SAHEL

African Food Changemakers

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Leveraging Innovations for Nigeria's Tomato Value Chain Development

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EDITORS' NOTE

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We are excited to present the 33rd edition of the Sahel Quarterly, themed **'Leveraging Innovations for Nigeria's Tomato Value Chain Development'**. This edition highlights tomato's critical role in the food system and the agricultural practices that could transform Nigeria's tomato value chain.

Tomato is an essential crop for household consumption in Nigeria. With annual consumption estimated at 3.3 million tonnes in 2020[1], tomato plays a critical role in the diet of Nigerians. From the popular jollof rice to soups, sauces, salads, ketchup, and juice, tomato has proved itself as a versatile ingredient and a tasty addition to the meal of over 200 million Nigerians.

Nigeria ranks as the 2nd largest tomato producer in Africa. However, its annual production of 3.6 million tonnes[1] falls short of meeting domestic consumption needs. To fulfill the local demand, Nigeria imports roughly 150,000 tonnes of tomato paste concentrate each year, valued at approximately $170 million.

The paradox of Nigeria's substantial tomato production and its position as a leading importer of tomato concentrate sheds light on the challenges in the tomato value chain. This contrast calls for a comprehensive evaluation of current practices and technology adoption to address identified gaps and bottlenecks that hinder efficient production and distribution.

Smallholder tomato farmers in Nigeria have been adopting measures to improve their production and salvage their harvest yearly. While the rate of technology application is still slow, the tomato value chain is developing with farmers adopting different production and post-harvest management practices. Drying technologies such as direct solar drying, indirect solar drying, hybrid solar drying, and mechanized drying have been locally fabricated in Nigeria.

Tomato farmers use production technologies such as screenhouses and greenhouses to protect tomatoes from pest and disease infestations. These technologies contribute to efficient water and nutrient use thereby improving the yield of tomato unlike when it is cultivated in the open field.

In this edition, we delved into the specific challenges faced by Nigeria in building a sustainable tomato value chain. We explored the various issues impacting the resilience of the value chain, such as the weak variety release system for tomato and other vegetables and limitations in post-harvest management. Additionally, through engaging interviews that provided firsthand accounts, we analyzed the pivotal role of various technologies and their specific applications in strengthening the resilience of the tomato value chain.

By examining these critical areas and showcasing real-world instances, we aim to equip you with comprehensive insights and practical solutions that will contribute to the establishment of a robust and sustainable tomato value chain in Nigeria.

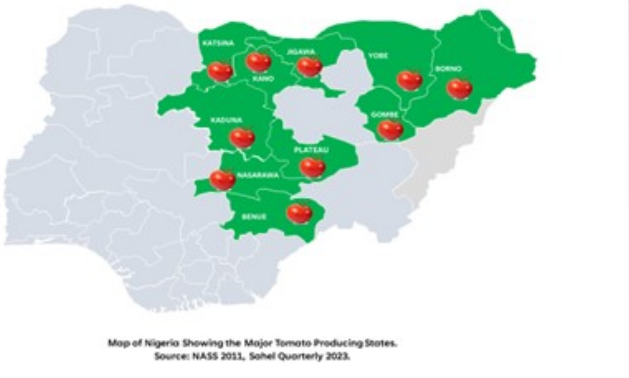
Noting the importance of tomato in the food system, there is an urgent need for the government at all levels and development organizations to invest more in research that can solve the multifaceted challenges facing the value chain, promote new production and post-harvest technologies and support the scaling of the numerous efforts of the private sector actors in the landscape.

1. FAO. (2021). Food and Agriculture Organization of the United Nations. FAOSTAT Statistical Database. Rome
2. Trade statistics. International Trade Centre. https://intracen.org/resources/data-and-analysis/trade-statistics

TABLE OF **CONTENTS**

UNDERSTANDING THE TOMATO VALUE CHAIN: CHALLENGES AND POTENTIAL MITIGATION STRATEGIES

BY ILESANMI PUPA

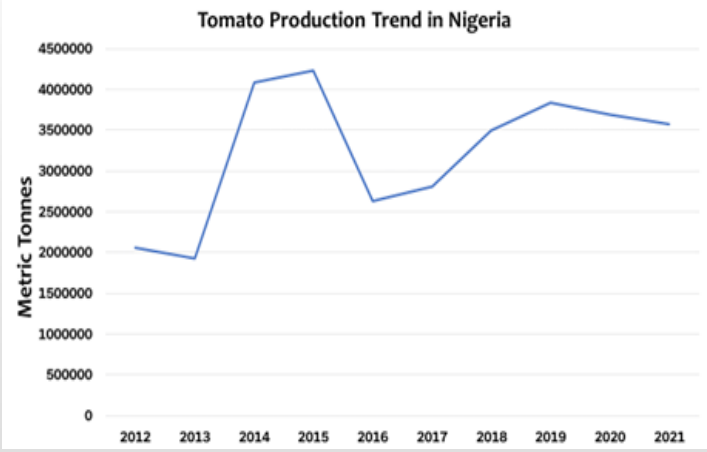


Map of Nigeria Showing the Major Tomato Producing States.
Source: NASS 2011, Sahel Quarterly 2023.

Overview of Tomatoes Production in Africa

Tomato production plays a vital role in generating income for rural and peri-urban producers in developing nations. However, numerous challenges across the value chain hinder its profitability. Low tomato yields are prevalent across many African countries, with Nigeria averaging 7-10 tonnes/ha, Angola at 2.70 tonnes/ha, and Somalia at 1.44 tonnes/ha[1].

Despite these challenges, Nigeria is currently the 10th largest producer of tomatoes globally and the second-largest producer in Africa after Egypt[4]. The country is responsible for roughly 16% of the fresh tomatoes produced in the region and 1.8% of the total world output. Nigerians consume tomatoes in different forms at an average of 16 kg per capita annually, which represents about 24% of their total vegetable household consumption[4].



Source: Food and Agriculture Organization[4]

The discrepancy between production and demand occurs because tomatoes are a highly sought-after crop due to their rapid growth and versatility in culinary applications. With a growing period of 90 to 150 days, tomatoes are considered a day-length neutral plant, meaning they are not affected by the length of daylight[5]. However, the daily temperature required for optimal growth ranges from 18 to 25ºC[5], with night temperatures between 10 and 20ºC. It is important to note that larger differences between day and night temperatures can have an adverse effect on yield.

Tomatoes are highly sensitive to frost and require an additional level of care. Temperature above 25ºC, accompanied by high humidity and strong winds[5], can reduce yield. Night temperatures above 20ºC, accompanied by high humidity and low sunshine, can lead to excessive vegetative growth and poor fruit production. High humidity can also lead to a greater incidence of pests and diseases, as well as fruit rotting.

Modalities of Exchange in the Tomato Market

The distribution of tomatoes in Nigeria involves a complex network of producers, commission agents, assemblers, wholesalers (regional and urban), retailers, and ultimately, consumers.

Producers sell their tomatoes to assemblers in rural assembly markets through commission agents who receive a commission per basket sold. The assemblers or regional wholesalers then transport the product to urban markets where they sell to urban traders through commission agents. Finally, the produce reaches the ultimate consumers who purchase from the urban traders. Commission agents exist at every level of the distribution chain, playing the role of intermediaries between market middlemen for a fee.

3. FAO. (2021). Food and Agriculture Organization of the United Nations. FAOSTAT Statistical Database. Rome.
4. Simone, D. (2018). Commercial greenhouse tomato production; pest and diseases management. 25-34
5. Deola Lordbanjoce. Tomato farmers lost 300 hectares worth 1.3bn to Tuta Absoluta. Daily Trust. 30 April 2023. https://dailytrust.com/tomato-farmers-lost-300-hectares-worth-n1-3bn-to-tuta-absoluta/

Local Tomato Distribution Channel in Nigeria

The prices of tomatoes at the farmgate vary depending on the season, location, and type. For example, in Nigeria, on average, prices are N130 per kg in the dry season and N400 per kg in the wet season in 2019. Premium tomato prices range from N350 to N800 per kg at the retail level, whether exotic or local. During the wet season, farmers in Northern Nigeria face significantly higher pest and disease pressure, making it more difficult to produce good quality tomatoes all year round. As a result, the volume is lower in this season, and prices are accordingly higher. To augment this, vegetables, including tomatoes are often supplied from the Southern part of the country during the wet season, where production is mainly rainfed.

Understanding the nuances of the tomato distribution chain is essential in evaluating the effectiveness of measures taken to ensure that tomatoes reach consumers promptly and at an optimal cost.

Key Issues & Opportunities across the Supply Chain

	Farmers	Middle Men/ Aggregator	Transporter	Wholesaler	Retailer	Consumer
Description of Activities	• Harvest on average 400 – 450 baskets of tomato per hectare when its green and sell in baskets to middlemen mostly at farm gate.	• Buy tomato weekly from farmers at different locations in 40-60kg or 6-15kg baskets in the North & South respectively. • Some farmers also serve as middle men, purchasing from other farmers.	• Transports tomatoes in 4 layered (12.8 tons) & 5 layered (16.8 tons) trucks. • Transports 320 – 550 baskets of tomatoes using trucks stated above.	• Based in urban markets, they buy tomatoes in baskets from middlemen and sell to retailers, fast food companies and other bulk buyers.	• Purchase 3 – 4 baskets of tomatoes per day from wholesalers and sell in bowls of various sizes from 2kg – 5kg. They also sell a hand-full of ~8 fruits (0.5kg).	• Buys tomato in small hand-full quantities from retailers. Middle class consumers may buy larger quantities and store in refrigerators to retain freshness & reduce spoilage.
Constraints/ Bottlenecks/ Loss/ Waste	• Poor yields averaging 6.3 MT/Ha from lack of the use of improved seeds & poor agronomic practices • On-farm loss is ~5 - 9%.	• Poor packaging and handling practices using woven baskets piled on each other. • Tomato baskets are carried on the head or shoulders while loading, and are sometimes forcefully dropped on the floor, increasing the level of damage to tomato particularly those at the base of the baskets. • ~36 - 41% losses were recorded when moving tomatoes from Kano/Kaduna to Lagos.		• Poor handling practices and display of tomatoes in baskets. • Poor storage of tomatoes in case of left overs. • ~10-50% loss.		• Consumers shift from consumption of fresh tomatoes to paste during periods of scarcity.
Opportunities	• Farmers should plant improved & desired varieties to increase yield.	• The use of improved packaging such as crates and cartons, and the use of cold chain transportation will reduce losses. • Crate-return structures must be available to encourage the adoption of crates by traders.		• The use of crates, cold storage & pack houses will reduce losses.		• Would benefit from nutrition awareness on appropriate practices for storing and cooking tomato.

Source: Sahel Capital Analysis from Stakeholder and Expert Interviews,2015. Global Alliance for Improved Nutrition (GAIN)

Challenges Facing the Tomato Value Chain in Nigeria

Tomato production in Nigeria is predominantly carried out by small-scale farmers who play a vital role in meeting the country's demand for this essential crop. The tomato value chain faces several challenges that hinder its growth and sustainability.

- **Low productivity and quality standards:** Low productivity and quality standards in tomato farming practices significantly challenge the value chain. This is due to several factors, including a lack of access to modern farming technologies, and poor soil management practices.

- **Season variation and pest infestations:** The tomato production cycle in Nigeria is seasonal, and farmers face significant challenges during the off-season, the most notable of which is pest infestations. The two major pests of tomatoes are nematodes and the tomato leaf miner (Tuta Absoluta).

  - **Nomatodes:** Nematode infestation and transmission can occur through various means, such as infected plant material, tools, rainwater, irrigation water, strong winds that carry infested soil particles, and contaminated soil carried on shoes or animal feet. Tomato plants infested with nematodes exhibit a range of symptoms, including stunted growth, yellowing of leaves, wilting, and collapse of individual plants, as well as swelling or gall on the roots.

    Fortunately, there are methods available for con trolling nematodes. One such method involves the use of plant extracts (Siam weed and Neem) and treated poultry droppings; One of the effective ways to utilize poultry droppings for nematode control is by incorporating them into the soil. This method involves mixing the droppings into the soil before planting, ensuring a well-distributed application. You can use a rototiller, a shovel, or even your trusty gardening gloves to get the job done. This will not only enrich the soil with essential nutrients but also create an unfavorable environment for nematodes, the plants will also have a boost of energy to grow strong and healthy. This approach is not only cost-effective and easy to apply, but it also poses no pollution hazards and has the potential to improve soil health.

  - **Tomato Leaf Miner (*Tuta absoluta*):** The tomato leaf miner is a major challenge, leading to significant losses of tomato produce, in the year 2022 *Tuta absoluta* affected over 300 hectares of farmland in Kano state alone which caused a price hike of NGN 1.3 billion[5]. Farmers and potential commercial growers are currently facing a significant threat from the *Tuta absoluta* outbreak. This pest infests the tomato plant, leading to fungal growth and ultimately resulting in the rotting of the fruit, either before or after harvest. This situation is a cause for concern, as it poses a significant risk to the livelihoods of farmers and the tomato industry. It is imperative that measures are taken to address this issue promptly and effectively.

- **Poor infrastructure and logistics:** The poor state of logistics infrastructure in Nigeria, including roads, storage facilities, and transport systems, poses a significant challenge to the tomato value chain. This results in post-harvest losses estimated at 40-50%, low-quality products, and high transportation costs[6].

6. SPORE, 2011. Post-harvest management. Adding value to crops. The magazine for agricultural and rural development in ACP countries.N° 152. http://spore.cta.int

Potential Strategies for Improving the Tomato Value Chain in Nigeria.

- **Investment in infrastructure and logistics:** There is a need for significant investment in infrastructure and logistics to improve the tomato value chain in Nigeria. This includes the construction of storage facilities, the upgrading of transportation systems, and the provision of affordable financing facilities to stakeholders in the value chain
- **Training and capacity building for farmers and traders:** Capacity building for farmers and traders is essential to improve their productivity and income levels. This involves providing training on modern farming practices, quality standards, and marketing strategies.
- **Adoption of new technologies and farming practices:** The adoption of new technologies and farming practices can improve productivity and reduce post-harvest losses. Technologies such as drip irrigation, greenhouses, and improved seed varieties can help farmers produce high-quality tomatoes all year round[7].
- **Increased demand for processed tomato products:** There is a growing demand for processed tomato products such as tomato paste, ketchup, and sauces. This presents significant opportunities for investment in processing facilities and value addition in the tomato value chain.
- **Export opportunities to neighboring countries:** Nigeria's neighboring countries such as Cameroon, Chad, and Niger are significant importers of tomatoes. This presents an opportunity for Nigerian farmers, traders, and processors to tap into these markets and increase their revenue.
- **Investment potential for private sector businesses:** The tomato value chain in Nigeria presents significant opportunities for private-sector businesses such as agricultural input suppliers, processors, and logistics companies. These businesses can invest in the value chain and create jobs while contributing to the development of the country's economy.

Opportunities for Growth in the Tomato Value Chain in Nigeria

- **Increased demand for processed tomato products:** There is a growing demand for processed tomato products such as tomato paste, ketchup, and sauces. This presents significant opportunities for investment in processing facilities and value addition in the tomato value chain.
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Recommendations to Improve the Tomato Value Chain in Nigeria

To fully unlock the potential of the tomato value chain in Nigeria, there is a need for continued investment in infrastructure, research and development, and technology. There is also a need for increased collaboration between the government and private sector stakeholders to address the challenges facing the value chain, such as post-harvest losses and inadequate storage facilities. If these challenges are addressed, the tomato value chain can become a significant contributor to Nigeria's economic growth and development.

In conclusion, the tomato value chain in Nigeria is a critical component of the agricultural industry and a significant contributor to the Nigerian economy. While the challenges facing the value chain are significant, there are opportunities for growth and development. With continued investment, government support, and private sector involvement, the tomato value chain in Nigeria has the potential to transform into a thriving industry that benefits farmers, traders, processors, and consumers alike.

7. Oyekale, K.O. (2014) 'Growing an Effective Seed Management System: A Case Study of Nigeria'. Journal of Agriculture and Environmental Sciences.

REDUCING POST-HARVEST TOMATO LOSSES IN NIGERIA: CHALLENGES, TRADITIONAL PRACTICES, AND SOLUTIONS

BY BUHARI ZUBAIRU

Introduction

Post-harvest losses significantly impact Nigeria's food security and economy, with the country losing approximately N3.5 trillion annually, according to the Food and Agriculture Organization (FAO)[8]. The tomato industry is particularly affected, with losses of over 45 percent of total production, making it a critical issue for the country. Nigeria is the largest producer of tomatoes in Sub-Saharan Africa, but over 50 percent of locally produced tomatoes are lost to poor storage, poor transportation systems, and lack of processing enterprises[9].

The Impact of Post-Harvest Losses and Contributing Factors to Tomato Losses

Post-harvest losses encompass both quantity and quality reductions from harvest to consumption. These losses affect tomatoes' nutrient and caloric composition, reducing their acceptability and consumption. Post-harvest losses have caused a significant decline in farmers' gross margin in tomato production.

The tomato value chain in Nigeria faces challenges due to inadequate production and processing techniques. The unorganized production system, limited use of technology, and lack of mechanization contribute to post-harvest losses. Wastage starts with poor management practices and resource utilization, including low-quality inputs, inadequate crop management skills, ineffective disease, pest control, and seasonal production glutes that affect overall yield.

Common Post-Harvest Practices Causing Tomato Loss

One common practice among small- and large-scale farmers in Nigeria is storing tomatoes in locally-made baskets immediately after harvesting. These baskets, especially the larger ones used for transportation, cause damage to the tomatoes at the bottom due to weight and the basket's geometry. Additionally, the uncontrolled temperature during transit induces stress on the fruits, leading to fungal growth and spoilage. Significant losses still occur despite attempts to reduce losses by using wooden planks to separate rows of baskets.

Traditional Practices to Reduce Post-Harvest Loss

- Farmers have devised traditional practices to minimize post-harvest losses. Sun drying is a widely used technique in Nigeria, where tomatoes are sliced and laid out on the ground to dry. However, this method often lacks proper standards and poses a risk of contamination, raising food safety concerns.
- Farmers have also employed Zeer pots to preserve produce for a few days, but this method may not be practical for large quantities of tomatoes. Zeer pots are evaporative cooling refrigeration devices that work without being powered by electricity. A Zeer pot is a porous outer layer clay pot that contains another inner pot[10]. The device can cool vegetables and requires only a flow of relatively dry air and a source of water. The cooling function of the Zeer pot is based on the principle of evaporative cooling and works best in hot and dry climates.
- Another local innovation, charcoal coolers, has been used in tropical regions. These coolers have proven effective and affordable for fruit storage, presenting a viable option for reducing post-harvest losses.

Solution to Reduce Post-Harvest Losses

To comprehensively address post-harvest losses,

- There is a need for reliable, and efficient storage and processing facilities. These facilities would alleviate the challenges farmers face in manual drying and ensure safety protocols throughout the production cycle.
- Access to extension services should be improved to enhance farmers' farm management practices and post -harvest handling. The government can support tomato farmers by creating an enabling environment for young and emerging farmers and encouraging innovation within the sector.
- Additionally, establishing accessible road networks linking farming communities to major markets would reduce transportation-related losses by minimizing transit time and exposure to temperature changes.

8. Agricultural Production Statistics 2000–2021. Food and Agriculture Organization of the United Nations. (n.d.). https://www.fao.org/food-agriculture-statistics/data-release/data-release-detail/en/c/1627788/
9. Ugonna, C.U., Jolaoso, M.A. and Onwualu, A.P. (2015). Tomato Value Chain in Nigeria: Issues, Challenges and Strategies. Journal of Scientific Reports and Reports. 7(7): 501- 515pp.
10. Oluwasola, O. (2011). Pot-in-pot Enterprise: Fridge for the Poor. United Nations Development Programme.

- Setting up storage and processing facilities near tomato-producing areas and organizing farmers into cooperatives or clusters can also improve coordination and allow for the adoption of modern harvesting practices.

In conclusion, reducing post-harvest losses in Nigeria's tomato industry requires concerted efforts from farmers, the government, and private investors. By improving farm management skills, investing in storage, and processing facilities, enhancing transportation infrastructure, and encouraging innovation and cooperation among farmers, Nigeria can take significant steps towards minimizing post-harvest losses, ensuring food security, and maximizing economic potential in the tomato value chain.

UNLOCKING THE POTENTIAL OF PRECISION AGRICULTURE IN NIGERIA'S TOMATO FARMING INDUSTRY

BY MEYAKNO EKONG

Amina Dikko*, a 34-year-old passionate tomato farmer from Nigeria, is faced with numerous challenges that threaten her livelihood. Unpredictable weather patterns make it difficult for her to plan irrigation effectively. She struggles with water shortages during droughts and experiences waterlogging during heavy rainfall. This inconsistency in water management impacts her crop yield and overall productivity.

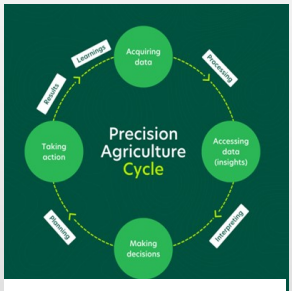
Amina also grapples with inefficient resource management. Without access to accurate data, she relies on guesswork, previous experience or local advice when applying fertilizers and pesticides. This often results in wasted resources, increased production costs, and potential environmental risks to her farmland.

Amina's story is the same for most Nigerian tomato farmers. The issues severely affect the overall productivity of the tomato sector, which means that consumer demand cannot be met by local production.

Precision Agriculture Applications in Tomato Farming

Precision agriculture presents a transformative opportunity for the Nigerian tomato industry. With precision agriculture, the challenges of high production costs, limited access to inputs, and low yields within Nigeria's tomato production ecosystem can be overcome.

Precision agriculture, a modern farming method empowered by advanced technologies, has the potential to revolutionize farming practices. It utilizes cutting-edge technologies, including GPS/GIS, remote sensors, and big data analytics[11] to provide real-time data on soil conditions, plant health, fertilizer and pesticide effects, irrigation, and crop yield to optimize resource utilization and aid informed decision-making by the farmer. This approach fosters healthier plants, reduces pest and disease pressure, lowers production costs, and ultimately leads to higher yields. By integrating these technologies into traditional farming practices, farmers can achieve precise and efficient cultivation methods.



The Cycle of Precision Agriculture[12]

Remote Sensing and Opportunities for Tomato Farming

The successful implementation of precision agriculture is heavily reliant on the constant monitoring of soil condition, plant health, fertilizer and pesticide effect, irrigation, and crop yield. Remote sensors provide farmers with real-time data on the conditions of selected characteristics in their crops and soil, using photography, infrared, or microwaves[1].

A notable case study conducted by Egmond et al[13]. illustrates the potential impact of precision agriculture on tomato farming in Nigeria. In the study, gamma-ray sensors were utilized for soil mapping in a vegetable farm, accurately mapping characteristics such as clay content (for water retention), pH, organic matter, and compaction. The precision techniques and resulting effects on the production are summarized below:

Sensor Mapping Characteristic	Application	Outcome
Clay Content (for water retention)	To determine the planting distance	13% savings in cost while maintaining standard yield levels
Nutrient content	To determine the amount of fertiliser applied	60% reduction in fertiliser used.
Organic Matter	To determine the amount of compost applied	Improved soil structure
pH & Organic Matter	To determine the extent of liming required for the plot	Improved yield for sugar beets.
Trichodorus presence	To determine the requirements for nematode control	40% - 60% reduction in amount of chemicals (nematicides) required.

Overall, the study found that the application of these techniques resulted in a 6% increase in earnings per hectare of cultivated land over four years. This highlights the transformative potential of remote sensing techniques for vegetable production.

11. Precision Farming Metrics and Benefits. (2022) Farm21. https://www.farm21.com/understanding-precision-farming-metrics-and-how-you-can-benefit-from-them/
12. Adhikary S, Biswas B, Kumar Naskar M, et al. (2023) Remote Sensing for Agricultural Applications. Arid Environment - Perspectives, Challenges, and Management. IntechOpen. DOI: 10.5772/intechopen.106876.
13. Van Egmond F.M., Loonstra E.H., Limburg J., (2010) Gamma Ray Sensor for topsoil mapping: The Mole. Proximal Soil Sensing. 10.1007/978-90-481-8859-8_27

Furthermore, to optimize precision, agribusinesses are increasingly integrating remote sensors with geographic information systems (GIS)[14]. By managing and analyzing spatial data generated by remote sensors, GIS enables better decision-making and future projections related to soil health and nutrient content.[15] This integration not only maximizes efficiency but also contributes to sustainable food production by mitigating environmental impacts[16].

Adoption of Precision Agriculture in Nigeria

The adoption of precision agriculture methods holds many benefits for farmers. The most important benefit is profitability. This is driven by the cost savings from efficient use of inputs. Additionally, the precise application of inputs often results in higher yields for precision agriculture practitioners – another avenue for increased profit.

Despite the many benefits of precision agriculture, the uptake of these technologies in Nigeria has been slow. One of the main challenges is the dominance of smallholder farmers within the farming ecosystem. This means land sizes tend to be too small for the set-up of precision agriculture technologies. This issue is compounded by the high cost of precision farming technologies, which can be prohibitive for small-scale farmers. Smaller plots are often perceived to not be worth the investment.

There is also a lack of awareness and understanding of precision agriculture among tomato farmers and other stakeholders in the value chain[17]. There are concerns about the availability of skilled personnel to operate and maintain the equipment.

Concerted efforts are required to overcome these challenges and unlock the full potential of precision agriculture in Nigeria's tomato farming. More significant investment in extension services and training programs is crucial to raise awareness and educate farmers about the benefits of precision agriculture. Moreover, developing affordable and tailored precision farming technologies for small-scale farmers is essential. Here, the government and private sector can play pivotal roles by providing financing and support mechanisms to facilitate the adoption of precision agriculture technologies.

In the end, precision agriculture offers a game-changing opportunity for Nigeria's tomato industry, enabling increased efficiency, higher yields, and improved market access. By embracing this innovative farming method and overcoming adoption challenges through strategic interventions, tomato farmers in Nigeria can usher in a sustainable and prosperous future for themselves and their communities.

14. Sood, Kunal & Singh, Sharda & Rana, Ranbir & Rana, Aditya & Kalia, Vaibhav & Kaushal, Arun. (2015). Application of GIS in precision agriculture. 10.13140/RG.2.1.2221.3368.
15. Urvil Kaswala. (2022) An Introduction to Remote Sensing and GIS: A Primer for the Novice. SGL. https://www.sgligis.com/remote-sensing-and-gis-introduction/
16. GIS in Agriculture: Making Farming Precise and Productive. FarmERP. https://www.farmerp.com/how-gis-in-agriculture-is-promoting-precision-farming
17. Samreen, T.; Ahmad, M.; Baig, M.T.; Kanwal, S.; Nazir, M.Z.; Sidra-Tul-Muntaha Remote Sensing in Precision Agriculture for Irrigation Management. Environ. Sci. Proc. 2022, 23, 31. https://doi.org/10.3390/ environsciproc2022023031

PRECISION AGRICULTURE: TRAINING THE NIGERIAN YOUTHS AND CLUSTERING TOMATO FARMERS FOR IMPROVED PRODUCTIVITY

BY HAMMED JIMOH, WISDOM EZECHI AND MEYAKNO EKONG

Interview Session with Femi Adekoya, Founder, Integrated Aerial Precision

The world is moving towards more precise, tech-driven agricultural practices, and researchers are working tirelessly to make this a reality. However, the question remains: how well are these innovations being received and implemented among African farmers?

In Nigeria, a country where agriculture is a significant part of the economy, the use of precision agriculture technology has the potential to transform the sector and create new opportunities for young people. To explore this topic further, the Sahel team sat down with Femi Adekoya, the founder of Integrated Aerial Precision, a pioneering start-up that is using drones to improve productivity among tomato farmers in Nigeria. In this interview, Adekoya shares his insights on the benefits and challenges of using agricultural drones in Nigeria and discusses how his company is training Nigerian youths to become experts in precision agriculture.

Below are the excerpts:

Tell us about you and the accomplishments you have achieved through the utilization of Integrated Aerial Precision?

I am Femi Adekoya. I lead two agriculture-focused enterprises: Integrated Aerial Precision and Precision Field Academy. What we do at Integrated Aerial Precision is to provide precision agriculture solutions to farmers by leveraging drone technology and the use of data. Our services or solutions are what we call drone-powered solutions.

These drone-powered solutions include precision drone spraying, targeted broadcasting operations, and agricultural drone mapping ranging from crop health scouting to the production of various deliverables like orthomosaic 2D maps and boundary mapping (which you call perimeter mapping). We also assess plant health, which is crop monitoring, using drone technology with specialized sensors. In addition, we provide topographic maps, as all of these are under agriculture mapping, among many others. We also serve stakeholders like agricultural insurance companies, providing them with data they need to ensure fast and transparent claims if the client wants to confirm their claim or get a refund of their claims. Those are part of the solutions we provide.

Precision Field Academy is my social enterprise with the mission of raising the next generation of farmers and young professionals who are tech-inclined and digital-savvy. We educate and train youths on emerging technologies like drone technology, GIS and remote sensing, artificial intelligence, and data science, among other technologies to lead with precision agriculture while preparing them for the future of work and technology in agriculture. So far, we have received some awards and recorded successes, including the African Precision Agriculture Young Scientist Award in Agriculture by APNI (Africa Plant Nutrition Institute) last year (2022) and the Orange Corners Nigeria Incubation Fund Grant, to name a few.

Could you kindly provide an overview of your utilization of drones in the agricultural landscape of Nigeria? Specifically, what is the extent of your drone coverage, the specific tasks they perform for farmers, and the notable benefits they offer in enhancing agricultural practices.

As Integrated Aerial Precision, we specialize in providing drone-powered solutions to farmers in the agricultural industry. One of the ways farmers leverage our drone services is through precision drone spraying, which provides higher efficiency and unprecedented effectiveness. By using drones to spray agrochemicals, farmers can use fewer amounts of pesticides, saving more than 30% of pesticides and reducing the cost of production while protecting the environment from pollution. Furthermore, using drone technology to spray agrochemicals protects farmers from overexposure to potentially hazardous adverse chemicals.

Another benefit of our drone service is combating pests and diseases. Traditional methods require labor to go out in the field and begin applying. With drones, farmers can solve this problem in an unprecedented way. For example, it would take two days for a farmer to spray one hectare with herbicide or insecticide depending on the growth stage of the crop or the production cycle using manual methods but with drone technology, it takes less than 15 minutes to spray the same area of farmland. This approach not only saves time and reduces labor costs but also helps conserve water. Farmers can save up to 90% of water compared to conventional methods.

In addition to drone spraying, there is agricultural drone mapping. With our drone mapping services, farmers can gain insight into their crop health, access high-resolution images, and understand the field topography, farm boundary, crop health status, disease condition, nutrient deficiency, soil conditions, and much more. Our drone technology helps farmers measure processes in their fields and make informed decisions about their agribusiness and planting.

Drone technology has revolutionized the agricultural sector, provided unprecedented efficiency, effectiveness, and cost savings while protecting the environment and promoting the health and safety of farmers.

Have you implemented drone technology specifically in tomato farms to assess plant health and monitor crop conditions?

Yes, we have applied drone technology to tomato fields. This season, we worked experimentally on tomatoes as a proof of concept. We have used drone technology in production, just like I have mentioned for every other crop, from crop counting to disease of crops. How do we use drones to achieve disease management? As someone who studied agriculture and knows the agronomy of these crops and integrated pest management, we use drones to enhance disease detection and pest detection. When we fly the drones on the field, we first work with tomato farmers after they have planted, and from aerial images, they are able to see their fields holistically.

Imagine flying up and seeing all your field like a bird's eye view. With this view, farmers can see where they have a low population, which can lead to low yields. If they have a low population compared to the optimal population, it means they have lost some yield already. This information can help farmers make decisions either in the short term or perhaps the next season. We teach them or give them insight into what to do next to improve their production.

To empower the farmers, we are developing different use cases for explaining our data to be able to analyze diseases apart from population assessment. Apart from taking the record of the field, documenting in videos, which is photos or 2D. In terms of documentation, we are exploring different ways by working with farmers to be able to explore our data. And when I say data, I mean imagery and with the aid of artificial intelligence, so we are leveraging technology and the power of data explored in analytics and AI.

Aside from that, we help in mapping the tomato fields. Farmers want to digitize their fields and know the size of their fields. Those who have farmland like three, four, and more hectares want to go to their field to confirm the size without having to go through the stress of moving around and measuring manually.

Another way tomato farmers are exploring drone technology in their production is drone spraying. Drone spraying is quite useful for them. For example, they want to spray foliar fertilizers or fungicides. Tomatoes are susceptible to fungal attacks like late blight, and farmers are leveraging drone technology to achieve all the aforementioned.

Could drone technology be a transformative solution for Nigeria's tomato value chain, leading to significant improvements in production and overall industry outcomes?

Yes. Nigeria already has a good position when it comes to tomato production in Africa. But as an advocate, I am passionate about agriculture and do not focus solely on metrics such as being the largest or second-largest producer of tomatoes. Rather, the important question is whether the production meets our population's growing demand sustainably.

Drone technology can indeed transform the Nigerian tomato value chain. In addition to addressing issues of harvest and postharvest loss, we can also use drones for disease detection, crop protection, and to fight against pests such as the Tomato leaf miner and diseases like early blight and deep blight.

Using drones can help us provide rapid and efficient crop protection to farmers, and if we leverage smart and modern technology along with the power of data, we will not only become the highest producer but also sufficiently feed our growing population and supply tomatoes to the rest of the world.

Do you offer specific opportunities or initiatives aimed at supporting smallholder farmers in rural areas?

Yes, we have opportunities for smallholder farmers. They happen to be our mainstay. Our services are not expensive because we also must consider our competition. I don't mean drone competition; I mean the conventional methods that are already in use. Our goal is to serve them in terms of business and keep our prices affordable, as compared to existing conventional methods. Our challenge as service providers is the volume of smallholder farmers we need to serve. We encourage them to come together in clusters, like what is happening in the north with rice farmers. This makes it easier for us to provide services and it makes business sense.

I also want to emphasize that our goal should be to commercialize smallholder farming ventures, not just sustain them. Many of these farmers want to grow and leave farming as a legacy for their children, not just to make ends meet. Promoting agribusiness is crucial, and we need to focus on this as a key priority.

Talking about business and commercialization. Are there existing government policies in Nigeria that actively promote and support the adoption and commercialization of drone technology? Additionally, do you benefit from any specific policies that encourage and facilitate the growth of your drone-related business activities?

An issue we face is that drone technology is multidimensional, and it means different things to different people. However, this is changing, and when you hear about drones, perhaps in the last five years, what comes to mind

is military applications or defense for security. The current view or perception of drone technology, based on regulation or policy, tilts towards that sentiment. This is limiting civil applications, particularly in agriculture. So, what can the government do? For example, India has opened its drone industry to make it more liberal, encouraging innovators to manufacture and assemble drones that can be used, particularly in agriculture. This move is having a positive effect on the landscape. I believe that the Nigerian government and other African countries can adopt this approach, particularly in agriculture. Agricultural drones are not seen as agricultural tools like tractors. When we first accept agricultural drones as tools in the hands of farmers, this opens opportunities for training. In terms of licensing and certification, it is important to note that licensing certifications are crucial because drone technology is considered aviation technology, and they must be regulated accordingly as they interfere with airspace.

Do you have mentees or individuals within your network whom you are actively mentoring and nurturing to expand the adoption and utilization of this technology in decentralized settings?

During my introduction, I mentioned that I lead Precision Field Academy, a social enterprise with a mission to raise the next generation of tech-inclined and digitally savvy farmers. We educate, train, mentor, and coach young professionals in agriculture on modern digital technologies, such as drone technology, GIS, remote sensing, IoT, and artificial intelligence for agriculture and data science. Our organization understands the agricultural industry and the plight of youth who want to enter agriculture but face obstacles such as negative perceptions of the industry. We provide them with a platform to learn and grow.

We have a community, and we are growing. We started in late 2022 and already have scholarships in partnership with our partners to provide GIS training and skills to people. We currently have another call for applications, and we have already received more than 4,500 applications. We are open to helping and collaborating to ensure that our young farmers are tech-inclined and digitally savvy. When this happens, we have leverage in terms of the youth population in this demography, and we can see a transformational revolution. We are preparing them for the future of work in agriculture.

Do you do have exchange programs or internships for undergraduate students?

The reason I am passionate about the involvement of youth in agriculture and why we have created a platform like this is that I have passed through what the youths are passing through. I studied agriculture in Nigeria, and I also studied outside of the country. I started as a passionate person in agriculture, not that I was given the course, I chose to study agriculture from my teenagerhood. That is based on aspiration. It is not that the youths do not want to take up a career in agriculture, they want something different, something nobler than the current outlook agriculture has. They want a career in that they can be able to build a proper life like their fellow students in medicine, engineering, and other fields. Talking about university students, yes. That is where our target is. This year we already sealed up partnerships with different universities across the country, more particularly in the southwest for now. We are looking forward to moving up north and to different universities. We are just open to universities because the university is where the students are more, particularly the agricultural students. We are already leveraging on that.

As a service provider, what are the main challenges you encounter in your operations and service delivery?

Regulatory issues remain a challenge for us. Additionally, the economy poses a challenge as we need to access some of our materials and technologies in United States Dollars ($), and the fluctuation of foreign exchange rates is also a challenge. Since drone technology is new in Nigeria, we face a challenge in building up the workforce necessary to scale our operations. At Precision Field Academy and Integrated Aerial Precision, we train young people and aim to bring them on board with us to help tackle this issue. Furthermore, technical know-how is still somewhat scarce, and we are taking it upon ourselves to develop our capabilities to use this technology more effectively across the country. In summary, the three main challenges we face are regulatory issues, access to materials and technology, and scarcity of technical know-how. Another significant challenge we face is securing funding.

Could you provide a step-by-step walkthrough of your project process, starting from the planning stage to implementation? How do you establish communication with farmers? Additionally, what strategies do you employ to promote and market your services effectively?

In terms of reaching out to farmers and marketing our services, we have various channels. First, we leverage partnerships, which is one of our competitive advantages. We have been in the agricultural industry for some time now, and we have a diverse network of farmers, as well as partnerships with fellow Agritech companies, government institutions, and farm management service providers who know these farmers. This allows us to connect with different stakeholders and expand our reach. Additionally, we use word-of-mouth marketing. When people see the value of our technology and services, they tell others about it. We also leverage digital media. People follow us on social media, and we use it as a platform to reach out to farmers directly. Our current campaign is to sensitize farmers as they plan for the next rainy season and open big fields. We approach them and talk to them about how we can help improve their agricultural production.

Regarding the process of our projects, it involves a lot of planning and preparation. First, we identify the problem we want to solve, and then we research and develop solutions using modern digital technologies. After that, we go to the field to test and validate our solutions, working with farmers to ensure that our solutions work for them.

Once we have validated our solutions, we deploy them on a larger scale. We have an office where farmers can reach out to us, and we also have a team that goes to the field to work directly with farmers.

Do you offer any training programs or sessions to farmers or your team members to ensure proper utilization of drones and maximize the benefits they provide?

That's our value proposition. We are farmers that empower farmers with drone technology. And when we do the drone analytics and all that flying mapping, we go a step further, not just giving them data, we make it make sense and relatable for them. We guide them on how they can convert data into insight that can transform their production. We move from data collection to flying the drone. We operate all over Nigeria to empower the farmer.

How do you envision the integration of agricultural drones contributing to the improvement of food security and rural development?

I believe that we can do less without technology and do more with drone technology. All that we are concerned with in 21st-century agriculture is to ensure that our agriculture can feed our growing population while we do this sustainably and not harm the environment. This is a promise that drone technology is delivering. We must ensure that we accelerate the adoption of this technology and ensure it becomes a common technology in the hands of our farmers.

In the context of Nigeria, what is your vision for the ideal future of drone technology in the agricultural sector? If you had the ability to shape the future of drone technology, what would your vision be for its role and impact in transforming agriculture in Nigeria?

The roadmap or future I see for drone technology is creating something like an “Uber for the drone” ecosystem. It would be an ecosystem where we can create software or digital platforms that explore the length and breadth of drone data to benefit our farmers. That is my vision for the drone space in Nigeria. A future where we can manufacture our drones and build the capacity of the youth across Nigeria so they can see drones as a tool in their toolbox. With digital skills to operate these drones, maintain them, and use them to serve farmers, we can explore the depth of drone data, providing high-resolution insights to deliver benefits to farmers.

What final message or advice would you like to share with the stakeholders in the tomato value chain regarding the importance of incorporating innovation into their practices?

I would like to advise the actors in the tomato value chain to embrace innovation and leverage technology to improve their practice. The tomato value chain is crucial to the agricultural sector and the economy, and innovation can help to enhance productivity and profitability while also addressing some of the challenges faced in the value chain. As we have discussed, the use of drones, precision agriculture, and data analytics can improve yield, reduce post-harvest losses, and enhance market access. I urge everyone involved in the tomato value chain to explore and adopt these technologies to improve their practice and contribute to the growth of the sector.

LEVERAGING HYDROPONICS TECHNOLOGY FOR IMPROVED TOMATO PRODUCTION IN NIGERIA

BY HAMMED JIMOH, WISDOM EZECHI AND PASCHAL ADIKAIBE

Interview Session with Samson Ogbole, Team Lead, Soilless Farm Lab

The tomato value chain is a crucial sub-sector of the agriculture industry due to its significant economic importance, potential for value addition, and contribution to food security. However, Nigeria struggles to meet the demand for the highly consumed, nutritious fruit. To address this, there is an urgent need to explore and scale innovative systems that optimize tomato production while accommodating producers of varying scales, from small to large.

Notably, there are companies at the forefront of implementing innovative approaches, such as hydroponics farming systems, to enhance production efficiencies and effectively manage resources like land. Hydroponics, renowned for producing high-quality tomatoes year-round with extended shelf life, offers promising solutions. To gain insights into the utilization of hydroponics technology within Nigeria's tomato value chain, the Sahel Quarterly team had the opportunity to interview Samson Ogbole, the Team Lead of Soilless Farm Lab. Soilless Farm Lab is a Nigerian farm that specializes in year-round vegetable production using hydroponics technology.

In this interview, we delve into the expertise and experiences of Samson Ogbole, exploring the application of hydroponics technology in tomato cultivation:

What do you think are the main problems associated with the tomato value chain and do you think hydroponics can solve these problems?

Looking at the tomato value chain the first issue is that we do not have seeds produced for the Nigerian climate or weather and this has become a major issue. That is why from time immemorial you will hear, oh! This tomato produces 10kg per plant, yet we cannot get such a yield and result in Nigeria. You are not getting that because it was not meant for you. It means that every time, it feels like you are fighting an uphill battle that is what it looks like. The first is long term, that will be, can we have breeders who breed vegetable seeds in Nigeria? To the best of my knowledge, we do not have any vegetable seed company for vegetables strictly in the country. Although there are existing distributors, we do not have people who are producing these seeds in the country.

Secondly, you realize that what we have as fertilizers in the country are the fertilizers produced in mass not because of what the land needs but because of what the company can produce. It is just about selling and making profits for them. So, you realize that there is an issue of input and there is an issue of knowledge of agricultural practices around tomatoes. For example, most tomato farmers when they harvest their tomatoes cannot store them without refrigeration for more than one week. It will start getting spoilt but from what we do here on the farm, we can keep our tomatoes for one month on top of the shelf and nothing will happen. It will still be fine, and the difference is not magic, we understand the practice through the understanding of how these chemicals are meant to react and, I know how to increase the breed score of these tomatoes naturally. Like the way I breed the nutrients, the way I provide the water, when I provide the water, and when I provide the nutrients. Because of these, the stem of the plant is properly formed such that one month later the tomato is still okay with no refrigeration.

So, one of the basic issues is that we do not have the requisite knowledge and again, everyone is saying that the Government is trying by telling all people to come into agriculture and that is where I have an issue. If we need to do well around the agricultural value chain, there is a need to be intentional about providing the right knowledge to increase the yield, providing the right knowledge to increase yield per square meter. This is because, I hear people say, “we need to farm more land”. No, right now we need to increase production per square meter not necessarily farming more land. So, that is where we summed up the basic issues.

There are general issues like storage, transportation, processing, and all of that. But if you increase the yield per square meter that farmer that is getting 5onnes per hectare can get as much as 100 tonnes per hectare. At 100 tonnes per hectare, he can do just 5 hectares which is enough that his power can carry. He can pay his laborers well, pay himself well and realize that just because there is more yield per square meter, everybody across the value chain can

can make more.

Is it your belief that plants cultivated using hydroponics exhibit better overall health compared to plants grown in traditional soil media?

This depends on what you are comparing with. When you use the word healthy and not healthy. It is like asking for the rice that I cooked with gas versus the rice cooked with a stove and firewood which is healthier. You will agree with me that hydroponic is just that we remove the soil and use other things except for soil. Healthy is not just a function of the medium that I am using to grow or cook, it is much more than that. If the cooking with a stove and the person cooking with firewood do what is right and required when cooking, they will both have healthy food. The same is applicable when the person using hydroponics does the right thing required for plant growth and the person using soil does the right thing required for plant growth. They will both have healthy crops.

However, the reality on the ground is that most of the farmers who plant in soil have never done soil tests, but they use fertilizer. The question now becomes, how do the farmers correctly diagnose without testing because of the method of agricultural practice in Nigeria where we do agricultural on trials and errors, it indicates that most of the food grown on soil is unhealthy which is not the best way to plant. This is not because foods from the soil cannot be healthy, but because the agricultural practices of growing through the soil media made them unhealthy. So, because of the way we practice our primary planting in Nigeria; food grown through hydroponic medium becomes healthier than those grown through the soil media.

Secondly, when it comes to the scientific aspect of the question; it is like asking the “Ajebo” and “Ajekpako” child which one is healthier. By default, we know that the “ajebo” will be healthier. Why? The “ajekpako” is the plant in soil that must struggle hard to get food, compete against the grass, and compete against nature. It is fighting hard to get everything that it needs. In hydroponics, you are providing the plants with everything that it needs on a platter of gold. This means this plant does not have to fight to live, rather it just must live and give you food and nutrients. So, from these two perspectives that is why hydroponics tend to be healthier.

From your perspective, would you recommend that individuals interested in investing in the tomato value chain should seriously consider incorporating hydroponic technology for tomato cultivation?

People willing to invest in the tomato value chain should consider hydroponics, but they must first understand that hydroponics is a tool. If I pick up a pen that I am going to write an exam and my friend is coming for the same exam with feather and ink; assuming I do not know anything about the exam, and my friend knows something. The fact that I came with a pen is not a guarantee that I will pass the exam. My friend using feathers and ink will struggle to pass although, it will take him time; if he has a pen, he will pass. This is a replication in hydroponics and soil farming.

Using hydroponics in tomato farming does not mean I will succeed; it is just a technology that makes the process faster. It is a technology that helps people produce year-round. It is a technology that ensures that you can meet your yield per square meter. It is a technology that increases the amount of input per reuse. It is not a technology that corrects your ignorance of good agricultural practices and if I use hydroponics, I will get to my failure faster. If I know what to do, I will get to my success faster. So, hydroponic is only a technology; it does not correct inadequacy in knowledge. It does not correct inadequacy in knowing the market. It does not correct inadequacy in low hiring, in picking the wrong seeds, and in picking the wrong input. It is just a technology but if you can get these other parts right, hydroponics now gives you an edge.

Considering smallholder farmers as the key contributors to food security in Nigeria and Africa, what specific opportunities do you believe soilless farming, such as hydroponics, offers to smallholder tomato farmers in Nigeria?

The notion that smallholder farmers are the drivers of food security in Nigeria is what kept us behind today in Nigeria. Go to developed nations in the world, you will never hear the saying about smallholder farmers. This is because the smallholder farmers are already poor, so they are producing for themselves first. That is where we need to change the narration, we cannot be investing in people whose stomach is their goal. It is not the fact that they are small that is the issue, it is their mindset that is the issue. And that is one of the major things that the Enterprise for Youth in Agriculture is trying to correct. Yes, we are going to have a lot of smallholder farmers that we are bringing out, but the difference is that we are putting them in a cluster. This is because they are an advantage as a cluster whether in hydroponics or normal farming. It is easier for 50 farmers who owe one plot each making it 50 plots to bring in a tractor than it is for a farmer who owes only one plot and operates outside a cluster. You will realize that technology becomes an advantage when there are numbers. But imagine that you buy a calculator, and you want to use it in calculating one plus one; you will agree that at our level, it slows down your pace. But calculators become an advantage when dealing with large numbers; this is because going manually with large numbers will take time unlike when it is with a calculator.

So, how does hydroponics help smallholder farmers? At first, we need to cluster them so they can be at an advantage of big although they are small. They can get the advantage of commercial farms, although they are small when they write policies and make rules and budget allocations. These things are done for commercial farmers and not smallholder farmers. So, if you are small, automatically what will be left is the crumbs of the policies. So, there is a need to find a way to change this mentality of the small in your cubicle, you are fine. There is no future in being small, the future is in

being large. Everybody that became big in any sector has sustainability built into it. So, why do we encourage mediocrity when it comes to agriculture by saying that smallholder farmers are the future? No! That is not where the issue is; we need to change that.

Based on your experience and expertise, if you were to conduct a cost-benefit analysis of hydroponic technology in the tomato value chain in Nigeria, what conclusion would you draw?

So, it is simple. Is the technology expensive to start? Yes, depending on your level of understanding. What do I mean, it is like somebody asking... buying a biro is it expensive? Yes, if I want to go for all these expensive ball pens. No, if I go for good biro like "bic" and all of that. So, the same thing with hydroponics depending on what you want to achieve. You see, there is this idea for modern technology because of how fancy it is; without understanding the purpose of that technology. If I do not understand the purpose of the technology, I might go for something that is working in the UK but has no business being in Nigeria. One needs to understand one's production needs. You realize that the more you understand what you need, the more you eliminate what you do not need; the cheaper it becomes. That is the foundation, so If I do not know what I need, I may end up spending a fortune buying what I do not need. In the end, I did not get the result I am promised because I want the system to do what it was not meant to do.

There is often confusion between Greenhouse farming and Hydroponic technology. Can you explain the relationship between these two methods of cultivation?

Greenhouse technology is a house that could be a screen house or a net house. It is just a house, and it is like asking why I have a house. We build a house to get shelter from the outside. So, the question is when I want to build a house whether a greenhouse, screen house, or net house; what do I need to protect the plant from or for? That is what determines what I build. So, that is just a house, but that does not mean it is soilless. It is just a house that I am building first. That is the first we need to understand Greenhouse, Net-house or Screenhouse is just a house and that is not hydroponic. I can have a Greenhouse with hydroponic, and I can have a hydroponic without Greenhouse. I can decide to do both, or I can decide to do neither. It depends on what I am trying to achieve which is the key difference between hydroponics and Greenhouse.

Based on your experience, how challenging has it been to educate and train tomato farmers, particularly those with limited education, in adopting and implementing hydroponic technology?

There is a difference between hydroponic set-up and management. The setup might not be easy for everybody, but management is easy for everybody. Everybody can do management, there is no special technical know-how because right now we go to the farms and take measurements. It is the data at your front that tells; what is lacking and what is present. It is that simple with hydroponics.

Could you provide an overview of your work and enterprise focused on empowering youth in the field of agriculture in Nigeria?

Soilless Farmlab focuses primarily on agricultural production. I have been in Agriculture for about 10 years, and I started the whole training for the youths for two years and running. You often hear the whole story that youths are not interested in agriculture. However, this thought should be clarified as follows – are we saying the youths are not ready to work? or the youths are ready to work but not interested in the agricultural ecosystem? That was my first line of thought.

In 2020, we started the whole process of training the youth for free. Over time, we felt that access to funds was a limiting factor to their establishment. We connected them to organizations for funding. Some of these organizations were giving them grants and some gave the youths soft loans and favourable loans from places like NIRSAL. However, there was still a major bottleneck identified along the process, which was that most of the youths coming into the agricultural space did not choose agriculture as a career path. If we make these people stay back in agriculture, there is a need to decipher what is wrong with the system and how can we correct the system.

Enterprise for Youth in Agriculture is a response to the gaps of the challenges that the youths face; firstly, a youth upon graduation would not want to move back home and live in his parent's house – there is an issue of shelter. Secondly, you are telling these youths to have a vision for themselves, but they do not have money to feed themselves, they still want to eat and be alive to have visions. Enterprise for Youth provides leverage for free bed space to cater for the accommodation issue, stipends monthly to support feeding, and provision of free practical hands-on knowledge. We are not just training them for the sake of acquiring additional knowledge, which is mostly the case in our academic system nothing just as you have spent four years in school. We are training the beneficiaries on how to set up the greenhouses and make them business.

Beyond these, we realized the issue of lack of funds to start up the farm when trainees are done. So, we are fortunate to have the support of the Mastercard Foundation, now you can set up your farm. But you are not getting this fund that you will diversify into other things. Instead, this fund is used during your practical training to set up your farms - which means that you have access to start-up finance. Much more than that, you are taught business and you are brought into teams where you learn collaboration. As the beneficiaries produce, they are provided with market linkages where they can sell off their products. This is based on our agreement from the beginning of the training. This is the overview of the Enterprise for Youth in Agriculture.

Based on your experience, is tomato cultivation in a hydroponic system less prone to pests and diseases compared to tomatoes grown in open fields? Additionally, how does the quality of the fruit, including its shelf life, compare between hydroponically grown tomatoes and those cultivated in traditional open-field systems?

Any plant can get disease what matters is your proper management system. Whether it is hydroponics or not. Yes, the pests will attack – they are meant to attack but if your biosecurity is available. It will be harder for those animals or pests or diseases to have access. Even when they have access, because your plant is healthy - It is easier for them to ward off on their own without you having to intervene.

On the shelf-life, our products are lasting longer not because it is hydroponics but because it is properly grown. The plants are grown rightly. Plants are not meant to die off once you cut them off their vine. No! That is not the idea. When they are properly grown, they can last long after you cut them off from their vine.

What measures or quality assurance protocols are in place to ensure that there are no malpractices in the cultivation of hydroponically grown tomatoes intended for the export market?

Yes, you must have a record of how you grow the plants. It is those records that make them trust your result, not another thing. Because they will be checking to know how much fertilizer you added. Alternatively, if you have a sensor on your farm, this will save the production data on the cloud. You just need to give access to the cloud for the data to be accessed for quality control and check. The data from the cloud tells what was done, and with the data, you do not need to test the products to know what to get; instead, the judgment is based on the parameters used to generate such data.

In what ways can individuals residing in urban areas leverage hydroponic technology to participate in tomato value chain production?

Yes! Although it depends on them. This is because the value chain is not just on production. They can be the ones selling the planting seed, and all of that. So, why am I not saying production for them? Because for one to be producing tomatoes on a commercial basis – one still needs a bit of quantity. You cannot be doing one crate of tomatoes, and say you are competing. Except you are doing just one crate to sell on your street.

Is there a connection between hydroponics technology and climate change? Can hydroponics be seen as a means of mitigating the adverse effects of climate change? And what impact does hydroponics have on the carbon cycle?

So hydroponic helps to mitigate the impact of climate change because:

- It is not contributing to climate change like I said, your set-up time is a one-off thing. This means every other year, you are not re-setting up, unlike traditional farming where you must set up at every production cycle.
- Most of the things that could cause climate change such as rice husks and coconut shafts are recycled in the hydroponic system. The hydroponic system reduces the carbon emissions that naturally would have occurred.
- Because we can produce more food per square meter. It means we are saving land degradation. So, what the traditional farmer probably needs 10 hectares for, we can do it on a hectare. So, we have saved emissions from 9 hectares.
- With hydroponics, you can naturally be in the city – which means we can grow plants in the city and capture the emissions from the city with these plants.
- Hydroponics uses less fertilizer than traditional farming systems, which means they are preserving the environment from run-off associated with fertilizer usage.

Yes. It is something that helps in mitigating climate change. It does not contribute to it.

Do you primarily source your inputs from local suppliers or rely on the international market? How does the fluctuation of foreign exchange rates impact the cost of setting up and operating your hydroponic systems?

I buy my input locally but some of these inputs are imported by the vendors that I buy from. Well, forex fluctuation has an impact because every time the Naira falls, the cost of production tends to go up. But, the advantage we have is most of the other things – the nutrients for example are not used in one-off production. You are going to use it for a while unlike in traditional farming. The setting up of the farm itself is not a one-off. So, like a proper businessman – we are not trying to make the cost in one year of production but can be spread across five years of production. You are still going to make a profit. That is where er have a little advantage.

As someone who has been at the forefront of promoting the use of hydroponics technology in Nigeria, what are the main challenges you have encountered in your operations? Also, if you could make an appeal to the Government and policymakers, what specific appeals or requests would you put forth?

Right now, it is in nutrients. This is because the nutrients we use, are not the type they use in traditional farming. And there is this misconception that if you produce fertilizer in Nigeria, we are settled. That is not entirely true, so there is a need for them to understand what we do so that they can make policies for our type of agriculture and not bundle everything as one.

Secondly, we have some exemptions when it comes to importation, but the issue is that they do not understand – they bundled everything up such that we are not able to make proper tax exemptions where we should.

Thirdly, there is a knowledge gap where we do not have a lot of people that understand hydroponics. Though, this is not the government's issue. We just need to do the right thing, which is what we are doing by training people specifically so that they can be subject matter specialists in this area of agriculture. And lastly, the basic infrastructure like power, good road, and others.

To the developmental sector and private sector players. My appeal will be that if you want to do agriculture, do it right. Stop investing in a poor system and expect the poor system to produce rich farmers. Especially those companies who are interested in CRS. Let us be intentional in bringing people out of poverty, not giving them what can only enable them to afford food for the next month and they are back to being poor. For the bigger organizations who must play along the agricultural value chain, they should stop seeing the farmers as the place - they must cheat them off the whole system. This is because they realize that the farmer buys the input; they do not make decisions about the market prices of the input. When it is time for the farmers to sell, these organizations decide the market for those farmers. This implies that at the end of the day, the farmer is just there playing a betting game. They are not intentional about working for the interest of the farmers.

UNLOCKING NIGERIA'S AGRICULTURAL POTENTIAL: REFORMING THE VARIETY RELEASE SYSTEM FOR IMPROVED PRODUCTIVITY

BY AGBARA CHINEDU

Nigeria, Africa's largest economy, has the potential to become a global agriculture powerhouse. With a vast arable land size of 82 million hectares and seven agroecology zones suitable for cultivating diverse crops, Nigeria is well-positioned to lead in the agricultural sector. Additionally, the country boasts a large youthful population of over 200 million, growing at a rate of 2.6% annually, providing a ready workforce and market to drive growth in the industry. With significant export market access for the West Africa region, the potentials are clearly there.

Currently, the country faces several agri-food challenges, the chief of which is the low productivity of its farmers. According to estimates, Nigerian farmers produce only about 40% of what their global peers achieve. These productivity challenges are further worsened by climate change issues, with irregular weather patterns, droughts, flooding, and pest and disease outbreaks increasing the risk of food production and eroding the productivity gains achieved over the years by efforts of global and national agricultural research institutions in the country. Thus, the country relies heavily on imports to meet the food supply gap, leading to unstable exchange rates, unsustainable food inflation, food insecurity, and economic instability arising from disruptions in global supply chains. Researchers estimate that 50% of this productivity gap can be closed using quality seed of improved and adapted varieties and the other 50% using improved cropping practices. Seed is the basis of agriculture production, as the quality and variety of seed planted significantly impact growth, yield, quality, and tolerance to adverse environmental conditions.

There have been notable investments in research and development to produce seed of high-performing crop varieties resistant to emerging pests and diseases and adaptable to changing climatic conditions. Nevertheless, the system supporting the release of these varieties into the Nigerian market has seen little innovation. The National Variety Release Technical Sub-committee, headed by Prof. Olusoji Olufajo, has led the effort to review the variety release system and identify critical areas to improve system efficiency. According to Prof. Olufajo, "The National Crop Varieties and Livestock Breeds Registration and Release Committee has always been concerned with speedy release of varieties and overall efficiency of the variety release process. To this end, the Collaborative Seed Programme under the Nigeria-Netherlands Seed Partnership provided a great opportunity for a comprehensive review of the entire variety release process in Nigeria." The programme he referenced conducted a systems study and recommended innovations that are being piloted. Prof. Olufajo added, "It is gratifying that some of these innovations are already being put into use by the National Variety Release Committee (NVRC), particularly optional value for cultivation and use (VCU) trial for vegetable crops and harmonization of varieties already registered in one country and launched into ECOWAS catalogue."

Indeed, for vegetable crops, the global best practice for VCU trials is to make them optional. The diversity of the crop makes them inappropriate for the one-size-fits-all approach of VCU testing, and niche market varieties may not meet the criteria for commercial viability set for the tests. Ultimately the market is the best determinate of the value for which a vegetable variety is bred. Dr. Akinyode, a tomatoes breeder with the National Horticultural Research Institute (NIHORT), is excited about this innovation stating, "The optional VCU testing for vegetable crops was instrumental in reducing the time required for varietal release of improved tomato varieties from 3 years to 1 year and two months. This allowed us to release three new tomato varieties to farmers in January 2023 with a significantly reduced financial commitment." stating further, "now we can make great strides in our breeding efforts, with the ability to release improved tomato varieties in record time. This breakthrough will help boost agricultural productivity in the country by making it more affordable for farmers to access high-quality tomato seeds." NIHORT is seeking to collaborate with private seed companies with high-performing vegetable varieties to release these varieties into the Nigerian market quicker and cheaper.

Private seed companies are playing leading roles in the reform, contributing funding and novel varieties to innovation pilots. Gideon Orolakin, Advanta Seeds Business Development Manager stated that "ECOWAS variety release harmonization innovation brought about an accelerated release of our quality maize variety from the ECOWAS by reducing the initial timeframe of DUS & VCU testing from 2-3years to 1year,". The company that operates across the ECOWAS region was motivated to join the reform as he stated that "the innovation bridges the gap in registration of seed varieties across ECOWAS and increases the ability to make seed accessible to farmers to improve productivity and livelihood in the region. It would also promote AFCFTA/ECOWAS trade ties on seed registration and trading in ECOWAS countries like Nigeria." The company is also

pioneering innovation in the registration and release of rice varieties. This time the innovation involves the concurrent conduct of mandatory DUS and VCU trials for the release of new varieties. This approach eliminates the wait time involved in the sequential conduct of both trials and is expected to revolutionize how rice and other cereal varieties are developed and released in Nigeria.

While speaking on the potential of optional value for cultivation and use (VCU) trial in the improvement of productivity of tomatoes, Ruth Hazard, the Country Manager of East-West Seed revealed that the time reduction for plant variety release will encourage quick entry of new tomato varieties in the market.

In conclusion, reforming the variety release system in Nigeria is a critical step toward unlocking the potential of the agricultural sector in the country. With the challenges posed by low productivity and climate change, innovative reforms are needed to improve efficiency and ensure that high-performing and well-adapted crop varieties become quickly available to farmers to increase productivity and respond to emerging climate threats. The exemption of vegetable varieties from mandatory VCU trials and the harmonization of ECOWAS release and registration regulation in Nigeria is crucial innovations already yielding positive results, with reduced time and financial commitments required for varietal release. More innovations to the system are in the pipeline and require collaboration between committed private seed companies, public research institutions, and regulatory authorities. By embracing innovations and critical reforms, Nigeria can boost its agricultural productivity, meet the growing food demands of its youthful population, and become a global agriculture powerhouse.

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SAHEL CONSULTING SPEAKS

- **IGNITE Research Summit:** Temi Adegoroye served as a panellist at the IGNITE Research Summit organized by IGNITE on the theme “Research to Action” on January 23, 2023
- **Livestock 247 Annual Retreat:** Hammed Jimoh facilitated a training session for Livestock 247 Doctors on “Training on Effective Data Management in Animal Health Service Delivery.” The event was organized by Livestock 247 on January 24, 2023.
- **ESCP Sensitization Workshop for Smallholder Farmers:** Chinedu Agbara delivered a keynote address on the “One-day Sensitization Workshop conducted for Smallholder farmers on the qualities of improved varieties of seeds and good cultivation practices”. The event was organized by the Institute for Agricultural Research (IAR) in partnership with the Collaborative Seed Programme (CSP) on January 25th, 2023.
- **FMARD Capacity Support Project:** Aisha Hadeija delivered a keynote address during the training program themed “Commercializing and Scaling Research from NARIs to Farmers Leveraging Extension Services”. The event was organized by Sahel Consulting on February 7, 2023.
- **International Women’s Day Celebration:** Temi Adegoroye delivered a welcome remark at the International Women's Day celebration themed "Celebrating Women Change Leaders, Transforming Food Systems in Africa" on March 3rd, 2023.
- Fisayo Kayode gave a presentation highlighting Sahel Consulting's contributions to the agriculture and nutrition landscape, as well as the challenges faced by women and the mitigating efforts by Sahel Consulting on March 3rd, 2023.
- **Nutritious Food System Convening:** Temi Adegoroye co-moderated a breakout session to identify principles of good practices for program implementation for nutritious food systems. The event was organized by the Bill and Melinda Gates Foundation on March 29, 2023.
- **National Animal Feed Summit:** Temi Adegoroye delivered a keynote address at the 2nd National Animal Feed Summit themed “Harnessing Alternative Feed Resources for Sustainable Animal Feed Supply”. The event was organized by Federal Ministry of Agriculture and Rural Development (FMARD), Sahel Consulting and Centre for Journalism Innovation and Development (CJID) on April 11, 2023.
- Hammed moderated a thought-provoking panel session on “Achieving Feed and Food Security in Nigeria through the Commercialization of Alternative Feed Resources Utilization”
- Fisayo Kayode participated in a panel session during the 2nd National Animal Feed Summit on April 11th, 2023.
- **Sahel Scholars Conference:** Wisdom Ezechi gave an introductory speech about Sahel Consulting at the Sahel Scholars Conference at Obafemi Awolowo University. The event was organized by Obafemi Awolowo University and Sahel Consulting on May 4, 2023
- Temi Adegoroye delivered a keynote speech at the Sahel Scholars Conference on May 4 2023.
- **GIZ/ECOWAS Validation Workshop:** Temi Adegoroye gave his opening remarks at the validation workshop for policy gap analysis in West Africa's Rice Sector, in his remarks, he stated that the report developed by the Sahel team will form a road map for various implementation plans in the rice sector of ECOWAS region on May 11 2023.
- **World Milk Day Conference:** Temi Adegoroye spoke at the World Milk Day Conference emphasizing the need for innovation financing in the dairy value chain to enhance smallholder productivity on June 1 2023.
- **Commonwealth Study Conference:** Ndidi Nwuneli gave a presentation on “Scaling Your Impact in Your Communities and Country. In her presentation she highlighted the need to change your mindset and embrace critical values that will change the world, being accountable and understanding what your values are on June 4 2023.
- Buhari Zubairu spoke during a panel discussion session at the Commonwealth Study Conference, addressing challenges across countries, sustainable development goals, and partnerships.

- **CSP Institutional Markets Inception Workshop:** Chinedu Agbara presented key findings from desk research at the CSP Institutional Markets Inception Workshop on June 21 2023.
- **Nexus Global Conference:** Ndidi Nwuneli spoke at the Nexus Global Conference on changing narratives and biases around local ownership in Nigeria and across Africa on June 25 2023.

AFRICAN FOOD CHANGEMAKERS SPEAKS

- **NPR Goats and Soda Interview Feature:** Ndidi Nwuneli, in an interview with NPR Goats and Soda, talked about her works and the impact African Food Changemakers are creating by changing the global narrative about African foods on January 3, 2023.
- **World Economic Forum:** Ndidi Nwuneli spoke at the SDG Tent organized by AGRA-Sustainably Growing Africa's Food Systems and moderated a roundtable discussion at the World Economic Forum in Davos, Switzerland between January 17 - 19, 2023.
- **Meda Annual Convention:** Ndidi Nwuneli delivered a keynote address on the "Crucial Role Africa Plays in the Global Food Systems". The event was organized by Mennonite Economic Development Associates (MEDA) on February 2, 2023.
- **Africa Food Prize Event:** Ndidi Nwuneli spoke and participated in a panel discussion on "Building the Africa Food Prize to Achieve its Full Potential" on February 17, 2023.
- **Appointment:** Ndidi Nwuneli was appointed to the First Presidential High-level Advisory Council for Women and Girls in Nigeria on February 22, 2023.
- **Aspen Climate Summit:** Ndidi Nwuneli spoke at the Aspen Climate Summit in Miami, United States of America, on March 6 - 9, 2023.
- **8TH Agrofood Plast Print Pack Nigeria:** Ndidi Nwuneli delivered a keynote address and served as a panelist on the "Feesding the Cities: Working Together on Common Sustainable Food System with Southwest States". The event was organized by Agrofood Nigeria on March 29, 2023.
- **Skoll World Forum:** Ndidi Nwuneli in attendance at the Skoll World Food Systems on April 13, 2023.
- **Black Women in Food Dine Diaspora Conference:** Ndidi Nwuneli in attendance and participation at the Black Women in Food Dine Diaspora Conference on April 24, 2023.
- **GTCO Food and Drink Festival:** Ndidi Nwuneli duly represented AFC at the GTCO Food and Drink Festival in Lagos, Nigeria, on April 28, 2023.
- **Nigerian-British Chamber of Commerce:** Tapping into foreign investment opportunities in the Nigerian Agribusiness Sector: Ndidi Nwuneli spoke at the Nigerian-British Chamber of Commerce on tapping into foreign investment opportunities in the Nigerian agribusiness sector on May 4, 2023.
- **We Connect African Regional Conference:** Nosa Obano spoke and participated in a panel session at the We Connect African Regional Conference on May 16 – 17, 2023.
- **7th African Leadership Forum:** Odunayo Omotosho in attendance at the 7th African Leadership Forum in Accra, Ghana on May 25 – 26, 2023.
- **US Consulate Roundtable Discussion:** Ndidi Nwuneli and Oladunmade Otitoola facilitated and spoke at the US Consulate Roundtable Discussion with AFC export-ready members in Lagos on May 30, 2023.
- **2023 Duke of Edinburgh's Commonwealth Study Conference:** Ndidi Nwuneli served as a speaker and panelist at the 2023 Duke of Edinburgh's Commonwealth Study Conference on June 5, 2023.

- **UN Food Systems + 2 stocks:** Ndidi Nwuneli participated in UN Food Systems + 2 stocks event held in Rome, Italy, on July 24 - 26, 2023.
- **The NIHOTOUR Gastronomy Food Festival:** Nosa Obano, Cassandra Taiwo, and Joseph Noble participated and facilitated the AFC member's exhibition at the NIHOTOUR Gastronomy Food Festival in Abuja, Nigeria, on June 17, 2023.
- **SEGAL Family Foundation Annual Meeting 2023:** Anna Mambula represented AFC at the SEGAL Family Foundation Annual Meeting in Kigali, Rwanda on July 12 – 14, 2023.

SAHEL CAPITAL SPEAKS

- **AVCA Conference 2023:** Mezuo Nwuneli shared valuable insights on opportunities for exit from domestic institutional investors in sub-Saharan Africa during the panel discussion on ''Creating Value for Successful Exits' and engaged with other participants, discussing Sahel Capital's mission of building resilient food systems in Africa and supporting food security on the continent between May 1 - 5, 2023.
- **Sahel Scholars' Conference:** Tosin Ojo delivered the keynote address on "Amplifying youth voices: The role of young leaders in building sustainable food systems" at the Sahel Scholars' Conference held at the University of Nigeria, Nsukka on June 16, 2023.

UPCOMING EVENT

The changemakers conference seeks to facilitate partnership formation and synergy between public and private actors in the food and agriculture and highlight the opportunity to build on the gains of the previous administration to build a more resilient and equitable food system by investing in Nigerian agribusinesses.

Conference Description

The conference presents the much-needed opportunity to bring together incoming public officials with development partners, agribusiness leaders, and industry experts from various value chains to pool ideas for collaborative strategies to create and support sustainable growth in Nigeria.

Objectives

- Facilitate dialogue between stakeholders on the urgent need to champion cross-sectoral climate-responsive policies and interventions for a systematic transformation.
- Highlight emerging solutions and innovative private sector-led strategies in the agri-food landscape as a sustainable option for a resilient food system.
- Develop a clear blueprint for multi-sector collaborations to scale up successful agri. PPP models for a sustainable food ecosystem.

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