professor Shola Ogunniyi of the UCH, Ibadan, Pharmacist Bolaji Adeoye, Dr. Francis Demola Kuponiyi, Dr. Teniola Ojo, Mr Kolawole Asimiyu Badaru (late) and others too numerous to list. Here in Minna God has surrounded me with amiable persons: Professors K.R. Onifade, A.O. Osunde, T.Z. Adama and S.L. Lamai as well as Dr. Solo Oyeleke, Dr. Tsado and others too numerous to mention. They are friends indeed and only the Almighty One can pay you all back.

I have an associate who is also a friend and a brother. He is Mallam Haruna Ibrahim. We did so much running around together to make the preparation of the lecture given today possible. May God bless you and your family, Amen. Mallam Alhassan Aliyu Wasagi (our wonderful Field Assistant), Hajia Rakiya (our Laboratory Technologist) and all my other colleagues in the Department as well as my research associates within and outside the School of Agriculture and Agricultural Technology, I say thank you all. Chief Kanmi Shobowale, the Executive Director of the National Agricultural Seed Council (NASC), Abuja, Rev. A.O. Olatokun, Director SIDMCB of the NASC, Abuja, Mallam Garba Tanko (a retiree of the Niger State ADP), Director, Agric. and Technical Services, Niger State ADP, Minna and his staff went extra mile to provide me with relevant information for this write-up. God will always be your helper, Amen. I greatly appreciate the prayers of the members of my church, the Seventh-Day Adventist Church, Minna. May God continue to hear your prayers, Amen.

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