

## **Constraints to Smallholder Agricultural Productivity and Sustainability in *Fadama* Areas**

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**ABSTRACT:**-Fadama areas (floodplains) are extensively used by smallholders for agricultural production and hence it is of critical importance to their survival and economic development. Fadama farming relies on the high moisture retention capability of the floodplains making it suitable for recession (dry season) farming. Farming families engage in subsistence farming in which family needs determine the scale of production and wherein small plots of land are cultivated by individual owners or sub-owners using age-old methods of soil and water management. This paper investigates the constraints to agricultural productivity faced by smallholders in fadama areas. Findings reveal that some of the limitations faced by smallholders were found to include institutional constraints, harvest/post-harvest losses, and the seasonality of agriculture and the challenge of irrigation, parasitic weeds, low soil fertility, land tenure/women disempowerment, labour, and limited access to funds/capital.

**KEYWORDS:**-*Fadama, Smallholders, Sustainability, Productivity, Institutions, Indigenous Knowledge, Nigeria*

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### **I. INTRODUCTION**

The quest for food security while safeguarding the environment has been a perennial challenge to people throughout history. Since the late 20th century, however, there has been an increasing consciousness on the need for environmental sustainability. Rachel Carson's *Silent Spring* (1962) raised environmental awareness and galvanised an environmental movement that examined the effects of industrialized agriculture on the environment. From concerns with the consequences of pollution, the whole rationale behind the Green Revolution (GR) was increasingly questioned and thus started the quest for adaptive and location-specific technology and research techniques (Chambers, 1997; Collinson, 2000). Other concerns included climate change and its attendant challenges including changing rainfall patterns and increased struggle for scarce resources (Godfray et al., 2010). In light with all these, there was also the increasing realization that local knowledge and local solutions were crucial for agricultural progress (Tripp, 2006, p. 2). The notion of sustainable agriculture is situated within this broader context of the important even if unfocussed concept of sustainable development. It is an umbrella term for a variety of ideological approaches to alternative agriculture: organic agriculture, biological agriculture, alternative agriculture, low-input agriculture, biodynamic agriculture, regenerative agriculture, permaculture and agroecology (Bidwell, 1986; Gips, 1988; Carter, 1989; MacRae et al., 1989; Rodale, 1990; Dahlberg, 1991; Kirschenmann, 1991; O'Connell, 1992; Hansen, 1996). 'Alternative agriculture' is usually associated with sustainable agriculture and in contrast to 'conventional agriculture' (Hansen, 1996). Despite the common theme of sustainability, therefore, 'sustainable agriculture' lends itself to a variety of interpretations and the concept is used both as an approach to evaluating agriculture development and as a set of specific techniques and technologies (Tripp, 2006, p. 3). Underlying the different ideological approaches to sustainable agriculture is, however, a broad consistency in definition that agriculture has an economic as well as ecological and social dimensions (Brown et al., 1987). According to Douglass (1984), sustainable agriculture balances the following three dimensions: stewardship, food sufficiency and community. In Nigeria, smallholders account for over 70% of export and supply 95% of the country's food demands (Alkali, 1997; Lawal, 1997). Yet, as with many parts of Africa, productivity is largely low and does not measure up agricultural productivity among smallholders is generally considered to be low and can hardly be said to be optimal. This has been attributed to environmental, socio-economic and institutional factors among others (Goldman and Block, 1993; FAO, 1996; Adedipe et al., 1997b; Spencer and Kaindaneh, 1998). There are several studies that reveal this trend of low agricultural productivity among smallholders (Spencer and Kaindaneh, 1998; Adedipe et al., 1997a; FAO, 1996). Recent studies have focused on specific constraints faced by smallholders (Neven et al., 2009, Liverpool and Winter-Nelson, 2010)(Gbahabo, 2015) which include many socio-economic and cultural factors.

#### **Study Area and Participants**

This study was conducted in two communities in North Central Nigeria: Karshi and Badeggi. The former is the core study area and much of the data generated comes from Karshi, which is an Area Council of Nigeria's Federal Capital, Abuja. Covering an area of about 8,000 square kilometres, Abuja straddles the north and south of Nigeria and falls within latitude 7° 25' N and 9° 20' North of the equator and longitude 5° 45' and 7° 39'. As a district of

the capital city, Karshi is similar to many agrarian settlements and is occupied by many indigenous farming communities. Some of the major ethnic groups in these areas are Gwari, Gwandra and Gwandu.

**Figure 1: Location of Surveyed Farms in North Central Nigeria**

Baddeggi is a small district of Bida town, the second largest city in Niger State. Bida sits on the Bako River, one of the several minor tributaries of the Niger River. It is approximately 100 km/60 mi southwest of Minna and 200 km/120 mi northeast of Ilorin and falls on Latitude 9° 4' 60 N, Longitude: 6° 1' 0 E. Baddeggi is a major trade centre for rice, which is mainly cultivated in the *fadamas* of the Niger and Kaduna rivers. It is predominantly inhabited by the Nupe people. Most of the inhabitants of Karshi and Baddeggi are farmers involved in both upland and lowland (*fadama*) farming. Baddeggi served as a comparative study of the similarities and differences with Karshi and the underlining general structure that generates them.

**Data and Methods**

Methodological Triangulation was used in this research. It is pluralistic, mixing the mainly qualitative data (generated from in-depth interviews) with quantitative data (generated from survey methods) (Hurst, 1990). This is in line with the realist epistemology/ontology that sees reality as stratified; on the one hand social objects have a real ongoing existence irrespective of what we know of them, while on the other hand they are affected by the way they are construed (Moody, 1996). Triangulation considers as false the claim that quantitative and qualitative methodologies are incompatible (Altieri, 1998) and seeks to avoid simple generalizations by enabling a more comprehensive understanding of social phenomenon carter (Moseley, 2005).

Over a period of four months, 47 people were interviewed in-depth in Karshi and 21 in Baddeggi. The research strategy consisted of mixed techniques led principally by a core interview schedule which was complemented by a follow-up strategy, involving survey techniques used to accurately measure the demographic features of the research participants and the extent of agrochemical use. The research methodology was Grounded Theory (GT) as the research was concerned with expanding an explanation of *fadama* agriculture through the identification of its key elements and then categorizing the relationships of those elements to the context and process of the experiment (Collings, 1995, FAI, 2004). The data collected was mainly analysed using the qualitative GT technique which helped to achieve a more critical and reflexive interpretation of the statistics generated and hence helped to avoid the often simple, general and impersonal nature of statistics.

**Results and Discussions**

In Karshi village, 47 farmers were interviewed. Of these, 27 (57.4%) were females and 20 (42.6%) were male. Like in many parts of Nigeria, smallholder rice farming in Karshi is predominantly done by women (table 1). Others are involved in cultivating such crops as cowpea and a broad range of vegetables. In Baddeggi, however, 81% of the respondents were men while only 19% were women.

**Table 1: Statistical distribution of farmers based on sex and farm size in Karshi**

Majority (59.6%) of the respondents in Karshi cultivate between 0.2 to 1Ha of land, whereas 40.4 % cultivate between 2-4Ha (table 1). In Baddeggi, however, a higher percentage of the respondents (40.4%) have between 2-4Ha while 59.6 have 1ha or less. The bulk of the farmers, therefore, fit into the general characteristics of smallholder farmers typical in many developing countries of Africa. Similarly, land use is intensive among the majority of the respondents as they attempt to alleviate land constraints. As in many parts of Africa, arable land is a priced commodity in Karshi and Baddeggi in light of scarcity and population growth. The problem is compounded in Karshi because of the influx of people into Federal Capital Territory (Abuja) and land loss to road construction through the community. The pressure on land is also not helped by the lack of viable alternative employment opportunities in the non-farm sector.

The cropping pattern in the two communities was mixed cropping. Most of the farmers were involved in some kind of arrangement that allowed them to plant multiple crops, rotate them or integrate crops and livestock/poultry/fish ponds (fig 2).

**Figure 2: Schematic of a typical farmstead**

The problems encountered by the farmers in Karshi and Baddeggi ranged from institutional, biophysical, and socio-economic. These are discussed below:

**Institutional: Agriculture and the Petro-dollar**

Despite its huge oil reserves and the status of petrol as its main foreign earner, Nigeria remains predominantly an agrarian country with 71% of the workforce engaged in agriculture and over 90% of the agricultural output comes from smallholders living in rural parts of the country (constituting 60% of Nigeria's total population). Yet, Nigeria's agricultural output falls abysmally short of the food needs of its population and hence has to rely on food imports. This is a reflection of government's approach to agriculture since the advent of crude oil. Generally, the agricultural sector (as reflected in the avalanche of agricultural programmes since independence) has been characterized by the combination of half-hearted strategies, reversals, contradictions, or at best, misguided interventions (Bogoro, 1999). For instance, between 1986 and 1994, rice imports were illegal. In 1995, imports were allowed at 100 per cent tariff. 1996, the tariff was reduced to 50 per cent and became full cycle to 100 per cent in 2002 and partially in 2008 (Babaleye, 2008).

Just as agriculture is directly linked to food security in Nigeria, it is similarly linked to poverty. In a survey by the Federal Office of Statistics on poverty and the agricultural sector, of the more than 65% of the poor people in Nigeria live in rural areas and are involved in smallholder farming on fragmented lands (practicing various forms of mixed cropping) and are poorly educated. In fact, the report estimates that 77% of all Nigerian smallholder farmers are poor, while about 48% are in extreme poverty. The highest incidence of poverty was in the Northern parts of the country (where this research was based) (FOS, 1999). This is despite capital infusion to agricultural projects. Paradoxically, agriculture presents the greatest potential for combating hunger and poverty in Nigeria because it has the least demand for foreign exchange and hence it is cost effective with regards domestic resource utilization (fig 3).

**Figure 3: Average Sectoral Utilization (share in %) Of Foreign Exchange (in US\$ million)**

Source: (African Institute for Applied Economics, 2005)

The challenge posed by poverty and food security continue to mount even as Nigeria continues to spend over \$350, 000 on rice importation alone annually. All the respondents from agricultural research institutes and the universities interviewed explain Nigeria's profligacy and lack of will to vigorously resolve the problems of food security and poverty to the petro-dollar problem. Firstly, the Nigerian government spends so much money on food importation and totally remove duties and taxes on all imported grains (as they did in the height of the food crisis) simply because the money is there to spend (Aderinokun, 2008). For instance, between 1999-2007, the Olusegun Obasanjo administration spent over NGN300 billion on fertilizer importation without any significant change in agricultural output of smallholders for whom the fertilizer was intended (Shaibu and Uja, 2008). The Nigerian Agricultural Cooperative and Rural Development Bank (NARCDB) alone claims to have invested NGN29 billion in over 500,000 agricultural projects across Nigeria in the past seven years (Azubuike, 2008). Similarly, in the 2008 farming season, the Nigerian government procured 650, 000 tonnes of fertilizer. Yet, the true beneficiaries of government subsidy on all farming inputs and at all levels are not genuine farmers but corrupt government officials and their contractor allies.

Secondly, petro-dollar made agriculture the poor man's enterprise as many young people migrated to cities in search of better job opportunities in the oil and affiliated sectors of the economy. In fact, the percentage of Nigerian students enrolling for courses like petrochemical engineering is on the rise while those in agriculture and related fields plummeted. Finally, the huge earnings from petrol made Nigeria strictly a consumer society and aggravated the propensity for emergency measures instead of real solutions to the substantial problem of hunger and poverty that confronted that country. Governments over time lacked commitment to planning, organizing and coordinating of the agricultural sector.

Ironically, in the last two decades Nigeria was well placed to solve the problems of hunger and poverty. The huge earnings from petro-dollars could have been used to fund agricultural research and extension targeted at improving the farming systems and practices of smallholders, reducing the drudgery associated with it and giving the farmers enough incentives to produce more. Ironically, however, the oil boom (since the 70s and 80s) heralded the collapse of the agricultural sector due to neglect. Cheap and subsidized agricultural produce such as rice and maize grossly undermined the capacity of smallholders to produce more. Food importation policies killed research initiatives and farmers' enthusiasm to give national research breakthroughs a trial. Instead, it enriched other smallholders in Asia. Many of the older farmers refer to the golden age of agriculture before the advent of petrol when smallholder farmers drove the economy and provided the food needs of the population.

The food crisis in Nigeria and in many parts of Africa represents a general failure of 'modern' agriculture and capitalism to provide the needed impetus for smallholder farmers to increase their production output. Instead, the focus had been on 'agribusiness' such as cash crop production at the expense of food, often with severe environmental consequences (Oculi, 1979, Lawal, 1997, Osemeobo, 1992, Ogen, 2003). This posture was evident in the agricultural policy adopted by President Goodluck Jonathan (2011-2015) which promoted the production of crops like cassava for export. This process of the *commodification* and commercialization of indigenous food crops has further exacerbated the food crisis as cassava, hitherto a staple in most families, became expensive and scarce due to high export demand.

Overall, it is very puzzling that Nigeria has been unable to exploit its oil wealth to develop a viable large-scale agribusiness sector. Except for isolated mega farms owned by very rich Nigerians, the bulk of the food in the country is still produced by smallholders. For the large part, most farm inputs (machinery and agrochemicals) are still largely imported despite the huge potential of the Nigerian petrochemical industry. This has basically been due to structural inefficiency and is symptomatic of the consumer nature of Nigeria's elite and the country's reliance on cheap and easily accessible imported goods.

In general, the needs of small farmers and their traditional knowledge systems ignored and their technological innovations are regarded as inferior. Due to this lack of institutional recognition, the sustainable farming practices of many *fadama* users have been seriously compromised and in some cases lost. In the last few years, however, there has been a resurgence and re-claiming of traditional methods as a result of the failures of agricultural intervention pursued by the government – an approach that relied on technical assistance while ignoring cultural,

social and historical dimensions of agricultural development. This fall-back on traditional agricultural methods, even if largely by default, needs to be methodically promoted not just to meet the growing food needs in Nigeria but also because of the environmental and health cost of promoting more use of external inputs such as agrochemicals.

#### ***Harvest/Post Harvest Losses***

Harvesting, handling and storage are obvious constraints to food availability in Karshi and Badeggi. This restates the point that the problem of food security in Nigeria is more than just that of production but more of inadequate management, sustainability and diversification of foods and their processed derivatives. It is generally estimated that over 40% of farm products are lost due to storage problems among smallholders in Nigeria (Bogoro, 1999). Agricultural production improvements in Nigeria were never matched with post-harvest storage policies, strategies and practices as market and technological interventions have been either grossly inadequate, misdirected or haphazardly made.

In both Karshi and Badeggi, a lot of food is lost due to inefficient processing and storage and also due to lack of processing implements. For instance, whereas the farmers are able to store grains such as maize and sorghum in barns, and tubers such as yam and cassava in dry rooms, storage of perishables like vegetables and fruits (tomatoes, eggplant, okra, lettuce, spinach, among others) poses a significant challenge. Some resort to slicing and drying but for the most part, what is not sold in the market ends up wasting away. Furthermore, fire outbreaks are a common means of crop loss and this is so even in the barns which have thatch roofing. Other means of produce loss include biological losses to insects and pests, especially rodents.

Nigeria lacks an organized system of storage (silos) that can acquire the surplus of food produced by the farmers for storage. Farm produce handling in Nigeria remains primitive and undeveloped. Many crops abound at a given season and disappear as soon as that season is over. Poor infrastructure (road and transport systems), marketing facilities and high cost of transportation further compound the problem of wastage.

Poor food marketing and lack of production incentives add to the problem of food losses in Karshi and Badeggi. Farmers do not get favourable pricing for their produce neither do they get any incentives. Farmers are left to their own devices and no cushions are provided for them against periods of price fluctuations. Mode of disposal of farm produce is through market which accounted for 90% and the farm gate 10%. This is facilitated by the proximity of the village market which is open for business every four days. Karshi village is connected with motorable road to Abuja city which helps with easy evacuation of their produce. However, the road is in a deplorable state and the farmers hardly get fair prices for their produce from the buyers who come from all parts of the city (Abuja). The buyers re-sell these same farm produce for twice or thrice the amount they paid for them. In the end, the farmers are the losers as they have limited access to city markets.

#### ***Irrigation and the Seasonality of Agriculture: Identifying the Right Priorities***

Despite the inherent potential of *fadama* farming to be productive, the farmers are constrained by the seasonality of agriculture and the changes in rainfall patterns in the last few years, as a result of climate change. Erratic rainfall means that planting is delayed and this in turn affects crop yields and the time for harvesting. Furthermore, seasonality means that many farmers can only produce during the rainy season (April-September) and do little for the remaining months of the year. Also, erratic rainfall generally leads to drought stress. This is a problem even for *fadama* farmers that practice recession (dry season) farming as rainfall affects the level of water/moisture retained by the *fadama* lands. Thus, the complimentary relationship between *fadama* land and rainfall, which has been exploited by *fadama* farmers for centuries, is continuously endangered either by drought or by erratic rainfall. Recently, there have been relatively successful experiments to study the feasibility of growing important food crops like yam in the dry season (Shiwachi et al., 2008)

Closely related to the problem of agricultural seasonality in Nigeria is the difficulty in irrigation. Many of the farmers rely on simple and traditional means of irrigating their farms and this poses a problem for farms that are far from water sources or on sloppy areas, especially at times when the water level is low due to drought or poor rainfall. The use of simple pumps has gained popularity among the farmers in Karshi as this makes water pumping easier for them. Yet, not many of them can afford to buy water pumps and the schemes put in place by the government and WB to assist farmers in purchasing water pumps is unrealistic as it places impractical demand on poor, low earning farmers who cannot provide the counterpart funding required.

Generally, the history of government's intervention in irrigation in Nigeria has been skewed towards large scale systems that totally ignore the necessity of simple and adapted technologies based on existing cultural practices and suited for the purposes of smallholders. Thus, dams and major structures were constructed (some of which still remain to be completed) over a period of twenty years under parastatals such as the River Basin Development Authority (RBDA). With an investment of over \$3 billion in irrigation between 1970-1980, large-scale irrigation systems failed to achieve the needed increase in food production, reflecting the inability of the government to meet the targets set out in the national Development Plan of Nigeria (Adams, 1991).

Increasingly, however, the government and development agencies have started to invest in informal small-scale irrigation in light of low level or non-participation of smallholders in large-scale irrigation (Kolawole, 1982, Etuk and Abalu, 1992).

#### **'Parasitic' Weeds**

Parasitic plants, especially striga (*S. aspera*, *S. densiflora*, *S. gesnerioides* and *S. hermonthica*) pose a significant challenge to increased productivity among the farmers in Karshi and Baddegi. In fact, it is the most pressing problem in the whole of the North-eastern and North central regions of Nigeria and indeed West Africa as a whole (Saueborn, 1991, Gworgwor et al., 2001). *Striga* is an obligate parasite and depends entirely on host plant for its nutrient requirement. *Striga* germination and growth is often in response to certain substances exuded by host roots (Cook et al., 1972). *Striga* (*S. hermonthica*), the most pervasive species in both Karshi and Baddegi, significantly reduces maize, rice and sorghum yields and leads to significant economic losses to the farmers. *Striga* infestation results in reduced plant height, panicle length, panicle weight and heavy infestation often kill plants before heading.

Quantifying crop loss to *Striga* is difficult but Ramaiah (1987) reports 10-35% loss while Doggett (1998) estimates 59% sorghum loss due to *Striga*. In general, an average loss of between 5-15% is estimated within the African region (Riches and Parker, 1995). Maize is generally very susceptible to *Striga* attack and as a result, yield loss usually high (Ogunbodede and Olakojo, 2001).

#### **Low Soil Fertility**

Inherent low soil fertility constitutes another major challenge to smallholder food production in the *fadama* areas. By FAO's rating, most lands in Nigeria are between low to medium in fertility. An extensive body of literature exists on the inherent problem of soil fertility in many parts of Northern Nigeria due to factors that range from biophysical (nutrient deficient parent material), chemical (nutrient depletion) and socioeconomic (inflation, poor producer price, poor infrastructure, and unfavourable exchange rates (Balasubramanian et al., 1984, Bationo et al., 1996, Chude, 1998, Yusuf and Yusuf, 2008). In the case of *fadama* areas, the problem of soil fertility is compounded by salinity and sodicity development as a result of high ground water and constant irrigation which in turn pose hazards to soil and crop productivities (Mustapha, 2007).

In addition to the above factors, low soil fertility as a result of continuous cultivation is a limiting factor to increased productivity among the farmers in Karshi and Baddegi. Continuous cultivation exerts pressure on the soil leading to soil acidification and decline of exchangeable cations, and decrease of soil pH and calcium (Agbenin and Goladi, 1997). This explains the appeal of inorganic fertilizer to majority of the farmers as the quest for higher yields becomes more dependent on fertilizer. Generally, many farmers are venturing into unsustainable agricultural intensification given the decline in yield and unfavourable market conditions.

Overall, farmers report a decline in yield from lands that have been in use for over 5 years, especially where cereals such as maize and sorghum were planted. This is true despite fertilizer application. The problem of soil fertility is compounded by erratic rains – all of which affect the output of the *fadama* farmers. There is an appreciable decrease in vegetative cover in most of Northern Nigeria due to decline in rainfall which in turn exposes the soil to wind and water erosion (Hess et al., 1995, Nicholson et al., 2000). This is, in fact, a challenge to efficient food production in the whole of Northern Nigeria where there is strain on soil due to threat of desertification, nutrient mining and soil erosion. Yusuf and Yusuf (2008) have shown that there has been steady decline in cereals yield (maize, sorghum, millet and rice) in the area over the last decade (table 2).

#### **Table 2: Yield trend and growth rates of cereals in Nigeria, 1996-2005**

**Source: (Yusuf and Yusuf, 2008)**

In the past, banana farmers in Karshi practiced the fallow system or the cultivation of virgin forests and hence could afford to switch farms once every 5-6 years. This practice is no longer practicable due to population expansion and lack of readily available virgin land (Van Rueler and Prins, 1993). Hence, there has been a transition from shifting cultivation to a system where the same plot is continuously cultivated. Different crops are planted and alternated between seasons to protect soil integrity and ensure fertility over long periods of time.

Due to the high cost of chemical fertilizer, the farmers have resorted to methods such as rotation/intercropping and the use of green manures to deal with the problem of soil fertility. Clearly, however, there is need for much research on how to sustainably increase soil fertility, especially because of the challenge posed by soil degradation which seems to continue despite several measures and approaches aimed at dealing with the problem (Sanchez and Leakey, 1997).

Related to the problems of low soil fertility is imbalance in fertilizer use, as farmers often have no access to enough quantities of fertilizer and simply use whatever amount they can get. They are usually oblivious of any considerations as to what type of nutrients a given plant needs and at what stage. Sometimes this problem is the direct fallout of late supply of fertilizer by the government and many farmers only get fertilizer late into the farming season when many of the crops are already at advanced stages of maturity. In addition to this, inefficient land preparation and lack of timely control of weed - which can lead to stronger weed competition and reduced

yield - are some constraints to efficient food production in Karshi and Badeggi. Similarly, the extension workers pointed out the problem of poor management such as low plant population, which affects crop yields.

#### ***Land Tenure/Women Disempowerment in African Agriculture***

Many *fadama* farmers cultivate inherited lands which are often fragmented and shared among male children of a given household who can either give part or all of it to their wives, friends or rent it out. In general, land ownership in both Karshi and Badeggi is communal and the land holding group in most cases is the family, under the supervision of the community (represented by the village head).

Culturally, women are not allowed land ownership in both communities. Ironically, in Karshi, the majority of the farmers (especially of rice) are women. A woman is allowed to either cultivate her husband's land (if she was married into the Karshi community from another), or her father's (if she is from Karshi) or both as the specific case allows. This means that women have no sole ownership over the lands they cultivate and ownership rights can be withdrawn by the husband or the father at any time (in the event of divorce or other related problems). The reasoning behind this practice is, as explained by the village chief, that women are often married into other communities other than their parents' and this means they are considered 'strangers' having no ownership rights over land. Whereas this reasoning might not make sense to the outsider, land is often considered a traditional heritage and men as the custodians of this sacred inheritance. On the other hand, women's place in the village is not guaranteed because of factors such as marriage.

The implication of this cultural practice is that long term planning is not possible for many women as whatever their plans for the land is has to be in line with the targets set out by the man (husband or father). The woman is not guaranteed use in the successive season(s). Similarly, women have no access to choice lands and they make use of whatever is given to them. Often, the men choose the best lands for themselves and give the ones with low fertility to the women. This increases demands made by production on men.

The problem of land ownership rights is similarly faced by 'outsiders' as it is difficult to get land for agricultural purposes outside one's own indigenous community. Fluidity in land ownership is therefore a significant challenge as most farmers and intending farmers are restricted to particular areas and their potentials for expansion into more fertile areas are severely curtailed. For anyone to lay claim to land in these communities (and very much in any part of Northern Nigeria), the consent of the village heads is an imperative and not always easily forthcoming.

Thus, there is a dual and often parallel tenure system in Nigeria. The first being the traditional/customary tenure system already described and the second being the state tenure system. The result of this pluralism is ambiguity and insecurity in land rights, conflicts and disenfranchisement of vulnerable groups (women and migrants) (Abdullahi and Hamza, 2003, Cotula et al., 2004).

The Land Use Decree of 1978 unified Nigeria's land tenure system and vested all land on the state (mainly for agricultural and industrial development). This represented an attempt by the government to democratize landholding system so as to protect the rights of all citizens to access and use land as against the customary land tenure system which made land the exclusive property of 'landlords' and families that controlled them. Land ownership, under the decree required a certificate of occupancy from the government and the payment of rent. The 1978 Land Use Act aimed at giving individuals access to land.

However, the customary tenure system has persisted, creating a gap between the legal provisions of the Decree and the real practice of land acquisition and use. In much of Northern Nigeria (as is the case with Karshi and Badeggi), for instance, land ownership remains communal as individuals have usufructuary rights to land in one's lineage/community area, which is passed on to one's heirs but cannot be sold or mortgaged. Existing cultural practices and land tenure constitute the major obstacles to the productivity of women farmers whose rights are fragile and transient and determined by factors such as marital status, number of children, and their sexual conduct. There were cases in Karshi where a woman's access to land was revoked by the husband because she had denied him what he considered to be his conjugal rights.

In summary, the traditional tenure system in Karshi and Badeggi constitutes a formidable obstacle to women, non-indigenous people in these communities and any farmer desirous of increasing his/her farm size. This constraint is not limited to Karshi as the literature is replete with examples of how the traditional tenure system restricts and limits agricultural productivity and why the Land Use Decree of 1978 has been so difficult to actualize (Oluwasanmi, 1966, Adegboye, 1967, Ijaodola, 1970, Adeniyi, 1972, Famoriyo, 1972, Famoriyo, 1973a, Famoriyo, 1973b, Fabiyi, 1974, Wells, 1974, Olatunbosun, 1975, Osuntogun, 1976, Williams, 1978, Famoriyo, 1979).

Another issue related with the tenure system especially in Karshi is the issue of compensation for land taken by the government for development/industrial purposes. The Land Use Decree makes provision for compensation in such cases but this remains largely inefficient in Karshi as farmers whose farms have been taken away by the government either receive nothing or negligible compensation. Additionally, the compensation to farmers is seldom prompt or adequate.

#### ***Labour***

Labour is a prominent limiting factor to many of the smallholder farmers in Karshi and Baddeggi as the whole agricultural process from land preparation, weeding to harvesting is done manually because most of the families (77%) rely on family labour, self-help organizations and farmer cooperatives (*gandu* or *gaiya*). Similarly, the majority of the farmers can neither hire labour nor buy labour saving technologies (where such are available). In fact, the 23% that employ external labour restrict the number of people employed to between 2 to 5 and only occasionally throughout the farming season. Access to animal traction is similarly low among the farmers in the area of study which could help increase labour productivity and reduce the drudgery associated with smallholder farming.

As mentioned earlier, family labour, by and large seems ideal for the purposes of many smallholder farmers. However, there is shortage of labour during peak farming periods. This problem is further compounded by the fact that many farmers send their children to school. The majority of those interviewed in both Karshi and Baddeggi value the education of their children saying they do not wish the same future as theirs to their children. It has been observed that Nigerian farmers wish for their children to be anything but farmers (Odigboh, 1976).

On the whole, more male children are sent to school and this means fewer hands to work the land except on weekends and school holidays. Thus, female labour constitutes the bulk of the family labour and extends from land preparation to harvesting. The shortage of labour, therefore, means delayed weeding or harvesting and this in turn means reduced yield. It has been estimated that up to 50% of the total crop yield in Africa is lost due to late planting (Steiner and Kienzle, 2004). The tedium involved in soil tillage has led many farmers to either adopt low or no tillage (in addition to other methods such as crop rotation/intercropping, use of cover crops and green manure) as means to both controlling weed and cutting cost associated with the use of herbicides. However, for other crops such as yam and cassava, tillage is almost inescapable in these areas.

#### ***Socio-economic Constraints (Shortage of Funds/Capital)***

Despite the fact that the bulk of the farmers derive their income from farming and farming-related activities, agriculture, specifically smallholder farming, has largely been neglected by the government. All of the respondents encounter the problem of funding and declare that they have not received any kind of financial support from the government or donor agencies for the purchase of farm implements, processing machines, or general farm expansion. Most of the farm implements used by the farmers (hoes, cutlasses, and machetes) are fashioned out either on the farm or purchased somewhere else in the village. All the respondents owned hoes, cutlasses and other farming implements. A few (12%) own water pumps and on one farm, there was a rice processing machine (provided by the land owner). In general, investment in capital goods in the study areas is low; so is investment by government in infrastructure. It is to the credit of these smallholder farmers that they have developed a self-contained economy where the system is dependent on itself, an element lost in mainstream agriculture. On the other hand, adequate research and funding can help to improve farm design and methods of production as well as modify and improve farm tools.

Faced with limited income and lack of financial assistance from the government, the farmers can neither improve nor expand their production base. Equally, they cannot diversify because they are restricted and limited by lack of funds. What meagre income they make from farming is expended on meeting food needs and other social pressures such as paying school fees and medical bills.

Additionally, all of the respondents encounter a problem of shortage or lack of fertilizer (organic and inorganic). Inorganic fertilizer remains available but only through unofficial means and at prohibitively high prices. Yet, many of the farmers invest whatever little income they have on fertilizers because of the entrenched view that the success of crops depends on them. In most cases, official supply of fertilizer scarcely gets to the smallholder farmer and when it does, the timing is problematic (often way into the farming season). Also, there is a problem of information accessibility as most of the respondents interviewed were not aware of where to find farm inputs especially improved seeds for purchase. In general however, as fertilizer becomes increasingly inaccessible to poor farmers due to high prices and government's erratic and inefficient policy on fertilizer and fertilizer distribution, they are falling back on organic fertilizer.

#### **Conclusions and Recommendations**

All too often, the problem of agriculture and agricultural productivity in Nigeria and indeed most of Africa has been reduced to insufficient mechanization, low inputs (such as fertilizer, herbicides, insecticides and high yielding seeds and so on) and inadequate irrigation. Such a technical and production function model identified the solutions as: increased provision and availability of subsidized fertilizer and other chemicals, more improved seed varieties, bigger dams for irrigation, and expanded microcredit (Eicher, 2003, IAC, 2004).

In many instances, however, smallholders (such as the ones in Karshi and Baddeggi) face unique social and biophysical problems that cannot always be solved by generalized interventions based on 'modern' notions of progress and productivity. In this study, the constraints faced by smallholders were found to include institutional neglect, harvesting, handling and storage difficulties, seasonality of agriculture and the changes in rainfall patterns, parasitic plants, low soil fertility, adverse tenure systems, labour challenges, and limited access to capital.

In addressing these challenges, a paradigm shift that conflates modernization and bottom up approaches in order to maximise the benefits of both is required. This is in line with an increasingly popular position that promotes complementarity between modern and traditional methods towards achieving efficiency in resource utilization (Gregory et al., 2009, Fedoroff et al., 2010).

Institutional support for smallholder farmers has been limited or non-existent as the Nigerian government pursues an approach to agriculture based on dominant technological models which are limited even in their technological horizon and ignore sustainable and productive practices such as crop and livestock integration (Scoones and Wolmer, 2002).

There is the need to cut down on losses in harvest and storage through enhancement and application of indigenous techniques/technologies, fairer prices for farmers, improved infrastructure, improved quality of smallholder produce, private sector involvement and more government funding for research.

With regards the seasonality of agriculture, findings in both Karshi and Badeggi suggest widespread willingness to adopt small-scale motorised pumps, a finding replicated in research in nearby states such as Niger and Bauchi (Baba, 1993). Thus, there is need for more funding and research in the area of small-scale irrigations as this has the potential to boost agricultural production of smallholder farmers in rural parts of Nigeria.

In controlling parasitic weeds, biological and cultural methods of controlling *Striga* have been effective in some parts of the developing world and a careful study of these successes can greatly reduce economic loss due to *Striga* in the *fadama* areas. Such methods include hand pulling, crop rotation and trap cropping and germination stimulants. Other methods include high nitrogen fertilization, herbicides and host plant resistance. In Kenya, *Striga* has been controlled by intercropping with *Desmodium* spp. (Khan et al., 2002). Legumes have also been used to control *Striga* with an observable increase in yield (Khan et al., 2007). Mullen et al (2003) have proposed a bio-economic model for *Striga* control. It combines the implications of various agricultural practices for *Striga* infestation levels and the economic repercussions of *Striga* infestations levels and pre-determined cultural practices. Promoting these biological methods of *Striga* control requires renewed and viable extension and an attitude change. However, research on *Striga* control in Nigeria is ongoing but resistant varieties (inbred/hybrid) have been reported in various parts of Africa (Kim et al., 1984, Olakojo and Kogbe, 1999, Ogunbodede and Olakojo, 2001, Ezeaku and Gupta, 2004). A lot remains to be done in this area however for effective control and hence the need for sustained search for sustainable resistant varieties.

To enable smallholders cope with the challenge of low soil fertility, integrated soil fertility management has been suggested as a means to carefully incorporate “a wide range of adoptable soil management principles, practices and options productive and sustainable agro-ecosystems” (Yusuf and Yusuf, 2008, p. 21). This can only be achieved, however, with favourable socio-economic and political conditions.

Finally, in order to reduce the demands of labour in smallholder food production, research is needed in the area of expanding cultural practices such as the ones already described and investment is needed in the area of small-scale, sustainable time and energy saving agricultural tools such as simple cultivators for weeding, planters, shellers, rice processing machines and mills and processing/storage tools for perishables.

## REFERENCES

- [1] ABDULLAHI, H. J. & HAMZA, I. 2003. Women and land in Northern Nigeria: the rights. In: WANYEKI, L. M. (ed.) *Women and Land in Africa*. London: Zed Books.
- [2] ADAMS, W. M. 1991. Large scale irrigation in Northern Nigeria: Performance and ideology. *Trans. Inst. British Geogr. N.S.*, 16, 287-300.
- [3] ADEGBOYE, R. O. 1967. The need for land reform in Nigeria. *Niger. J. Econ. Soc. Studies*, 9, 339-350.
- [4] ADENIYI, E. O. 1972. Land tenure and agricultural development in Nupeland. *Niger. Geogr. J.*, 15, 49-59.
- [5] ADERINOKUN, K. 2008. Food Crisis: FG Lifts Import Duties on Rice. *Thisday*, May 8, 2008, p.1.
- [6] AFRICAN INSTITUTE FOR APPLIED ECONOMICS 2005. Sustainable Funding of Agricultural Sector in Nigeria. *Technical Assistance to the House of Representatives Committee on Agriculture*. Enugu, Nigeria: African Institute for Applied Economics (AIAE).
- [7] AGBENIN, J. O. & GOLADI, J. T. 1997. Carbon, nitrogen and phosphorus dynamics under continuous cultivation as influenced by farmyard manure and inorganic fertilizers in the savannah of Northern Nigeria. *Agric. Ecosys. Environ.*, 63, 17-24.
- [8] ALTIERI, M. 1998. Ecological Impacts of Industrial Agriculture and the Possibilities For Truly Sustainable Farming. *Monthly Review*, 50, 60-71.
- [9] AZUBUIKE, G. 2008. Agric Bank Boosts Projects with N29bn. *Leadership*, July 26, 2008, p.39.
- [10] BABA, K. M. 1993. Irrigation development strategies in sub-Saharan Africa: a comparative study of traditional and modern irrigation systems in Bauchi State of Nigeria. *Agriculture, Ecosystems and Environment*, 45, 47-58.
- [11] BABALEYE, T. 2008. Research needed to boost local rice production. *Thisday*, p.49.



- [12] BALASUBRAMANIAN, V., SINGH, V. L., NANDI, L. A. & MOKWUNYE, A. U. 1984. Fertility status of some upland savannah soils of Nigeria after fallow and cultivation. *Samaru J. Agric. Res.*, 2, 13-23.
- [13] BATIONO, A., RHODES, E., SMALING, E. M. A. & VISKER, C. 1996. Technologies for restoring soil fertility. In: MOKWUNYE, A. U., DE JAGER, A. & SMALING, E. M. A. (eds.) *Restoring and Maintaining the Productivity of West African Soils: Key to Sustainable Development*. Miscellaneous fertilizer studies No. 14.
- [14] BOGORO, S. E. 1999. Food Security Programme: Time to go step further than food self-sufficiency in Nigeria. Bauchi, Nigeria: ATBU, Bauchi.
- [15] CHUDE, V. O. 1998. Understanding Nigerian soils and their fertility management for sustainable Agriculture. *Inaugural Lecture*. Zaria: Ahmadu Bello University.
- [16] COLLINGS, H. G. 1995. *Commercial Fertilizers: Their Sources and Use*, New York, McGraw Hill Book Co.
- [17] COOK, C. E., WHICHARD, L. P., COGGAN, P., LUTHAN, P. A. & MCPHAID, A. T. 1972. Germination stimulants 2. The structure of Strigol - a potent seed germination stimulant for witch weed (*Striga lutea* Lour.). *Journal of the American Chemical Society*, 94, 6198-6199.
- [18] COTULA, L., TOULMIN & CAAD HESSE, C. 2004. *Land Tenure and Administration in Africa: Land Tenure and resource Access in Africa*, London, IIED/FAO.
- [19] DOGGETT, H. 1998. Witchweed (*Striga*). In: DOGGETT, H. (ed.) *Sorghum*. 2nd ed. Essex, UK: Longman Scientific and Technical.
- [20] EICHER, C. K. 2003. Flashback: fifty years of donor aid to African agriculture *Successes in African Agriculture Conference Paper 16*. Washington, D.C: International Food Policy Research Institute.
- [21] ETUK, E. G. & ABALU, G. O. I. 1992. River basin development in northern Nigeria: a case study of Bakolori Project. *Fourth Afro-Asian Regional Conference of ICID* Lagos, Nigeria.
- [22] EZEAKU, I. E. & GUPTA, S. C. 2004. Development of sorghum populations for resistance to *Striga hermonthica* in the Nigerian Sudan Savannah. *African Journal of Biotechnology*, 3, 324-329.
- [23] FABIYI, Y. L. 1974. *Land tenure innovations in rural development: The problems in western Nigeria with some Tanzanian comparisons*. Ph.D, University of Wisconsin.
- [24] FAI 2004. Fertilizer Statistics 2003–04. New Delhi: The Fertilizer Association of India.
- [25] FAMORIYO, S. 1972. Elements in developing land tenure policies for Nigeria. *Q. J. Admin*, 7, 55–57.
- [26] FAMORIYO, S. 1973a. Land tenure and food production in Nigeria. *Land Tenure Centre Newsletter*
- [27] 41, 10-15.
- [28] FAMORIYO, S. 1973b. Some problems of the customary land tenure systems in Nigeria. *Land Reform, Land Settlement and Cooperatives*, 2.
- [29] FAMORIYO, S. 1979. *Land Tenure and Agricultural Development in Nigeria*, Ibadan, Nigeria, Nigerian Institute of Social and Economic Research.
- [30] FEDOROFF, N. V., BATTISTI, D. S., BEACHY, R. N., COOPER, P. J. M., FISCHHOFF, D. A., HODGES, C. N., KNAUF, V. C., LOBELL, D., MAZUR, B. J., MOLDEN, D., REYNOLDS, M. P., RONALD, P. C., ROSEGRANT, M. W., SANCHEZ, P. A., VONSHAK, A. & ZHU, J.-K. 2010. Radically Rethinking Agriculture for the 21st Century. *Science*, 327, 833-834.
- [31] FOS 1999. Poverty and Agricultural Sector in Nigeria: Poverty Incidence of Farmers by Region. Abuja, Nigeria: Federal Office of Statistics.
- [32] GBAHABO, T. 2015. Peasant Household Livelihood in the Semi-Arid Region of Nigeria: The Case of Gursulu. *International Journal of Sociology and Anthropology*, 7, 158-16.
- [33] GODFRAY, H. C., BEDDINGTON, J. R., CRUTE, I. R., HADDAD, L., LAWRENCE, D., MUIR, J. F., PRETTY, J., ROBINSON, S., THOMAS, S. M. & TOULMIN, C. 2010. Food security: the challenge of feeding 9 billion people. *Science*, 327, 812-8.
- [34] GREGORY, P. J., JOHNSON, S. N., NEWTON, A. C. & INGRAM, J. S. I. 2009. Integrating pests and pathogens into the climate change/food security debate. *Journal of Experimental Botany*, 60, 2827-2838.
- [35] GWORGWOR, N. A., NDAHI, W. B. & WEBER, H. C. Parasitic weeds of North-eastern region of Nigeria: a new potential threat to crop production. The BCPC Conference: Weeds, 2001 Brighton, UK British Crop Protection Council.
- [36] HESS, T. M., WILLIAM, S. & MARYAH, U. M. 1995. Rainfall trends in the North East and arid zone of Nigeria, 1961-1990. *Agric. Forest Meteorol.*, 74, 87-97.
- [37] HURST, P. 1990. *Rainforest politics : ecological destruction in South-East Asia*, London, Zed Books.
- [38] IAC 2004. *Inventing a Better Future. A Strategy for Building Worldwide Capacities in Science and Technology*, Amsterdam, InterAcademy Council.
- [39] IJAODOLA, J. O. 1970. The creation of states on Nigeria: An opportunity for amending the law of land tenure in the former Northern Region. *Law in Society*, 4, 1-12.

- [40] KHAN, Z. R., HASSANALI, A., OVERHOLT, W., KHAMIS, T. M., HOOPER, A. M., PICKETT, J. A., WADHAMS, L. J. & WOODCOCK, C. M. 2002 Control of witchweed *Striga hermonthica* by intercropping with *Desmodium* spp., and the mechanism defined as allelopathic. *J Chem Ecol.*, 28, 1871-1885.
- [41] KHAN, Z. R., MIDEGA, C. A. O., HASSANALI, A., PICKETT, J. A. & WADHAMS, L. J. 2007. Assessment of Different Legumes for the Control of *Striga hermonthica* in Maize and Sorghum. *Crop Sci*, 47, 730-734.
- [42] KIM, S., KHADHAR, V., PARKINSON, J. M. & FAJEMISIN EFRON, Y. 1984. Breeding maize for field resistance to striga in Africa *76th Ann. Conf. Amer.Soc Agron.* Lag Vegas, Nevada, U.S.A.
- [43] KOLAWOLE, A. The extent of local farmers' participation in large-sale irrigation projects in Nigeria: a preliminary study of south Chad irrigation project. Fourth Afro-Asian Regional Conference of ICID, 29-30 January, 1980 1982. 325-334.
- [44] LAWAL, A. A. 1997. The Economy and the State from the Pre-colonial Times to the Present. In: OSUNTOKUN, A. & OLUKOJU, A. (eds.) *Nigerian Peoples and Cultures*. Ibadan: Davidson.
- [45] LIVERPOOL, L. S. O. & WINTER-NELSON, A. 2010. Poverty Status and the Impact of Formal Credit on Technology Use and Wellbeing among Ethiopian Smallholders. *World Development*, 38, 541-554.
- [46] MOODY, R. 1996. Mining the world: the global reach of Rio Tinto Zinc. *The Ecologist*, 26, 46-52.
- [47] MOSELEY, W. G. 2005. Global Cotton and Local Environmental Management: The Political Ecology of Rich and Poor Small-Hold Farmers in Southern Mali. *The Geographical Journal.*, 171, 36-55.
- [48] MULLEN, J. D., TAYLOR, D. B., FOFANA, M. & KEBE, D. 2003. Integrating long-run biological and economic considerations into *Striga* management programs. *Agricultural Systems*, 76, 787-795.
- [49] MUSTAPHA, S. 2007. Fertility Status of Fadama Soils in Dass Local Government Area of Bauchi State, Nigeria. *J. of Sustainable Development in Agriculture & Environment*, 3, 104-111.
- [50] NEVEN, D., ODERA, M. M., REARDON, T. & WANG, H. 2009. Kenyan Supermarkets, Emerging Middle-Class Horticultural Farmers, and Employment Impacts on the Rural Poor. *World Development*, 37, 1802-1811.
- [51] NICHOLSON, S. E., SOME, B. & KONE, B. 2000. An analysis of recent rainfall conditions in West Africa, including the rainy seasons of the 1997. El Nino and the 1998 La Nina years. *J. Climate*, 13, 2628-2640.
- [52] OCULI, O. 1979. Dependent food policy in Nigeria 1975-1979. *Review of African Political Economy*, 6, 63-74.
- [53] ODIGBOH, E. U. 1976. Engineering the mechanization of agriculture in the rain forest zone of Nigeria. *Symposium on Appropriate Approaches for Accelerated Food Production*. Nsukka, Nigeria: University of Nigeria.
- [54] OGEN, O. 2003. Patterns of Economic Growth and Development in Nigeria since 1960. In: ARIFALO, S. O. & AJAYI, G. (eds.) *Essays in Nigerian Contemporary History*. Lagos: First Academic Publishers.
- [55] OGUNBODEDE, B. A. & OLAKOJO, S. A. 2001. Development of *Striga asiatica* tolerant hybrid maize (*Zea mays* L.) varieties. *Tropical Agriculture Research and Extension*, 4.
- [56] OLAKOJO, S. A. & KOGBE, J. O. 1999. Reaction of some maize Genotypes with infestation with *Striga asiatica*. *Bioscience Research Communication*, 131S-139S.
- [57] OLATUNBOSUN, D. 1975. *Nigeria's Neglected Rural Majority*, Ibadan, Oxford University Press for Nigerian Institute of Social and Economic Research.
- [58] OLUWASANMI, H. A. 1966. *Agriculture and Nigerian Economic Development*, Ibadan, Oxford University Press.
- [59] OSEMEOBO, G. J. 1992. Impact of Nigerian agricultural policies on crop production and the environment. *The Environmentalist*, 12, 101-108.
- [60] OSUNTOGUN, A. 1976. *Institutional Determinants and Constraints on Agricultural Development: Case Studies from the Western States of Nigeria*, Reading, UK, University of Reading/ ODI joint programme on agricultural development overseas.
- [61] RAMAIAH, K. V. 1987. Control of *Striga* and *Orobanche* Species a review. In: WEBER, H. C. & FORSTRENER, W. (eds.) *Fourth International Symposium on Parasitic Flowering Plants*. Marburg, Germany: Philipps-Universital.
- [62] RICHES, C. R. & PARKER, C. 1995. Parasitic Weeds as Plants. In: PRESS, M. C. & GRAVES, J. D. (eds.) *Parasitic Plants*. London: Chapman and Hall.
- [63] SANCHEZ, P. A. & LEAKEY, R. R. B. 1997. Land-use transformation in Africa: Three determinants for balancing food security with natural resource utilization. *Eur. J. Agron.*, 7, 1-9.
- [64] SAUEBORN, J. 1991. The economic importance of the phytoparasites *Orobanche* and *Striga*. *5th International Symposium on Parasitic Weeds*. Nairobi, Kenya.

- [65] SCOONES, I. & WOLMER, W. (eds.) 2002. *Pathways of Change in Africa: Crops, Livestock and Livelihoods in Mali, Ethiopia and Zimbabwe*, Oxford: James Currey.
- [66] SHAIBU, I. & UJA, E. 2008. Obasanjo wasted N300b importing fertilizers that were not seen by Nigerian farmers - Interview with senator Babalola Gbenga. *Vanguard*, May 6, 2008, p.34.
- [67] SHIWACHI, H., KIKUNO, H., FASHOLA, R. & ASIYEDU, R. 2008. Enhancing off-season yam production in Nigeria. *African Journal of Agricultural Research*, 3, 407-411.
- [68] STEINER, K. G. & KIENZLE, J. 2004. Mitigating the impact of HIV/AIDS by labour saving technologies. *African Conservation Tillage Network: Information Series*, 9.
- [69] VAN RUELER, H. & PRINS, W. H. 1993. Plant nutrients and food production. In: VAN RUELER, H. & PRINS, W. H. (eds.) *The Role of Plant Nutrients for Sustainable Food Crop Production in Sub-Saharan Africa*. Leidschendam, The Netherlands: V.K.P.
- [70] WELLS, J. C. 1974. *Agricultural Policy and Economic Growth in Nigeria, 1962-1968*, Ibadan, Oxford University Press for Nigerian Institute of Social and Economic Research.
- [71] WILLIAMS, S. K. T. 1978. *Rural Development in Nigeria*, Ife, Nigeria, University of Ife press.
- [72] YUSUF, A. A. & YUSUF, H. A. 2008. Evaluation of strategies for soil fertility improvement in Northern Nigeria and the way forward. *Journal of Agronomy*, 7, 15-24.

#### Tables & Figures



Figure 4: Location of Surveyed Farms in North Central Nigeria

Figure 5: Location of Surveyed Farms in North Central Nigeria

	Karshi		Baddeggi		
		Frequency	Percentage	Frequency	Percent
Sex	Male	20	42.6	17	81.0
	Female	27	57.4	4	19.0
	Total	47	100.0	21	100.0
Farm Size	1Ha & Below	28	59.6	6	28.6
	Between 2-4Ha	19	40.4	15	71.4
	Total	47	100.0	21	100.0

Table 3: Statistical distribution of farmers based on sex and farm size in Karshi

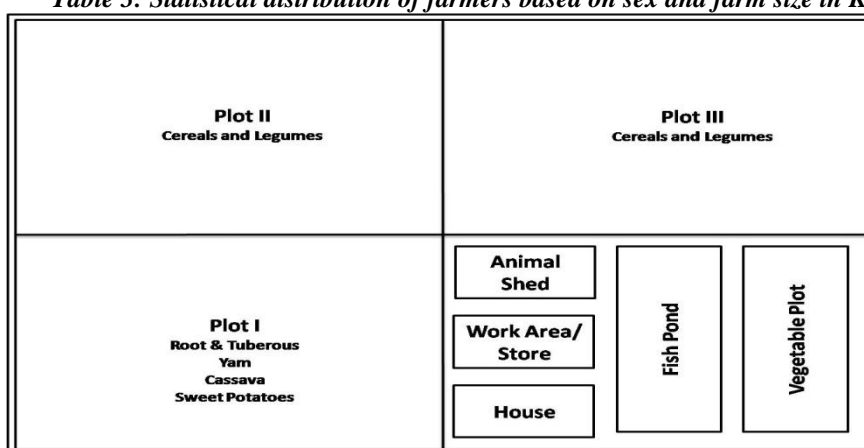


Figure 6: Schematic of a typical farmstead

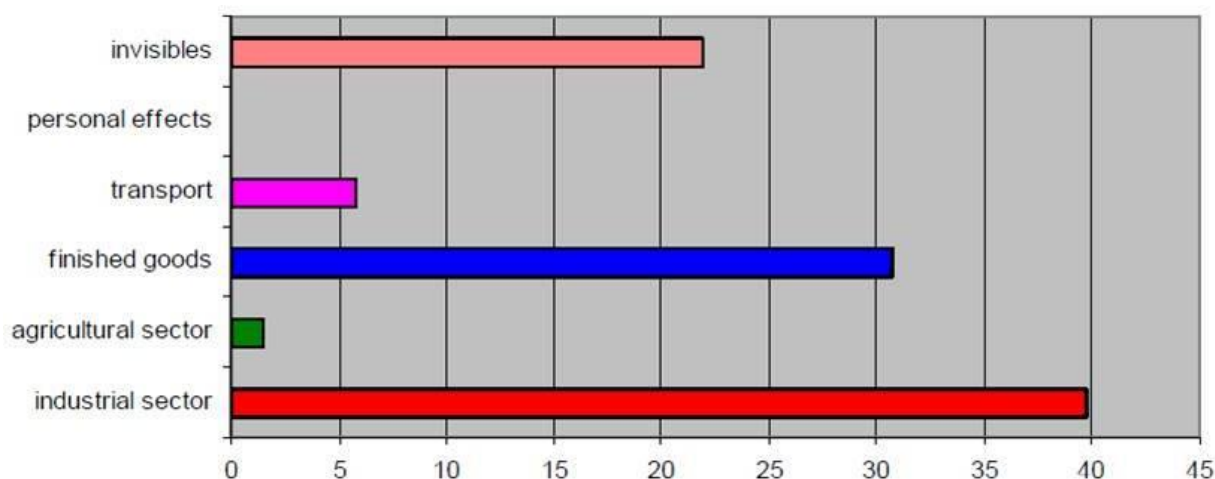


Figure 7: Average Sectoral Utilization (share in %) Of Foreign Exchange (in US\$ million)

Source: (African Institute for Applied Economics, 2005)

Years	Maize Actual (kg ha) Growth (%)	Millet Actual (kg ha) Growth (%)	Sorghum Actual (kg ha) Growth (%)	Rice Actual (kg ha) Growth (%)
1996	1326	1061	1144	1750
1997	1251	1076	1107	1596
1998	5.67	1.41	3.22	-8.82
1999	1320	1000	1133	1602
2000	5.52	7.03	2.29	0.41
2001	1381	1064	1126	1496

2002	4.63		6.37		0.59		-6.65
2003	1027	-	1050		1120	-	1500
2004	25.64		-1.28		0.54		0.27
Mean	1143		944	-	1021	-	1247
	11.32		10.05		8.81		16.86
	1044	-	990		1090		1010
	8.68		4.81		6.72		18.99
	1070	-	1030		1135		956
	2.49		4.04		4.13		-5.45
	1070		1030		1140		960
	0.00		0.00		0.88		0.00
	1195	-	1027		1109		1395
	2.29		-0.25		0.00		-8.01

**Table 4: Yield trend and growth rates of cereals in Nigeria, 1996-2005**  
*Source: (Yusuf and Yusuf, 2008)*