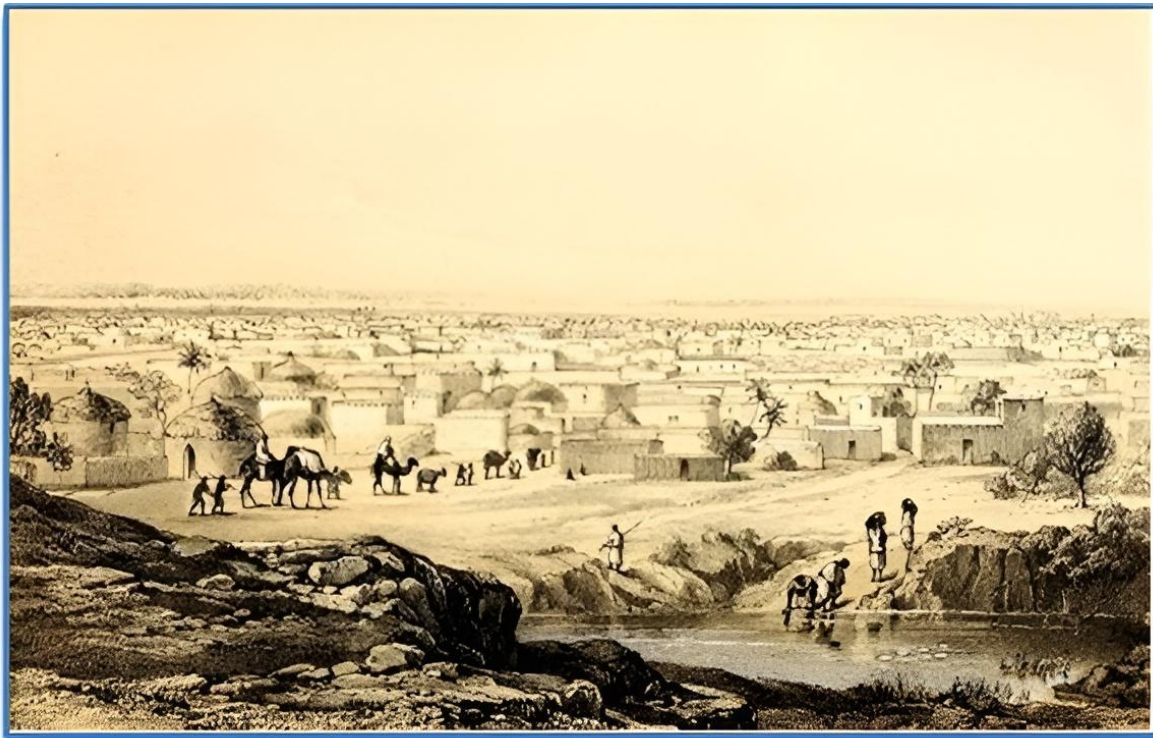


Strengthening Peace and Resilience in Nigeria (SPRING)

# The Evolution of Nigerian Farming Systems in Relation to Farmer-Herder Conflict

Raymond Dawum and Roger Blench

April 2025



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## SPRING

The Strengthening Peace and Resilience in Nigeria (SPRING) Programme is a four-year (2024-2028) UK-funded initiative designed to support a more peaceful and climate-resilient Nigeria. SPRING is grounded in a politically informed, evidence-based approach that integrates environmental science, political economy, and conflict analysis. By addressing the root causes of conflict and vulnerability, SPRING works to reduce violence, strengthen local systems, and promote inclusive governance across conflict-affected areas in North-West and North-Central Nigeria. The programme is implemented by Tetra Tech International Development in partnership with Nextier SPD (Nextier), the Centre for Democracy and Development (CDD), and the Centre for Humanitarian Dialogue (HD).

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## Acronyms

ABU	Ahmadu Bello University
ADP	Agricultural Development Project
AFAN	All Farmers Association of Nigeria
APMEU	Agricultural Projects Monitoring and Evaluation Unit
CBO	Community-Based Organisation
CGIAR	Consultative Group for International Agricultural Research
FCT	Federal Capital Territory
GDP	Gross Domestic Product
IAR	Institute for Agricultural Research
IDB	Islamic Development Bank
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
KSADP	Kano State Agricultural Development Programme
LGA	Local Government Area
MACBAN	Miyetti Allah Cattle Breeders Association of Nigeria
NGO	Non-Governmental Organisation
NLTP	National Livestock Transformation Plan
SE	South-East
SMEs	Small and Medium-sized Enterprises
USD	United States Dollar

## Executive Summary

This report examines the situation of Nigerian farmers and the institutions designed to work alongside them, drawing on field surveys carried out across 12 states in 2024.<sup>1</sup> It forms part of a wider body of research commissioned by the Strengthening Peace and Resilience in Nigeria (SPRING) Programme, a four-year UK-funded initiative implemented by Tetra Tech International Development to support a more peaceful and climate-resilient Nigeria.

Between July and August 2024, interviews were conducted with farmers, non-governmental organisations (NGOs), and community-based organisations (CBOs), and field trips were carried out to regions identified as potential sites of conflict. A comparable survey was also undertaken with herders in the same areas, to build a balanced picture of the dynamics at play. This report should therefore be read together with SPRING's companion study, [Pastoralist Practices and their Relevance to Conflict in Nigeria](#). It also builds on findings from earlier surveys conducted by the authors between December 2023 and January 2024. The present version was updated in April 2025.

The research findings reveal the multiple, compounding pressures on Nigerian farming and pastoral systems. Above all, demographic growth and low productivity are driving the expansion of farmland into pastoral territory. As cultivated areas spread, the traditional routes once used for cattle migration are shrinking, and in some places disappearing altogether. Migration, however, is likely to remain a feature of pastoral life in the medium term. Ironically, the expansion of farmland has increased the need for herders to move, pushing them to migrate in both wet and dry seasons, whereas in the past they would often remain settled during the rains.

The continuation of nomadic cattle herding in its traditional form appears unsustainable over the longer term. A more viable direction would be the promotion of agropastoralism, in which households keep smaller herds to provide milk, meat, and animal traction to supply local markets. Yet Nigerian farming has remained strikingly conservative. Most farmers still rely on rain-fed cropping, and although there are isolated successes in intensification and large-scale production, these remain rare.

A central challenge, therefore, is to make agriculture more productive. If farmers can produce more food on smaller areas of land, the incentive to expand into pastoral territory will diminish. At the same time, greater productivity could encourage closer collaboration, with herders reducing herd sizes and adopting more permanent settlement.

Social and economic changes are also reshaping rural life. Farm labour, once managed through collective labour parties, has become increasingly monetised, with individuals now hiring workers for individual cash payments. Alongside this trend, is the widespread use of synthetic opioids such as fentanyl and tramadol by farm labourers, taken to sustain bursts of intense work and high output.

This report documents the main types of agriculture practised across Nigeria, shaped by rainfall, ecology, and vegetation. While rain-fed cultivation remains dominant, recent decades have witnessed a notable growth of counter-season horticulture along major river basins. Yet this shift has created new tensions: dry-season gardens now block access to rivers that herders traditionally relied on for grazing in the dry season. In some areas, however, local collaborations between herders and farmers have emerged, particularly where farmers value access to manure at a time when fertiliser prices are high. Despite these minor examples, agricultural policy in many regions remains weakly grounded in empirical research on sustainable farming systems. One promising exception is found in Kano State, where a government-led project to promote agropastoralism has begun to show results.

This report concludes by outlining a series of straightforward innovations that could raise smallholder productivity and increase rural incomes. By supporting the adoption of agropastoral practices, such measures have the potential not only to strengthen rural livelihoods but also to reduce the drivers of conflict between farmers and herders.

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<sup>1</sup> States included Plateau, Kaduna, Kano, Jigawa, Gombe, Nasarawa, Benue, Edo, Ogun, Oyo, Kwara, and Federal Capital Territory (FCT).

# 1. Introduction

## Background

Nigeria has the largest population in Africa and one of the highest gross domestic products (GDPs), largely due to its income from oil. Despite this, food shortages have become commonplace in recent years, and economic stratification – the widening gap between the richest and poorest – has worsened significantly. The country also faces growing problems of insurgency and insecurity, with terrorist movements active in parts of the North and rising criminality across the country. Conflicts over access to resources, particularly between herders and farmers, are a major issue in many rural areas. Although Nigeria is a functioning democracy with considerable oil wealth, it remains unable to deliver public services equitably. The ‘brain drain’ of Nigerian professionals, particularly health workers, leaving the country is further undermining service delivery (Ileyemi 2024).

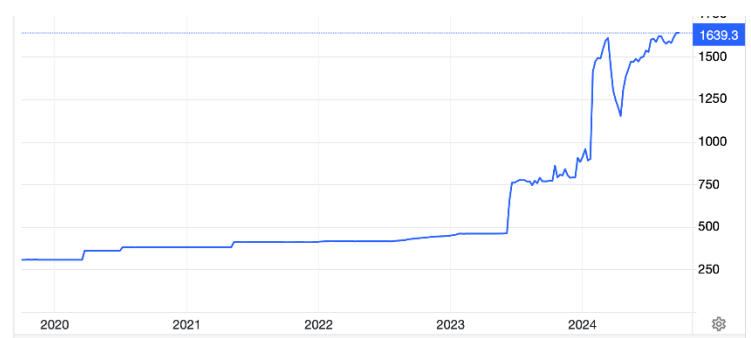
Across large parts of Nigeria, reliable data – both socio-economic and biophysical – is limited, and this represents a growing challenge. Much of the existing literature is outdated; while it provides useful baseline information, new research is needed to explain current conditions. Analysis of climate change, particularly at the local level, is also constrained by weak data. Rainfall records are patchy, and in some areas reportedly ceased around two decades ago (Hess et al. 1995; for an overview of current rainfall data, see SPRiNG’s [Climate Risk and Vulnerability Analysis](#)).

Empirically-based descriptions of Nigerian farming practices are even older, in some cases dating back to the 1960s. These studies (see references in Section 2) provide valuable context and baseline data, but they urgently require updating if government and donor supported agricultural programmes are to be better informed and equipped to address the realities of farming in Nigeria today.

Meanwhile, Nigeria’s food security situation is deteriorating rapidly. Historically, the country has relied on food imports, financed by oil revenues, to cover domestic shortfalls. However, a complex array of exchange rates often disadvantaged local producers in favour of importers, leading to markets being flooded with South-East (SE) Asian rice and bread wheat. The naira was once a relatively stable currency, but this is no longer the case. Its sharp depreciation in recent years – falling from 300 to the US dollar in 2019 to 1,640 in 2024 – has made the import of staples prohibitively expensive, and increasingly unaffordable for many Nigerians. As a result, local producers have been forced to fill the gap. They are making some progress in doing so, and farming has become a more attractive livelihood option than in the past, owing to rising market prices. Yet, the precise ways in which farmers are adapting remain largely unexplored.<sup>2</sup>

Nigeria remains a nation of small farmers. The economies of scale characteristic of large farms in the developed world have yet to make a significant impact on its food supply. Development programmes designed to establish large farms and ranches, both private and public, have achieved only limited results. The reasons often relate to management – notably the difficulty of finding competent farm managers – as well as challenges with input supply, fluctuating prices, and irregular utilities. There is some evidence that in the semi-arid zone, for example in Jigawa State, wealthy urban entrepreneurs are acquiring land for larger-scale enterprises. However, their approach is often to access protected forest reserves rather than purchase private land, a business model that may not be sustainable in a realistic economic environment.

**Figure 1: Naira exchange rate against the USD, five-year averages**



Source: Trading Economics, <https://tradingeconomics.com/nigeria/currency>

being flooded with South-East (SE) Asian rice and bread wheat. The naira was once a relatively stable currency, but this is no longer the case. Its sharp depreciation in recent years – falling from 300 to the US dollar in 2019 to 1,640 in 2024 – has made the import of staples prohibitively expensive, and increasingly unaffordable for many Nigerians. As a result, local producers have been forced to fill the gap. They are making some progress in doing so, and farming has become a more attractive livelihood option than in the past, owing to rising market prices. Yet, the precise ways in which farmers are adapting remain largely unexplored.<sup>2</sup>

**Figure 2: Reports of child malnutrition**

**Child malnutrition crisis in Nigeria amid rural violence and soaring food inflation**

MSF says it is overwhelmed in country where 11.8 million people are suffering from hunger



© MSF says it is overwhelmed in country where 11.8 million people are suffering from hunger. Photograph: Pui Chuen Ip/MSF/Corbis Images

Source: Médecins Sans Frontières

<sup>2</sup> In February 2024, Europe experienced widespread farmers’ protests, emblematic of the challenge facing authorities in various countries to effectively balance incentives and subsidies to make farming economically viable.

Whether the growth of larger farms will begin to out-compete smallholders remains uncertain. Larger farms have less built-in flexibility, which may disadvantage their managers in a constantly changing security environment. If it is small farmers who are to feed the cities, however, then they will clearly need to raise their productivity. Traditional production methods simply cannot provide sufficient food and, moreover, contribute to environmental degradation. The rain-fed fallow systems that were feasible in pre-colonial times now accelerate erosion and deforestation.

A further striking consequence of these pressures is the increase of hunger, especially in rural areas. Anecdotal evidence from many of the interviews undertaken as part of this study suggests that hunger is indeed rising. Child malnutrition rates are on the increase given the lack of basic foodstuffs. Farmers are unable to produce enough food to feed their families. The government has announced the release of food stocks to address this, but few rural households have received such aid, despite its prominent coverage on television.

Anecdotal evidence suggests that the agricultural landscape has been transformed, yet detailed accounts of how farmers are adapting remain scarce. For donor projects, government policies, and NGO initiatives to succeed, they must be grounded in realistic data. At present, there is little reliable information on what should be a central question: how Nigerian farmers farm today (2024-2025). To help address this gap, SPRiNG commissioned a study of Nigerian farmers in selected parts of the country. The aim was to establish some basic parameters that could contribute to a broader understanding of farming practice and of the institutional actors involved with agriculture – including government agencies, donor projects, private companies, and NGOs and CBOs.<sup>3</sup> Inevitably, this study is indicative rather than definitive, being based on a relatively small sample, but the findings are sufficiently robust to help fill important knowledge gaps.

This research should be read alongside SPRiNG's [Pastoralist Practices and their Relevance to Conflict in Nigeria](#) report, which examines the situation of pastoralists. The next section outlines the conditions under which the survey was conducted and provides a brief review of the existing literature (Section 2). Section 3 presents the survey findings across several thematic areas. Section 4 discusses the policy conclusions which may be drawn, and Section 5 considers practical next steps.

## Drivers of Farmer-Herder Conflict

Farmer–herder conflict has been a subject of growing concern since the early 2000s. A small incident, such as cattle straying into farmland, can quickly escalate into more serious violence. Taken together, the pastoralist survey and the present survey of farmers strongly indicate that such conflict is fundamentally resource-based. Typically, disputes arise when cattle enter crop fields and damage harvests. During the dry season, herds seeking water at rivers often intrude on vegetable plots along the banks. Most importantly, tensions centre on stock routes, grazing land, and access to river water points.

In principle, migrating cattle should be able to keep to official or customary stock routes. Historically, land was sufficiently abundant to make this feasible. However, a combination of demographic growth and low agricultural productivity has forced farmers to expand cultivation simply to achieve the yields that were once possible on much smaller areas. In some regions, stock routes and grazing reserves are especially tempting to farmers because the land has been naturally fertilised by passing cattle. When farmers encroach on these areas, cattle trample the fields and disputes follow.

Demographic growth is a key driver of these pressures. From an estimated population of five million in 1900, Nigeria's population has now risen to approximately 220 million. While family size is decreasing in southern Nigeria, fertility remains extremely high in much of the North. Total fertility in the North-East is almost double that in the South-South zone. Table 1 presents total fertility rates for the three years preceding the Demographic and Health Survey, 2023-24 by zone and state.

Smallholder farming systems in West Africa are notably unproductive compared not only with Euro-American systems but also with smallholder systems in Asia. Explanations vary, but key factors include the absence of widespread composting and the tendency to grow only a single annual crop on each plot. Whereas a Vietnamese rice farmer might produce three crops a year, West African farmers often produce only one. These rain-fed and shifting cultivation systems evolved under conditions of very low human population density. In the face of West Africa's highly variable

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<sup>3</sup> There were two phases of the survey. From December 2023 to January 2024, interviews with individual and groups of farmers 'in the field' were undertaken with the support of private funding. The second survey from July to August 2024 was funded by the SPRiNG Programme. Both surveys were conducted by Roger Blench and Raymond Dawum.

climate, the crop varieties selected and the farming practices adopted represented rational adaptations. Yet many techniques have proven resistant to change, despite today’s vastly different demographic context.

Nonetheless, increasing agricultural productivity – and thereby reducing the area required for cultivation – is both possible and necessary. Crucially, many of the strategies to achieve this involve fostering greater collaboration between herders and farmers, creating stronger incentives for peaceful coexistence.

**Table 1: Total fertility by zone and state**

<b>Zone</b>	<b>Fertility Rate</b>
North-Central	4.2
North-East	6.1
North-West	5.9
South-East	4.1
South-South	3.3
South-West	3.4

*Source: Nigeria Demographic and Health Survey 2023–2024*

Other sources of pressure on land include urban expansion and land seizures by powerful interests. Vast areas on the peripheries of towns are allocated, cleared, and then often left unused. In rural areas, land – particularly within grazing reserves – is frequently sold to business, often for the cultivation of cash crops such as sesame. This intense pressure on land has produced some unexpected consequences. Rising food prices have stimulated large-scale reverse migration from towns to the countryside, with urban dwellers reclaiming land and producing food. Alongside this has emerged the phenomenon of the *nomad farmer*: in some regions, shortages of land are driving entire households and even villages to relocate in search of farmland. According to interviews, such movements have provoked intercommunal conflict as well as clashes with herders.<sup>4</sup>

If Nigerian smallholder farmers were able to produce more from less land, they would not only raise their incomes but also be better able to feed their families. Shifting cultivation is sustainable only when the cycles are long; if a farmer does not return to a plot for 20 years, the vegetation and soil have time to recover. Today’s demographic pressures, however, have forced these cycles to shorten dramatically – or disappear altogether – particularly when combined with:

- maize production, which depletes soil fertility;
- destruction of habitats for pollinating bees;
- removal of nitrogen-fixing trees such as the locust bean (*Parkia biglobosa*);
- loss of earthworms, which are essential for soil aeration.

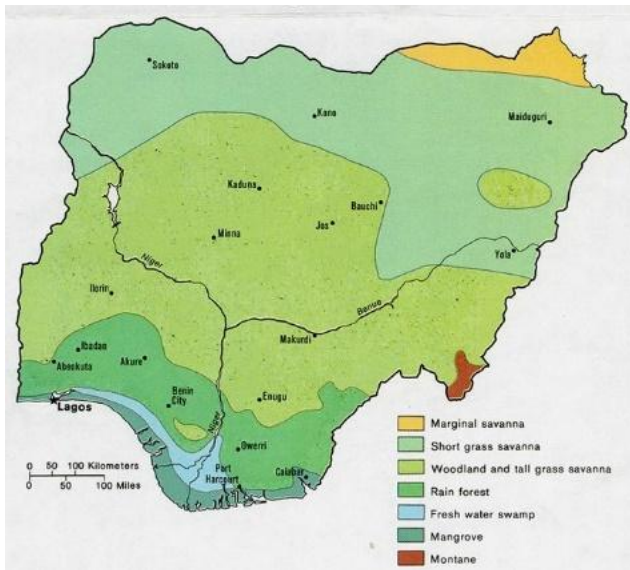
## Basic Ecological Parameters

Nigeria, like many West African countries, has a climatic profile that spans a wide range of ecozones and rainfall regimes. Annual precipitation in the South-East can reach as much as 4,000mm, while in parts of the North-East it is as little as 50mm. Figure 3 illustrates the main vegetation zones of Nigeria. It is important to note that until the mid-twentieth century much of the savanna, or subhumid zone, was originally forest. However, the region has since undergone extensive deforestation and can now be classified as anthropic savanna.

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<sup>4</sup> This was reported by participants of the Pastoralist Practices study in the Ogoja area of Cross River State during fieldwork conducted between 13 and 15 July 2024 and in Edo State during fieldwork conducted between 17 and 20 July 2024.

Figure 3: Vegetation zones of Nigeria



Source: Central Bank Annual Report 1999

## Survey Approach

The first author has conducted numerous surveys of Nigerian farmers over the past three decades, but the security situation now makes it difficult for international researchers to visit many regions. Prior to the inception of SPRiNG, Raymond Dawum was commissioned to travel around the country in December 2023 - January 2024, meeting farmers and discussing their current production strategies. In July and August 2024, Roger Blench and Raymond Dawum undertook a further survey across a sample of states with significant farming populations, selected to correspond with those included in the parallel pastoralist study. This exercise concentrated on engagement with organisations representing farmers, as well as NGOs and small and medium-sized enterprises (SMEs). The original field reports from these surveys are available. The present document synthesizes the existing literature on farming with the findings of these two studies.

## 2. The Study of Nigerian Farming

Nigeria has a long tradition of studying traditional farming systems. A journal entitled *Farm and Forest* was published from 1945 to 1952 and served principally as an outlet for studies conducted by agricultural and forest officers in the course of their work. Other relevant papers appeared in *The Nigerian Field*, although this journal focussed mainly on natural history.

The Institute of Agricultural Research, established in 1922 and located on the campus of Ahmadu Bello University (ABU), continues to operate. Originally tasked with studying all aspects of farming, it now appears to focus primarily on genetically improved strains of dry-zone crops.<sup>5</sup> In the 1970s, however, the study of ‘farming systems’ was highly popular, emphasising agricultural economics and the inputs and outputs of traditional farming.

Several important publications date from this era, including Norman (1973, 1974) and Norman et al. (1979). Researchers such as Mike Mortimore studied peri-urban farming systems, for example around Kano and Zaria, producing monographs that are now difficult to access (Adams & Mortimore, 1997, 2005). A different perspective, written more than a quarter of a century after the relevant fieldwork, is the Marxist analysis of Clough (2014, 2020), which examined the ‘moral economy’ of Hausaland in terms of capital accumulation. At the same time, the Consultative Group for International Agricultural Research (CGIAR), a multilateral body, established the International Institute of Tropical Agriculture (IITA) at Ibadan.

A unique study of Middle Belt farmers is Netting (1968), which described the terrace farming practices characteristic of the escarpment of the Jos Plateau among the Pan (Kofyar) people. When his student, Glenn Stone (1996), revisited the same communities, the Kofyar had abandoned terracing in favour of farming on the plains below. Netting (1968) highlighted the diversity of crops grown on the terraces, which declined sharply when the Kofyar moved to the plains. Terrace farming remains rare in Nigeria, although it also occurs along the border with Cameroon in the Mandara Mountains. Studies of farming systems in the humid zone are less common. Lagemann (1977) examined the South-East in some detail and considered the implications of demographic growth and farmers’ responses. Academic research has also explored major cash crops such as palm, rubber, and cocoa (e.g., Galletti et al., 1956).

There is limited evidence of research that has influenced agricultural policy in Nigeria. For example, the Agricultural Projects Monitoring and Evaluation Unit (APMEU) in Kaduna collected data on the implementation of Agricultural Development Projects (ADPs) with the aim of informing and adjusting policy within the state’s ADPs. However, there is little indication that such processes were effectively followed through. From 1992 onwards, the Fadama projects (I-III), which promoted dry-season horticulture, replaced the ADPs. Nevertheless, during the 1980s and 1990s, interest in agriculture declined. Rising oil revenues, coupled with the corresponding importation of staples and other consumer goods, reduced the perceived importance of the agricultural sector.

<sup>5</sup> Field visit conducted on 27 June 2024.

## 3. Approach to Farming

### Primary Crops

West African farmers cultivate an extremely wide range of crops. Indeed, the region is now recognised by archaeologists as one of the world's centres of plant domestication. The diversity of crops largely reflects the availability of moisture. Broadly, wetter areas rely principally on tubers such as taro, yams, and cassava as well as tree crops such as oil palm. The only cereal that can be grown as far south as the coast is maize, a Portuguese introduction. In the subhumid zone, or Middle Belt, conditions are particularly favourable for agriculture, allowing both humid- and semi-arid-zone crops to be cultivated. In the semi-arid and Sahelian areas, the focus shifts to cereals, typically millet and sorghum, alongside pulses such as cowpea and Bambara groundnuts. Some regions are so dry they farming is possible only with wells or pumped water, and these have historically been devoted primarily to livestock. Around larger cities, fruits and vegetables are also grown and sold, often using commercial seed; however, these constitute only a small proportion of overall farm output. Potherbs, which often appear spontaneously on waste ground rather than being deliberately cultivated, are extremely numerous.

*Photo 1: Yam heaps in Zing, Taraba State*



*Photo Credit: Raymond Dawum*

Many of these crops are little known to the international agronomic community and have been the subject of minimal research. For example, the cowpea (black-eyed bean) and Bambara nut are believed to have been domesticated in Nigeria. Although Nigeria hosts the IITA, a CGIAR research centre, its focus is largely on crops such as maize and cassava – New World introductions – rather than on indigenous Nigerian crops. Yet there is a clear rationale for Nigerian farmers' practice of crop diversification: resilience. Humphry et al. (1993) studied crop diversity in Hausaland and concluded that it was a major strategy for reducing famine following droughts. Regardless of the climatic conditions, farmers are likely to achieve at least a harvest. However, while terms such as 'resilience' and 'climate-smart' frequently appear in project descriptions, few of those using them appear to fully understand how these concepts are implemented in practice on the ground.

Many of the novel crops introduced during colonial times proved extremely successful. Cassava, maize, tomatoes, guavas, pawpaw, and pineapples have become essential components of farming systems in many parts of Nigeria. Indeed, development agencies have often prioritised cassava and maize over indigenous crops such as yams and guinea corn.

Nigeria has a vibrant market for staples, ranging from yams and cassava in the South and Middle Belt to sorghum and millet in the North. Farmers are highly responsive to changing market and climatic conditions, and evolving tastes are bringing an increasing variety of fruits and vegetables to market. Technologies such as the mobile phone have transformed the ways crops are sold and transported. Photo 1 shows the extensive yam heaps in Zing, Taraba State, grown both for household consumption and for sale in the market.

### Traditional and Modernised Farming Techniques

#### Rainfed systems

In the pre-colonial era, almost all farming in Nigeria was rain-fed. In the South, rainfall can occur in any month, but further north it is confined to a few months. On the border with the Niger Republic, the rainy season may last as little as three months. Farmers have therefore always been vulnerable to fluctuations in rainfall, and years of extreme drought are frequently recorded in folk memory (Watts 1983). Farming practices were ingeniously adapted to these conditions, particularly through the ridging system, which prevents flooding, and the use of multiple crops and cultivars within the

same ridge, which spreads risk. With very few exceptions, however, strategies for providing water during periods of precipitation deficit were largely absent. In some parts of Sahelian Nigeria, cultivation relied on deep wells, with buckets hauled by camels.

Traditionally, farmers planted only a single crop each year and developed numerous varieties of long-season sorghum and millet to cope with variable rainfall. In recent years, however, the pressure to maximise yields within the short rainy season has prompted farmers to develop more effective moisture-use strategies. In the Kano/Katsina area, for example, some farmers now cultivate the same land three times in succession: first planting short-season sorghum or millet, followed by a second crop such as a pulse, and then using residual moisture to plant a third crop, such as tomatoes. This practice has had the unintended consequence of reducing traditional co-operation with herders, as farmers no longer have the time to allow cattle to graze on crop residues. Fields must be cleared at immediately, and second crops planted without delay.

## Natural flooding systems

**Photo 2: Cassava residual rain farm in Bayelsa State**



*Photo Credit: Raymond Dawum*

including the Kainji Dam – have reduced seasonal flows, as has the abstraction of water upstream for urban supply and irrigation. In recent years, it has become common for the Niger to cease flowing at the height of the dry season, an occurrence that would have been unthinkable in previous decades. While Nigeria has limited control over the management of the Niger's water in other states, it could introduce more effective river management within its own territory. At the same time, demand for rice in Nigeria has increased markedly, and the cost of imported rice has made it unaffordable for many households. Consequently, there has been a notable expansion in local rice cultivation.

## Rising River Farming

The Niger and Benue rivers historically flooded seasonally following the rainy season in their upper reaches in Mali and Cameroon. This created marshy grasslands along the riverbanks, particularly in the subhumid zones of what are now Niger and Benue/Nasarawa States. Significant wetlands included the Kainji area, the Hadejia-Nguru wetlands, Lake Chad, and the Niger Delta. These areas were notable wildlife habitats and were also exploited within interlocking systems of farming and cattle grazing. Farmers used the wetlands as natural paddies, cultivating rice and capturing the fish that accompanied the rising rivers. This was recognised as a highly productive system, and rice projects were proposed for the Niger (Baldwin 1957).

However, in recent decades these systems have declined significantly. Water-control measures, such as dams –

## Flood Recession Farming

In marshy areas, when river levels fall, large, exposed patches of wet ground remain. These can be used for short-season crops that reach maturity before the soil dries, a practice typical of cultivation systems in the humid zones along riverbanks. Photo 2 shows a residual rain farm for cassava at Osomo Camp, Bayelsa State.

Recession farming can also be practised on soils with good water-retention properties in regions with seasonal rainfall. For example, tomatoes are often cultivated in this way in parts of the Middle Belt (Slaymaker & Blench, 2002). Evidence from Kano State suggests that farmers are increasingly adopting these systems as land shortages become more acute. However, recession farming can give rise to conflict with herders, as cattle trampling the fragile soil renders it unsuitable for planting.

## Irrigated Systems

Nigeria has extensive and complex river systems, as well as wetlands, which in pre-colonial times were used for contra-season farming on a small scale. Water-raising was achieved through the shaduf, a counterbalanced bucket originally developed in North Africa. This device was apparently brought across the Sahara in the medieval period and was used mainly by the Hausa and Kanuri in peri-urban environments to grow vegetables for urban markets. The overall volume of production was small, and the practice did not spread southwards beyond Hausaland and Borno.

A major change occurred with the introduction of small petrol pumps to raise water. These pumps could be transported on the back of bicycles, allowing farmers to explore much larger areas for dry-season farming. This coincided with rapid urban growth in Nigeria, creating year-round demand for fresh produce. Small pumps appeared in the 1980s, but their use expanded significantly as vegetable prices rose in response to changing urban diets. This expansion also triggered conflicts over land ownership. In Plateau State, for example, indigenous communities had sold plots along rivers to the Hausa, not perceiving them as valuable. By the 1990s, however, the growing market for vegetables and the potential for profit prompted attempts to reclaim the land, sometimes resulting in serious and violent disputes.

As the price of imported rice has increased, more farmers are turning to paddy systems based on the seasonal flooding of the Niger-Benue system. Land along the riverbanks is divided into plots using low earthworks. Photo 3 shows an

**Photo 3: Rice farm in Argungu, Kebbi State**



*Photo Credit: Raymond Dawum*

**Photo 4: Irrigation channel under construction in Dadin Kowa, Gombe State**



*Photo Credit: Raymond Dawum*

**Photo 5: Drilling pipe connected to a water pump**



*Photo Credit: Raymond Dawum*

irrigated rice farm in Argungu, Kebbi State; similar systems exist along the lower Niger and Benue. These farms are often a source of conflict with herders, as cattle may enter the fields while heading to the rivers to drink, particularly if access routes have been blocked by cultivation.

Seasonal flooding means that only one crop per year is possible. However, if storage facilities and channels are constructed and supplied with water by pumps, multiple crops can be grown within a single year. There is some movement towards this type of larger-scale irrigation. For example, water from the Dadin Kowa Dam in Gombe State is being channelled on a large scale to supply local farmers (Photo 4).

In countries such as the United States, large artisanal wells are drilled to access plains where no nearby water source exists. These sub-industrial wells are excavated using large drilling rigs and are powered by wind. In the Sahe, it is also possible to open deep wells and extract water, albeit slowly, using animal power. In more recent times, however, farmers have begun employing an enterprising method to drill boreholes, known in Hausa as burtsatse, using much simpler techniques. This involves hand-jetting water into a tube and removing the spoil. Photo 5 shows a drilling pipe connected to a pump for hand-jetting water during drilling at Ungwar Garji, Jega, Kebbi State. Photo 6 shows water being pumped from a hand-drilled borehole at Fadaman Mari, Sabon Garin Gada, Jega, Kebbi State.

The ingenuity of this system cannot be overstated. Without access to professional equipment, these farmers have devised a cheap and easily maintained system of making dry plains cultivable, without the need for complex, long-distance irrigation. This represents the type of local technology that merits further study, both to explore potential improvements and to facilitate its wider adoption in other regions of the semi-arid zone.

## Key Inputs for Farmers

### Chemicals, Fertiliser, and Veterinary Drugs

Historically, farming in Nigeria relied on few, if any, external inputs to increase crop yields. In the semi-arid regions, a system of exchange developed between herders and farmers, whereby cattle grazing on cereal stalks in harvested fields, depositing manure that subsequently enriched the soil. Around the large pre-colonial urban centres in the North, such as Kano and Sokoto, a system had developed in which ash and vegetable biomass were collected and transported into the city to fertilise small vegetable plots. This practice was noted by Heinrich Barth as early as 1851 (Barth 1857; Photo 7). In many ways, these systems still persist today, but composting methods have not been widely extended to other regions of Nigeria, where land pressure is far more intense.

**Photo 6: Hand-drilled borehole in Jega**

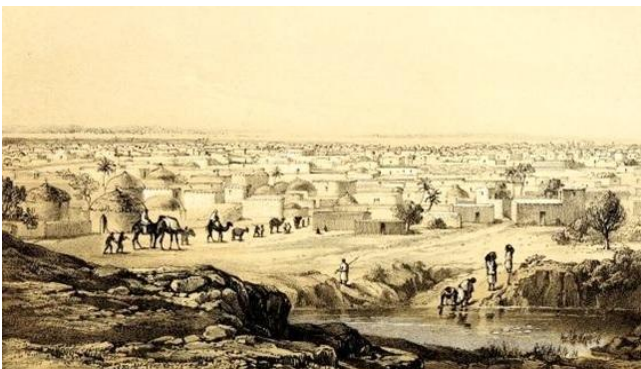


*Photo Credit: Raymond Dawum*

Several farmers reported that these systems have gradually spread to more remote rural areas, reflecting the high cost of chemical fertiliser. Green manure systems, using nitrogen-fixing plants, were known in isolated areas such as the Mambila Plateau, but remained uncommon. With the advent of the colonial era, three major changes occurred:

- a) The introduction of industrial inputs, including fertilisers, insecticides, and herbicides;
- b) The introduction of novel crops, often from the New World, along with improved varieties of existing species;
- c) The introduction of veterinary drugs, which reduced preventable diseases across all livestock species.

**Photo 7: Entrance to Kano in 1851**



*Source: Heinrich Barth (1857)*

The manufacture of fertiliser using the Haber-Bosch process, first introduced in 1912, rapidly transformed agriculture across the developed world. Its adoption in developing countries took longer, but it is now firmly established. In Nigeria, fertiliser use expanded with the ADPs from 1979 onwards. Heavy subsidies made it extremely attractive to farmers, and even after subsidies were removed, demand remained high. However, fertiliser in Nigeria, particularly when locally produced, has suffered from persistent quality issues, and distribution has often been politicised, with allocations frequently determined along party lines.

The introduction of veterinary drugs also transformed herders' strategies and arguably contributed to a significant increase in cattle numbers. Prior to the colonial era, zebu cattle were largely confined to the semi-arid zone, as trypanosomes and skin diseases such as dermatophilosis caused high mortality in more humid areas. From the 1920s onwards, veterinary measures against liver fluke and immunisation gradually became available. Combine with epizootic protection, notably against rinderpest, cattle survival rates increased substantially. These drugs also enabled cattle to thrive in more humid regions, facilitating the relocation of the national herd and inadvertently increasing conflict with farmers who had previously had little interaction with pastoralists.

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### Animal Traction

In pre-colonial times, the primary function of animals for work was load-carrying. Both donkeys and oxen were used as pack animals, while horses served human transport. Tillage was carried out entirely by hand, and the wheel was unknown. The colonial authorities' plan to grow cotton on a large scale was closely linked to the introduction of the ox-plough (Blench 1997). This initiative began in the 1920s and was heavily promoted by the government.

At the same time, local blacksmiths began making carts, often based on discarded vehicle chassis, which became the main form of farm transport in many Northern regions. Ox-ploughs are suitable only in semi-arid areas, as the stress of work in more humid regions can be fatal to the animals. Oxen must be well fed to undertake ploughing, which is challenging in areas with short pasture, where grass must be hand-cut to feed them. They are also vulnerable to theft,

being bulky and fetching good prices as meat. Consequently, ploughing is no longer viable in areas affected by civil insecurity, such as much of North-East and North-West Nigeria.

The introduction of subsidised tractors under the ADPs from 1979 onwards caused a significant decline in plough use. However, as tractor use has waned due to maintenance challenges, the ox-plough has returned to regular use in many areas. Animal traction remains an important point of collaboration between herders and farmers, as the animals used by farmers are often purchased from herders and, during the dry season when not required, are given back to herders for care.

## Mechanisation

Mechanisation transformed farming in Europe and North America from the late nineteenth century, triggering a mass exodus from the land as the need for agricultural labourers declined. This led those responsible for agricultural development in Africa to hope for similar results. Although some tractors were introduced during the colonial era, the major push for tractorisation occurred in the 1970s and 1980s, when ADPs introduced them on a large scale. Tractor hire was heavily subsidised, and farmers welcomed the labour savings they provided. However, maintenance proved an insurmountable problem. Project compounds became tractor graveyards, and entrepreneurs were unable to buy tractors and hire them out at scale. Moreover, the need to operate tractors in straight lines encouraged farmers to remove trees, including those of considerable economic value, such as locust beans, leading to reduced soil fertility and accelerated erosion.

Tractors are undoubtedly useful in heavy soils in the more humid regions. Nevertheless, the failures of previous tractor schemes, combined with foreign exchange constraints, are likely to limit widespread adoption in the near future. The high cost of fuel and spare parts presents an additional disincentive.

## Farm Transport

Historically, produce was transported from the farm to the road by human portage in the South and by donkeys and ox-carts in the North. Ox-carts were adapted from harnesses used for plough oxen, and the carts were often constructed from the chassis of wrecked vehicles. The introduction of cheap motorcycles led to their use for transport. However, motorcycles proved to be relatively inefficient, and there has been a shift towards dedicated cargo tricycles, similar to those in use in Italy. Even the *tuktuk* tri-wheelers (Hausa: *keke napep*), which are very popular for urban transport, are now also being used to move goods in rural areas. Despite the increased costs, this trend is likely to continue, as the practicality of such vehicles reduces other types of transaction costs.

## Fencing

Cattle entering unfenced farms remains one of the most significant sources of farmer-herder conflict in Nigeria. Historically, farmers throughout most of the country did not fence their fields, as the labour required was not justified by the relatively low risk of crop damage or theft. However, with rising population densities, farms are now situated closer together and cattle routes have become more constricted, increasing the likelihood of incursions. Commercial fencing using barbed wire and concrete posts is generally prohibitively expensive for smallholders, and wire is prone to theft. Consequently, live fencing has become the preferred option.

The Jos Plateau was the one region in Nigeria where fencing was common in the precolonial era. High population densities and the persistent threat of Hausa slave raiders prompted communities to erect 'fences' of cactus (*Euphorbia kamerunica*), which possess long spines and poisonous latex (Photo 8). These fences are still maintained today and are being replanted to meet modern needs. On the Jos Plateau, they serve both to separate individual farms and to prevent small ruminants and pigs from entering fields when allowed to forage independently.

**Photo 8: Fence of Euphorbia, Jos Plateau**



*Photo Credit: Roger Blench*

**Photo 9: Henna fence at Ungwar Garji in Jega, Kebbi State**



Photo Credit: Raymond Dawum

In other densely populated areas of Hausaland, different types of live fencing are also being established. For example, Photo 9 shows a henna (Lawsonia inermis) fence at Ungwar Garji in Jega, Kebbi State. While henna is not sufficiently robust to deter cattle, it is useful for demarcating farm boundaries in high-density cultivation zones. Some modern, larger-scale farms in rural areas are experimenting with cut planks and poles. Photo 10 shows a bamboo palm fence at JB Farms, Oban, Cross River State, demonstrating that such fencing can also be adopted in more southern regions, both to keep out goats and to mark farm boundaries.

Live fencing is likely to spread slowly across much of Nigeria, except in the extreme South, as rural populations increase. It functions both as a boundary marker – particularly important where land is increasingly bought and sold – and to keep livestock out during the dry season. Its adoption could, however, be accelerated if the practice were promoted

more widely and alternative strategies were tested and disseminated to farmers across different ecozones.

**Photo 10: Bamboo palm fence at JB Farms, Oban in Cross River State**



Photo Credit: Raymond Dawum

## Integration with Livestock

Nigerian farmers typically keep livestock, which may include cattle, sheep, goats, and further south, pigs. Donkeys are kept for work, while cattle may be used either for labour or fattened for sale. Small ruminants are generally kept for festivals or local consumption. However, integration between livestock and crop production is limited. Various strategies to improve the nutritive value of cereal residues have been demonstrated to work in theory but have never been widely adopted. Most livestock forage for themselves, and where herds are large enough, they are sent out to graze. In the semi-arid regions, cowpea residues (Hausa: *harawan wake*) are prepared for feeding cattle. Photo 11 shows

stored residues piled up in Jega, Kebbi State. Research suggests that value could be added to cereal residues through fermentation, which would increase the value of fattened cattle.

**Photo 11: Stored cowpea residues**



Photo Credit: Raymond Dawum

True agropastoralism remains uncommon in Nigeria, though it is increasingly seen as an aspiration by both farmers wishing to expand their livestock holdings and by pastoralists, who now recognise that the large-scale migrations characteristic of earlier centuries is no longer feasible. Pastoral associations are calling for ‘modernisation,’ albeit often without clear details of what this would entail.

In much of Kano State, semi-settled pastoralists already cultivate basic staples. However, the high density of farms forces them to move their animals in both wet and dry seasons. Evolution towards smaller herds with improved productivity could reduce unnecessary movement and simultaneously enhance household livelihoods. A project hosted within the Kano State Agricultural Development Programme (KSADP) aims to advance the development of settled agropastoral enterprises. First proposed in 2016, it began in 2019 with USD 90M in funding from the Islamic Development Bank (IDB). Key elements of the project include:

- Surveys of stock routes and grazing reserves, followed by demarcation;
- Establishment of nomadic schools and support for teaching;
- Creation of dairy collection points and cooling centres;
- Drilling of boreholes and excavation of dams for livestock;
- Livestock vaccination programmes linked with reference laboratories;

- Improvement of market and slaughterhouse infrastructure;
- Youth training programmes;
- Genetic improvement of cattle breeds.

Although ambitious and beyond the scope of the SPRiNG Programme, this initiative illustrates that moving towards agropastoralism requires an integrated approach, combining multiple elements within a cohesive strategy rather than focusing on isolated interventions.

It is important to emphasise that this approach contrasts sharply with the ranching model promoted in government documents such as the National Livestock Transformation Plan (NLTP). In the agropastoral model, pastoralists live interspersed among farming communities rather than being segregated by marked boundaries. They provide valuable services to their neighbours, including animal traction, manure, meat, and milk. This interdependence would likely reduce conflicts compared with current arrangements.

Co-operative models can also emerge organically. Box 1 describes the system of collaboration between ginger farmers and pastoralists which has benefitted both parties and significantly reduced conflict. Although a pathogen of unknown origin affected ginger in 2023, causing a partial breakdown of this system (Section 4), it remains a strong example of the type of co-operation that can develop.

#### **Box 1: A Positive Example from Kaduna State**

An example from southern Kaduna State illustrates how positive integration with livestock producers can be achieved. Ginger is intensively cultivated throughout this region as a cash crop, and producers regard cattle manure as superior to chemical fertilisers (even if they could afford the latter). A system of co-operation has been developed with herders: farmers demarcate a grazing area, and a trusted herder camps there with the herd for a couple of weeks. The farmer provides shelter, basic mattresses, and food for the herders. Once the herd moves on, the farmer collects the manure for use on the farm. Both parties report that this arrangement has significantly reduced conflict.

## Expectations for Intensification

The aspiration to intensify Nigerian farming has been a long-standing theme in the study of farming systems. Researchers such as Mike Mortimore, who studied the Kano Close Settled Zone, assumed that this model of intensification could be expanded across Northern Nigeria in response to rising population pressures (Adams & Mortimore 1997, 2005). In a co-edited monograph, *More People, Less Erosion*, which examined farmers in Machakos, Highland Kenya, this idea was explored further (Tiffen *et al.* 1994). These historical texts are characterised by the optimism of their era, portraying intensification as a model that could be replicated elsewhere to sustain farming while feeding households.

However, Nigeria pursued a different trajectory. Policies included an unprecedented surge of food importation, which disincentivised local farmers. Security concerns discouraged investment in improved techniques, while large-scale deforestation degraded soil fertility and reduced pollination by destroying bee habitats.

Another form of intensification has been the creation of large farms to exploit economies of scale, modelled on the transformation of Northern France in the seventeenth century, where aristocrats consolidated smallholder land into extensive mixed farms. In Nigeria, efforts to establish large farms have a long history, both through private enterprise and government initiatives. Kwara State, for example, attempted to create large integrated farms at Shonga, offering incentives to Zimbabwean farmers with relevant experience (Mustapha, 2011). When initially considered a 'success' at the time of Mustapha's study, by 2024 these enterprises had failed and the farmers had departed Nigeria.<sup>6</sup> Key challenges included management difficulties, fluctuating utility and input prices, and poorly maintained, unpredictable road infrastructure.

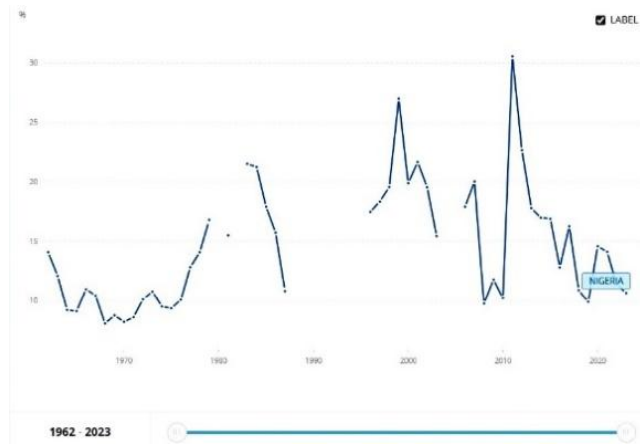
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<sup>6</sup> Mohammed, Y. 2024. *Kwara communities suffer deforestation, land degradation after departure of White Zimbabwe farmers.* Premium Times Nigeria, 24 June.

## 4. The Economics of Farming

### Importation of Staples

**Figure 4: Nigeria food imports 1962-2023**



Source: World Bank Group

Given the low levels of urbanisation in pre-colonial times, trade in staple foodstuffs was minimal, and settlements were largely self-sufficient. However, the discovery of oil in 1958 and its rise to become the major source of national income by the 1970s stimulated a process of food importation that has continued to the present day. Figure 4 shows food imports 1962 to 2023 as a percentage of total merchandise imports.

Gaps in the record reflect the limitations of statistical services, making it impossible to provide figures for certain years. Nonetheless, the available data indicate that Nigeria has not long struggled to feed itself, with deficiencies in its agricultural strategy masked by import substitution. For example, the Malaysian palm oil industry was founded on Nigerian genetic material, yet Nigeria remains one of the biggest importers of palm oil. Similarly, wheat has become a near-staple, yet it must be imported, reflecting heavy subsidisation. In 2022, Nigeria spent USD 3.03B on wheat imports, making it the fourth-largest importer in the world.<sup>7</sup>

As might be expected, this situation created a strong disincentive for staple food producers. Why cultivate a crop such as rice when it could be imported cheaply from Vietnam? Rice requires significant investment in processing to produce milled paddy, which compared poorly with imported products. For many years, therefore, local rice remained a minority product. Only in the 2020s has there been substantial investment in rice mills, driven by the rising cost of imports. A similar pattern was seen with vegetable oils: imported bleached palm oil drove local sources from the market. However, the decline in the value of the naira has led to a corresponding increase in the production of sesame and soya oil.<sup>8</sup> These changes are encouraging, and it is to be hoped that Nigerian government policy will become more supportive of local producers.

**Photo 12: Kano groundnut pyramids, 1965**



Source: Nigerian Produce Marketing Board

### Subsistence Versus Cash Crop Production

In pre-colonial times, farmers mainly produced for household consumption. The first and most important cash crop in Southern Nigeria was the oil palm, which began to be exported in the eighteenth century. The Calabar region was known as the Oil Rivers, not for its petroleum but for palm oil. Southern Nigeria also saw the growth of humid-zone crops such as cocoa, rubber, and palm oil. Following the establishment of the colonial regime in the North after 1900, emphasis was placed on cash crops such as cotton and groundnuts. The Institute of Agricultural Research in Zaria was established in 1922 with the aim of increasing cash crop production. The success of this shift in focus is perhaps best illustrated by the Kano groundnut pyramids – sacks of smallholder produce stacked while awaiting processing and a notable tourist attraction in the 1960s. These have long since disappeared, not because groundnut oil is unimportant, but because smallholder production is now processed and consumed locally.

Large-scale agro-processing gradually declined in Nigeria, mainly because the easy profits derived from oil undermined the motivation to maintain such enterprises, although structural adjustment policies in the 1980s may also have played a role. Smallholder production for minor industries, such as sesame and groundnut oil, reverted to the producers. The

<sup>7</sup> The Observatory of Economic Complexity (OEC). *Wheat in Nigeria*. Source: <https://oec.world/en/profile/bilateral-product/wheat/reporter/nga>.

<sup>8</sup> Local maize oil has been widespread in Nigeria, but the use of maize directly for food has diminished the demand for its oil.

fall of the naira is likely to make Nigerian products extremely cheap on the world market, and there is anecdotal evidence of the informal sale of staple foodstuffs to Sahelian countries. New agro-processing industries are being rebuilt. However, this treads a fine line between the requirement for foreign exchange and the need to ensure that staple production addresses very real rural hunger.

Figure 5: Food price inflation

### Food Price Inflation

These factors have combined to create a perfect storm of food price inflation. Imports of staple foods can no longer compensate for domestic production deficits. Farmers face both rapidly rising input costs and heightened security risks. As a result, food price inflation is significantly ahead of general inflation, which includes imported goods, suggesting that the real gap is even larger. illustrates the extent of this disparity.



Source: SBM Intelligence

### Access to Credit

For Nigerian farmers to expand their operations, invest in technology such as pumps, or even to clear land and pay labour, they need access to credit. Credit was traditionally accessed through rotating savings clubs, known as *adashi* in Hausa, which operated on the principle of members making regular contributions to a common fund. In one system, individuals were paid out in sequence on a rotating basis. Elsewhere, the fund was retained for family emergencies and to make loans to members. Interest rates were high, and

Figure 6: Nigerian microfinance banks



sanctions for non-repayment were sometimes severe. Consequently, outside agencies have long proposed various types of microcredits to operate at much lower interest rates. These have not been very effective, in part because of the difficult in enforcing repayment. Farmers and livestock owners may have legitimate reasons for being unable to repay, such as insecurity, drought, insects, or disease. However, if they perceive that the credit agency is unlikely to pursue them vigorously, they may seek to avoid repayment. Few of the farmers interviewed had received any credit from external agencies and are therefore likely to raise funds informally.

Since around 2010, there has been a noticeable expansion of microcredit. Small towns often display signs for micro-banks, which provide small loans. This development is closely linked to the rise of mobile banking and the ability to make money transfers quickly and cheaply, following the model pioneered by the mPesa system in Kenya, launched in 2007. The reduced transaction costs of microfinance, compared with the original schemes, have now made it an integral part of rural enterprise.

### The Role of the Mobile Phone

It is probably no exaggeration to say that the mobile phone has transformed the economics of farming in Africa more than any other technical intervention. In the past, producers had no direct access to market prices in larger urban centres. A buyer could come to the farm and make what might seem a reasonable offer. The farmer usually accepted this, having no information on price fluctuations in distant markets. In the case of perishable crops, such as tomatoes, the farmer was virtually compelled to accept the buyer's offer, otherwise the crops would rot. In addition, urban middlemen might advance credit to farmers for inputs, leaving the producer with no easy way of checking whether the sums offered were fair. This could result in serious financial disadvantages. The mobile phone has completely tipped the balance in favour of producers.

Mobile phone coverage is now almost universal in Nigeria and has reached even quite remote rural areas. Camera phones are increasingly used to photograph produce, forming the basis for price negotiations. The farmer then either transports the goods or uses rural transport to move them to a collection point. Consequently, traders and wholesalers no longer need to reach the village, reducing overall transaction costs. There is no doubt about the advantages of this system: farmers receive more realistic prices, and transaction costs are lowered, which in turn benefits the consumer.

The next step, however, is to develop a system in which quality and price are assessed more formally. At present, almost all foodstuffs are estimated by eye, which does not provide farmers with incentives to invest in improved quality. This issue is even more pronounced with livestock, where changing demand for higher-quality products and more specific cuts could significantly benefit producers.

### Value Chains: Peril and Promise

A focus on value chains is common among donors, where attention is directed at a particular commodity from 'farm to fork.' In principle, the idea makes sense: understanding how a farm product reaches the consumer and attempting to alleviate bottlenecks along the way should lower transaction costs while benefiting producers. The idea is so popular that there can be competing projects with almost identical goals. In Nasarawa State, for example, there are three nearly identical value chain projects, all focussing on rice and various other crops, and largely operating in the same target local government areas (LGAs). Farmers are subject to different conditions for accessing inputs, loans, grants, matching grants, and other outputs. Each project knew very little about the others and had not shared experiences.<sup>9</sup>

It can be questioned whether this is the correct approach if the aim is also to promote resilience. Nigerian farmers must respond to fluctuations in weather, input prices, and pathogens. Too much focus on a single crop puts them at risk of losing their investment. Resilience, by definition, requires an integrated view of the farming system and encourages diversification of species, crop varieties, and so forth. The loss of the ginger crop to a still-undefined pathogen in Southern Kaduna illustrates the dangers of over-reliance on a single crop in the Nigerian environment, where farmers cannot rely on technical support from the state. In addition, rumours began to circulate on social media that pastoralists were 'killing' the ginger, which is particularly senseless, as cattle are regularly used to fertilise it. Given that ginger cultivation had previously depended on co-operation with herders (Box 1), this was especially unfortunate.

Photo 13: Fruits & Veggies in Jos



Source: Raymond Dawum

### Secondary Processing

Value can be added to crops through secondary processing. Fruits and vegetables can be dried, pickled, or made into sauces and jams. Cereals can be processed into flours and parboiled grains, as well as packaged for convenient sale and consumption. Unfortunately, Nigeria has a long history of failed secondary processing. A series of attempts to can tomatoes into paste is one example, as were the establishment of 'modern' dairies. Most farm products are still sold virtually unprocessed.

Nonetheless, there are encouraging signs that small companies are being rebuilt to process and package agricultural products, effectively acting as intermediaries between the farm and the city. The survey was able to interview a number of SMEs packaging fruits and vegetables for sale to urban consumers. Photo 13 shows advertising for Fruits & Veggies, a Jos-based enterprise that delivers horticultural products, primarily to Abuja. Some companies have concluded they need to engage in agricultural extension, rather than acting merely as middlemen and have employed private extension agents. Almost every state has at least one company operating in this area, and in some there are several competing enterprises.<sup>10</sup>

Even though these are key players in the value chain, only a few donors, such as the Bill & Melissa Gates Foundation, have indicated interest. Encouragement of such enterprises would surely be valuable in stimulating greater interest in production and secondary processing.

<sup>9</sup> During field visits in Lafia, Nasarawa State between 9 and 11 August 2024, researchers met with three NGOs working on value chain development and rice cultivation, some in the same LGAs. None had shared experiences with one another.

<sup>10</sup> Field reports include a list of names and address for these enterprises as well as electronic brochures.

## Farm Labour

### The Transition from Collective Labour to Monetisation

The seasonal nature of rainfall in much of Nigeria means that farmers experience labour bottlenecks. Historically the solution to this was a variety of circulating labour strategies. For example, farmers would gather on an individual farm to take in the harvest and then move on to the next farm. The owner of the farm would then be responsible for the supply of food and beer to the workers. Sanctions were imposed on individuals who failed to turn up for collective farmwork. These occasions were often accompanied by entertainment; musicians were employed to beat out the rhythm of the cultivation, and young men engaged in hoeing contests and trials of strength.

Such systems functioned well in coherent communities where farms were broadly the same size and the amount of labour required was roughly matched. But communities are now more fragmented, and farms less equal in size as individuals invest in additional land or technology. Hence there has been an accelerating switch to the monetisation of labour. Paying for individuals to work the farm is nothing new; it has long been a practical solution to abrupt demands for labour or situations in which the owner lives in the town. However, the switch to cash payment as the main source of compensation for agricultural labour is new and has not yet completely taken hold in remote areas. Smallholder farm owners have become managers, often visiting from town and supervising paid labour at times of planting and harvesting.

A consequence of this is that labour shortages in rural Nigeria are now commonplace. Rates are rising rapidly, and bargaining power lies with the young men who can supply it. This may seem surprising, given that Nigerian towns are full of unemployed young men (e.g., Salami 2013). However, this type of work is physically demanding and exists within a specific cultural context. Work has increasingly shifted from whole jobs to piecework, where a labourer is employed to cultivate a specific plot of land. This trend is now intertwined with the increasing use of opioids, which allows workers to speed up the rate of work. It is likely that this trend will continue.

### Gender Roles in Farm Labour

Farm labour in Nigeria is typically divided along gender lines, reflecting both climatic conditions and religious practices. Research on this topic is relatively sparse for Northern Nigeria but considerably more abundant for the South. One of the few comparative studies, Oseni et al. (2015), highlights productivity differences between these regions.

In most Muslim areas of the semi-arid zone, women traditionally do not work on farms, instead remaining at home to process agricultural produce (Adams & Mortimore 2005). In the recent past, women from poorer households in the North could move around more freely to ensure the household economy functioned. However, the spread of stricter form of Islam has increased the seclusion of women, often confining them to the home or allowing them outside only veiled and at night. Consequently, the burden of agricultural labour has fallen almost entirely on men. Women still participate in processing agricultural products at home, but this shift has led to significant economic disempowerment.

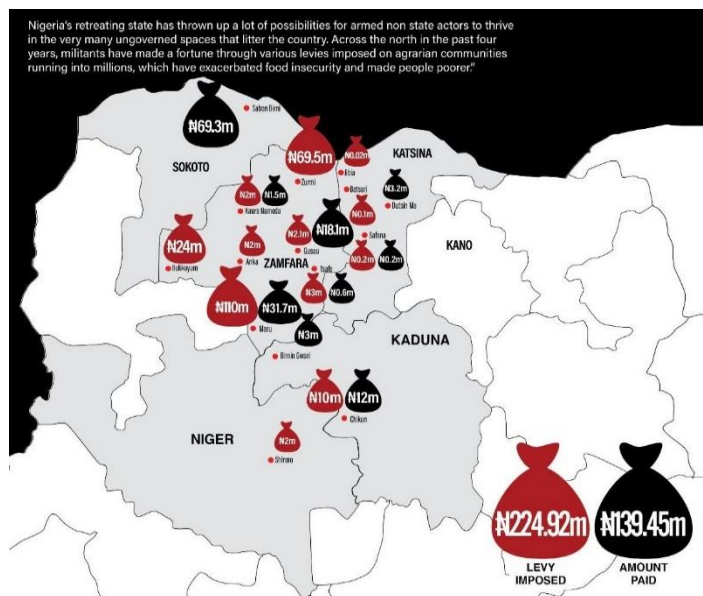
Further South, women are more actively involved in agricultural labour. They may own land and retain the proceeds from their produce. In the subhumid zone, or Middle Belt, a variety of strategies historically existed: men performed the heavy work associated with staple crop cultivation, while women focussed on vegetables and spices near the homestead. Studies measuring women's contributions to farm work in the Middle Belt and South, such as Audu (2009) in Kogi and Grace (2022), suggest that women perform nearly half of all agricultural labour, often in addition to household responsibilities.

### Opioid Consumption

Opioids such as Fentanyl and Tramadol have emerged as a significant source of social disruption in Nigeria. Although the precise date when these drugs began circulating widely is undocumented, it was likely sometime after 2010. Technically, they are not illegal and are readily available at the many small pharmacies that have proliferated across the country in recent years.

During a 2016 survey on conflict, many victims reported widespread opioid use among young people, which appeared to intensify the violence of the clashes. At the same time, farm workers may have discovered a short-term effect of these substances: a boost in energy that could be channelled into agricultural labour. This brings to mind the historical parallel with coca in the Andes. Indigenous peoples had long used coca to sustain themselves when working at high altitudes, but the Spanish colonial authorities also exploited it, forcing enslaved workers to labour harder in the mines. As with coca, the long-term effects of opioid use in Nigeria are harmful, with serious consequences for health and well-being.

Figure 7: Farm levies since 2020



Source: SBM Intelligence

## Deteriorating Security

A major challenge now facing farmers in many northern areas is security. Banditry, which has severely affected the North-West and North-Central regions, includes both the kidnapping of farmers for ransom and the operation of Mafia-like protection rackets. Those who refuse to pay risk being killed and having their farms burnt. Analysis group SBM Intelligence estimated that 1,356 farmers were killed in Nigeria between 2020 and mid-2024, although the true figure is likely to be considerably higher. The government’s failure to provide security in rural areas prompted protests in Katsina State in July 2024, ahead of the nationwide demonstrations in August, which centred on rising food prices.

## External Interventions

### NGOs

The most significant Nigerian NGO in agriculture is the All Farmers Association of Nigeria (AFAN), a national body with its headquarters in Abuja and branches in every states. AFAN’s general mission is to lobby government for agricultural inputs, particularly fertiliser. However, the objectives of its individual branches vary considerably, and some appear to be more directly engaged with practical farmers than others. Within AFAN, there are commodity-based associations, such as the Rice Farmers Association of Nigeria. Despite this structure, AFAN is not widely known among farmers, in contrast to pastoral associations, which are more diverse and continually generate new bodies with specific areas of focus, such as education or animal health. The pastoralist counterpart to AFAN, the Miyetti Allah Cattle Breeders Association of Nigeria (MACBAN), has faced many of the same challenges.

Lobbying for reduced price inputs is ultimately not a forward-looking strategy. Agriculture yield problems will not be solved merely by applying fertiliser, particularly given the likely economic conditions of the next decade. None of the interviewees highlighted alternative means of achieving sustainable farming with locally available resources. If farmers’ organisations are to make a meaningful contribution, they will need to adopt more innovative and future-oriented approaches.

### Nigerian Government

The Nigerian government maintains a large Ministry of Agriculture, the direct successor of the colonial Agriculture Department. In 2023-2024, although the agricultural sector ranked among the 10 ministries with the highest budget allocations – totalling N362.94 B – this represented only 1.32% of the total national budget of N27.5 T. Farmers interviewed reported that they are unclear what the Ministry does, as they see little or no impact on their daily lives.

The study identified two major challenges with the Ministry of Agriculture:

- a) **Policy focus:** Officials tend to prioritise the transfer of hi-tech enterprises and solutions from the developed world to Nigeria. They rarely consider that such techniques are difficult to implement in a country without a reliable electricity supply.

- b) **Weak of agricultural extension:** Nigeria once had a large-scale extension system, with officers travelling to villages on motorbikes to promote best practice. However, a lack of practical ideas, inadequate funding for transport, and insufficient extension materials mean that any impact on farmers today is minimal.

Table 2 lists the agricultural programmes implemented by the Federal Government of Nigeria since 1973 (Daneji 2011). In many cases, it is difficult to establish whether these programmes are still operational.

**Table 2: Nigerian Government Agricultural Programmes**

Acronym	Full Title	Dates
NAFPP	National Accelerated Food Production Programme	1973-present
OFN	Operation Feed the Nation	1976-1980
RBDA	River Basin and Rural Development Authorities	1976-present
DFRRI	Directorate of Food, Road and Rural Infrastructure	1986-?
NALDA	National Agricultural Land Development Authority	1992-2000
NADF	National Agricultural Development Fund	2022-present

The persistently low crops yields, widespread rural hunger, and high food prices provide strong evidence that these substantial expenditures have had little or no impact on the supply of staple foods within Nigeria. As with NGOs such as AFAN, there is a marked absence of a forward-looking approach that reflects the realities of Nigerian farming today and anticipates its needs over the next decade.

### International Donors

The high value of Nigeria’s oil income has created perverse incentives for global financial institutions. In exchange for soft loans at favourable rates, these institutions have lent Nigeria vast sums over the years. Multilateral loans for agriculture in Nigeria are among the largest ever made worldwide. Perhaps the most significant were those for the Agricultural Development Projects ADPs which together cost Nigeria around USD 2 B – roughly half for the projects themselves and the other half for loans to finance subsidised fertiliser.<sup>11</sup> In addition came the Fadama I, II, and III projects (1992-2019), which promoted the use of riverbanks for dry-season cultivation.<sup>12</sup>

Agricultural projects have typically been designed by agricultural economists rather than by those with practical knowledge of Nigerian farming systems. The resulting solutions tend to share certain features: the imposition of high-yielding maize varieties, the promotion of subsidised tractors, heavy reliance on herbicides and insecticides, and above all, fertiliser. These measures raised unrealistic expectations among farmers, while their environmental costs and potential to increase tensions with pastoralists were rarely considered. The attraction of economies of scale familiar to European and American agriculture – one tractor replacing the labour of ten hoe farmers, or one application of herbicide removing the need for repeated weeding – has often overshadowed the realities of smallholder farming in Nigeria.

The environmental damage resulting from such large-scale projects has been significant. Common consequences include:

- a) The removal of economic trees from fields to allow tractor ploughing, causing soil erosion and the loss of nitrogen-fixing species.
- b) The erosion of traditional repertoires of crop species and varieties, reducing resilience.
- c) The clearance of gallery forests along riverbanks, destabilising soils and leading to recurrent annual floods;<sup>13</sup>

<sup>11</sup> World Bank 1993. *Agricultural Development Projects in Nigeria*. OED Precis no. 50, June. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/658931468288625090/pdf/28360.pdf>

<sup>12</sup> Jenane, C. and Oredipe, A. A. 2022. *Delivering development: collaboration the key to success in Nigeria’s FADAMA projects*. World Bank Blogs, 13 January. <https://blogs.worldbank.org/en/nasikiliza/delivering-development-collaboration-key-success-nigerias-fadama-projects>

<sup>13</sup> 2024 has been marked by high levels of loss of life and farm produce. Source: Olanrewaju, T. 2024. *Nigeria’s weeks of flooding claim 170 lives*. Ankara: Anadolu Agency, 27 August.

- d) Nutrient depletion through maize monocropping, effectively “burning” the soil.

### **Box 2: Ginger Stem Rot – A Failure of Response**

Ginger (*Zingiber officinarum*) has become a major cash crop and source of income to farmers across Southern Kaduna and Nasarawa States. Its profitability has been such that many farmers abandoned staple crops, calculating that they could purchase food with the cash earned from ginger. However, in 2023 a pathogen of unknown origin virtually wiped out the entire year’s crop. Its identity remains unclear, and no strategies have yet been developed to prevent a recurrence. The research station responsible for ginger is located in Umudike, in the far South, well outside the ginger-growing region, and has therefore been unable to mount an effective response. A similar problem is affecting the Irish potato, cultivated primarily on the Jos Plateau. Late blight is becoming increasingly prevalent, and a comparable collapse of production is a real possibility. Collaboration is under way to import transgenic potato varieties from Kenya, but this represents a very long-term solution. Maintaining crop and varietal diversity should therefore be considered a key pillar of resilience.

Comparisons between internal evaluations of these major programmes and their long-term environmental costs are sobering. Evaluation systems rarely revisit project sites decades later to assess environmental degradation, which is harder to measure than economic outputs. One independent study – Chukwuemeka & Nzewi (2011) – interviewed farmers long after the ADP initiative had ended, reaching disappointing conclusions, particularly regarding sustainability. From another perspective, Nigeria remains in regular food deficit, and rural hunger is widely reported. This strong suggests that the long-term value of the ADPs has been highly questionable.

## **Crop Research**

Since the colonial era, Nigeria has maintained a relatively extensive crop research system, with dedicated stations for roots and tubers, cereals, and vegetables. However, many of these facilities are poorly situated, often far from the ecological zones where the crops are actually grown. This makes field trials with farmers impractical and limits their impact. For example, the failure to adequately address the ginger crisis in Kaduna state may be linked to the fact that the relevant research stations are located in Southern Nigeria. Similarly, the cereals research station at Lake Chad sits in an area affected by the Boko Haram insurgency in Borno, further undermining its effectiveness.

Given the current context of widespread food shortages, Nigeria urgently requires a more responsive research system if it is to meet its agricultural needs. While national research stations exist, the IITA has been based in Ibadan since 1967. Its mandate, however, is global in scope and not specifically focussed on Nigeria, leaving a gap in research tailored to the country’s own pressing challenges.

# **5. Policy Conclusions and Way Forward**

## **Overview**

This research shows that Nigerian farming is indeed adapting to the country’s shifting economic and demographic context, however the pace of change is too slow to prevent the likelihood of food deficits in the coming years. Farmers face further challenges in the form of rapidly fluctuating input prices and growing insecurity. At the same time, many prevailing practices are causing significant environmental damage.

Low productivity, combined with high demographic growth, has driven the rapid expansion of farmland and the conversion of bushland. This process has in turn led to encroachment on traditional herding routes and pastures, intensifying conflict between farmers and herders. Decades of investment from both international donors and the Nigerian government appear to have made little or no lasting impact on farming systems. None of the farmers interviewed reported meaningful engagement with development programmes, apart from limited access to fertiliser.

Instead, innovation has been almost entirely farmer driven. Yet policymaking and programming are rarely grounded in empirical evidence drawn directly from farmers’ experiences. Meanwhile, the body of essential biophysical data – on

rainfall, temperature, soils, and vegetation change – has become weak or non-existent across much of the country, despite being critical for realistic planning.

The national research system is fragile and poorly equipped to address many of the contemporary and real problems faced by farmers. Input supply remains highly politicised, fostering unrealistic expectations among producers. Meanwhile, NGOs and civil society organisations working directly with farmers are few and their impact, where present, is limited.

## Fluctuating Exchange Rates

The survey demonstrates that Nigerian farmers are under immense pressure. The old pattern of relying on food imports to offset production deficits is no longer economically viable and has fuelled food insecurity as prices have risen. The rapid depreciation of the naira has made imported staples unaffordable for most people. As a result, farmers are expected to increase production to supply the rapidly growing urban population, yet they are still working with systems that would have been familiar half a century ago. At the same time, the absence of evidence-based government policy and the misguided priorities of donors have failed to provide meaningful support.

Smallholder farmers are also undermined by factors beyond their control. For example, fluctuating exchange rates and the removal of fuel subsidies in 2024 abruptly increased transport and pumping costs, making the use of small petrol engines far less viable. Although such pumps have contributed significantly to food production in recent decades, they are inefficient compared with larger-scale irrigation, particularly gravity-fed systems. The Gezira Scheme in Sudan – the largest irrigation scheme in Africa – has operated since 1904 and continues to function despite insecurity, precisely because it is gravity-fed and does not depend on energy supplies. Donors could play a constructive role by supporting the surveying and installation of similar gravity-fed schemes in Nigeria, which would not only allow multiple cropping seasons but also help to combat erosion. In Sudan, for instance, nitrogen-fixing and other valuable trees are planted along field borders, further enhancing yields.

## Learning from Southeast Asia

A valuable model for Nigeria to consider is the agricultural development of South-East Asia. Like Nigeria, the region is tropical and densely populated, with several countries managing to feed large megacities. Indeed, SE Asia has also been the source of major imported staples, such as palm oil and rice. Crucially, food production in the region relies heavily on irrigation. Vietnam, for example, not only feeds its own population but also exports a significant share of its surplus production, despite being more densely populated than Nigeria (Table 3).

**Table 3: Comparative population densities**

Country	Population	Density
Vietnam	100 million	319 per km <sup>2</sup> (826 per mi <sup>2</sup> )
Nigeria	225 million	246 per km <sup>2</sup> (636 per mi <sup>2</sup> )

One could argue that Nigeria is attempting to feed a population approaching SE Asian densities while relying on farming practices better suited to the Sahel. Southeast Asia offers several ideas that could inform more productive strategies. These include:

- a) Large-scale gravity irrigation.
- b) The ability to produce rice up to three times a year.
- c) Integrated systems that combine rice with fish, ducks, and other hydrophilic crops such as lotus root;
- d) Livestock-based tillage using buffalo.
- e) Higher-quality processing that enhances both domestic sale and export potential.

Failing to look beyond national borders and to draw lessons from international experience will inevitably slow Nigeria’s response to what is clearly an accelerating agricultural crisis.

## Transparency in Project Design and Evaluation

A particularly frustrating aspect of evaluating project designs is the veil of secrecy that often surrounds them. If a project is intended to ‘improve value chains’ or to be ‘climate-smart,’ there is no reason why the underlying assumptions should not be made publicly available. Yet these assumptions are typically left opaque and may never have been formally documented. Glossy brochures are no substitute for rigorous scientific reporting. Many project evaluation reports are never publicly shared, making it difficult to draw lessons or inform future initiatives.

## Additional Research

A policy of researching the crops that farmers actually grow might seem self-evident, yet in practice, research priorities are heavily skewed towards international agendas. The absence of such research is reflected in the scarcity of relevant papers on Google Scholar. Nigerian farmers continue to cultivate a wide range of crops, guided by responses to climate fluctuations and the need to protect against insect pests. Many of these crops merit far greater attention, including Bambara groundnut, Kersting’s groundnut, tumuku, rizga, finger millet, fonio, iburu, and others. Typically, these crops are grown without fertiliser, are drought resistant, and possess natural insect-repelling qualities, the result of millennia of co-evolution.

The international research system cannot be changed overnight. However, a feasible step would be to support the re-orientation of existing Nigerian research facilities towards indigenous crops. This is necessarily a long-term strategy; tangible results will not appear immediately. Nonetheless, if resilience and ‘climate-smart’ agricultural innovation are genuine priorities, it is a strategy that merits serious consideration.

# 6. Practical Recommendations

## Overview

If raising the productivity of smallholder farms can both improve rural livelihoods and reduce tensions with pastoralists, then several low-tech innovations hold considerable promise. Water harvesting techniques can help farmers make better use of scarce rainfall; composting and the application of green manures offer ways to restore soil fertility without costly inputs. Research focused on improving traditional crops could strengthen resilience by building on what farmers already know and rely on. Live fencing provides an affordable means of protecting fields and marking boundaries, particularly as land transactions become more common. Finally, multi-use structures such as ponds –serving irrigation, livestock watering, and even catfish production – illustrate how integrated systems can multiply benefits from the same investment.

## Water Harvesting

Although Nigeria has a pronounced rainy season, confined to a few months in the norther two-thirds of the country, water harvesting is not widely practised. During the dry season, water becomes scarce: wells dry up, women must travel long distances to rivers for unclean water, and in larger settlements, water is sold in ‘gallons’ by vendors. Yet much of this hardship could be alleviated through the use of relatively simple technology, providing water for drinking, bathing, and the irrigation of kitchen gardens.

In rural areas, thatched roofs have increasingly been replaced by steeply pitched roofs made from composite materials. A water-harvesting system that combines guttering with polytanks (both manufactured in Nigeria) could therefore provide clean water throughout the dry season. Photo 14 illustrates how this system operates in Kerala, South India.

**Photo 14: Rainwater harvesting at homesteads**



Source: *The Andhyodaya, Angamaly in Kerala*

## Composting

By and large, Nigerian farmers do not practise composting, even though farms generate large amounts of vegetable waste. This material could be collected in lined pits, along with household sweepings, and converted into compost, a process that can be accelerated by worms. Alternatively, it may be gathered into mounds and covered with polythene sheets to prevent it from rotting during the rainy season. Composting would reduce dependence on fertiliser, increase yields, and provide an organic option that avoids the risk of burning the soil. Although various technologies to improve compost quality have long been available, a lack of agricultural extension services has meant they have never been widely adopted.

**Photo 15: *Tephrosia vogelii***



Source: Flora of Zimbabwe

## Green Manuring

Green manuring involves planting nitrogen-fixing species on farmland to restore lost fertility. These plants improve soil structure and, as their leaves fall, increase nitrogen levels, thereby reducing the need for fertiliser. This practice is scarcely used in Nigeria, where slash-and-burn techniques were traditionally employed. On the Mambila Plateau, where land shortages enforced alternative methods, the shrub *Tephrosia vogelii* – commonly known as the ‘fish poison bean’ – was planted in rows between crops to maintain fertility (Photo 15). This species offers additional benefits, as it also acts as an acaricide, reducing losses to insect pests.

International research on green manures has a long history in Nigeria. For instance, the IITA developed the ‘alley cropping’ system, in which plants such as *Stylosanthes* spp. were interplanted with vegetables and other crops (Osiname & Tonyé 1994). The leaves not only fixed nitrogen in the soil but also could be used to feed goats. Although this research is now three decades old, it remains relevant. Adoption at the time was limited, presumably because the soil fertility crisis was not yet acute and subsidised fertiliser was sporadically available. However, with today’s escalating soil fertility challenges, farmers may find such options increasingly attractive.

## Ponds

The technique of creating ponds, or ‘dams’, for livestock watering has a long tradition in Nigeria, dating back to early attempts at ranching in the 1930s. However, such dams have rarely been designed as truly multi-purpose structures. In principle, dams could provide water for irrigation, drinking water for livestock, and habitats for tilapia or catfish. A programme of dam construction could therefore open up dry areas and provide a focus for livestock watering away from settlements.

Experience has shown that the primary challenge to the sustainability of dams is maintenance, as they tend to silt up over time. For example, two dams constructed as part of the IDB-funded agropastoral project in Kano State are already no longer functional. Donor-funded projects often assign responsibility for maintenance to state governments, but these commitments are frequently not fulfilled, and the infrastructure falls into disuse. The National Livestock Projects Department once possessed the heavy equipment necessary for excavating and desilting dams, but this has now been sold off, leaving the government without capacity in this area. Any project to create dams must therefore include a clear strategy for their long-term maintenance.

## Live Fencing

Traditionally, farmers did not fence their fields, as low population densities made this unnecessary. The confinement of cattle to the northern semi-arid zone meant that there was little threat from livestock. This is no longer the case. Demographic growth has resulted in farms being contiguous, while mobile herds now pose an increased risk of crop

**Photo 16: *Physic nut (Jatropha curcas)***



Source: Wikimedia Commons

damage. The Jos Plateau was the one area in Nigeria where field fencing was carried out on a large scale. Here, extensive deforestation combined with large livestock movements effectively compelled farmers to adopt fencing. They planted *Euphorbia kamerunica*, locally known as ‘cactus’ (Photo 8). Thorny, containing poisonous latex and resistant to fire, this plant is almost ideal for protection.

The choice of fencing plants is influenced by both ecological conditions and economic value. Henna plants, sometimes used in northern regions, are unsuitable in areas of higher rainfall, although they do offer economic benefits, as the henna can be sold. Another plant with additional economic value is the physic nut, *Jatropha curcas*, which produces an oil suitable for lamps, while the nuts have medicinal value (Photo 16). Attempts to introduce industrial fencing using posts and barbed wire have generally failed. Apart from the high costs, these structures are prone to theft and can easily be destroyed in bush fires.

## Expanding Research on Indigenous Crops

Crop repertoires in Nigeria today comprise a mixture of indigenous West African domesticates and introductions from the New World, including maize, potatoes, cassava, and tomatoes. Research has historically focussed intensively on yield, often neglecting resilience, which has not served farmers well due to their reliance on external inputs. There is now growing evidence that farmers are returning to indigenous crops such as fonio (acha, *Digitaria exilis*), which perform well in poor soils, are drought resistant, and require little or no fertiliser. By contrast, cassava, although high yielding, is increasingly vulnerable to damaging waves of pathogens, such as the green cassava mite, forcing plant breeders to work continually to stay ahead of emerging infections.

## External Sale Agro-Products

Over recent decades, South-East Asian countries have succeeded in marketing indigenous fruits and spices on a large scale to developed countries. Today, virtually every supermarket in the developed world carries some of their products, providing a significant boost to smallholder incomes in the region. Nigeria, in contrast, has a wide variety of indigenous products, including many crops, spices, and fruits, as well as others that are less well known. Some of these are now recognised for their nutritional and health benefits.

The diaspora markets in Europe and the United States are extensive, yet little effort has been made to package and sell Nigeria’s characteristic crops to these communities. Yams and cocoyams provide a clear example of this missed opportunity: although widely available in Europe and America, their source is the Caribbean and Brazil rather than West Africa. Similarly, an oil such as *Canarium schweinfurthii* could compete with olive oil in terms of quality, yet no marketing system has been developed for it. The shea tree (*Vitellaria paradoxa*) produces butter in high international demand for cosmetics, yet in Nigeria, the trees are often felled for firewood. Tiger nut (*Cyperus esculentus*), the main ingredient in Spain’s national drink, horchata de chufa, is not sourced in Nigeria either.

All of this points to a lack of imagination. Nigerian agro-products could contribute significantly to GDP as well as to farmers’ incomes. Experiences in South-East Asia show how similar processes have benefited rural economies. Even a modest focus on less common crops and fruits could be relatively easy to implement and yield substantial returns.

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