
ASSESSMENT OF THE ADOPTION OF IMPROVED ONION PRODUCTION TECHNOLOGIES AMONG SMALLHOLDER FARMERS IN BENUE STATE, NIGERIA

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ABSTRACT

This study assessed information acquisition and the level of adoption of improved onion production technology among smallholder farmers in Gboko Local Government Area (LGA), Benue State, Nigeria. The study adopted a survey research method using a multi-stage sampling technique to select the 110 respondents, who were farmers who specialize in cultivating onions, to acquire the necessary information through a structured questionnaire. Data analysis utilized the mean, frequency, and percentage. Findings revealed that the respondents were generally in their productive life, with an average age of 45 years. Gender distribution was almost equal (about 51% male and 49% female), and literacy levels were high (80% with formal education). Regarding the availability and access to information, contemporary ICT tools and social media platforms played an important role, with the use of mobile phones (97.3%), friends and fellow farmers (95.5%), and TV (81.8%) were used frequently, whereas contact with extension services was low at 36.4%. The adoption trends indicated increase in the adoption of low-cost agronomic technologies such as nursery bed preparation ($x= 2.84$), Integrated Pest Management ($x= 2.60$), and storage ($x= 2.55$). On the other hand, high-cost technologies such as mechanized land preparation ($x=1.64$) and artificially aerated storage ($x=1.59$) were frequently adopted. The paper concludes that information accessibility and ease of application are major drivers of application. It is recommended that extension services leverage information technology and foster cooperation-based mechanization initiatives to bridge the divide in the adoption of capital-intensive farming technology in onion production.

Keywords: Adoption, Digital Extension, Information Access, Onion Technologies, Smallholder Farmers

INTRODUCTION

Onion (*Allium cepa L.*) stands as one of the most commercially significant vegetable crops globally, indispensable not only for its distinct nutritional properties rich in vitamins and antioxidants but also for its fundamental role as a culinary staple across diverse cultures. In the Nigerian context, onion cultivation is becoming a lifeline for rural economies, particularly in the North-Central region, where it serves as a primary source of seasonal income and household sustenance. However, a significant disparity exists between the crop's potential and the reality on the ground. The sector continues to grapple with staggering post-harvest losses and yields that fall far below global benchmarks, often attributed to inefficient traditional handling and poor access to modern inputs (Adebayo *et al.*, 2021). To bridge this gap, research institutes have pioneered a suite of improved technologies, including disease-resistant, high-yielding seed varieties and sophisticated storage solutions designed to extend shelf life.

The crux of the problem in Nigeria's onion value chain is not a scarcity of innovation, but rather a persistent and widening adoption gap. While advanced tools such as artificially aerated storage structures and plastic mulching films are technically available, their integration into the farming systems among smallholders' farmers remains sporadic. This hesitation is rarely a choice made in a vacuum; instead, it is often a survival strategy. Many farmers remain anchored to traditional knowledge because they lack the extension safety net that is the formal technical guidance needed to mitigate the risks of trying something new and are further constrained by limited financial liquidity (Oladimeji & Abdulsalam, 2022). Moreover, as documented by Adisa and Okunade (2021), the transition from legacy media such as radio to modern Information and Communication Technology (ICT) has inadvertently widened the digital divide. This gap often leaves older or less affluent farmers behind, as they struggle to access the high-speed data or smartphones required for modern agricultural apps.

Furthermore, the influence of social capital cannot be overlooked as observed by Arokoyo (2020), that the reliability of information often depends on the source's perceived trustworthiness, with many rural farmers often favouring peer-to-peer advice over distant governmental directives. This is compounded by the fact that certain technologies require a level of physical and financial scale that many smallholders farmers simply do not possess. For instance, while the low-cost innovations can easily be adopted, the larger-scale mechanization remains out of reach for the average farmer cultivating less than two hectares (Ruzzante *et al.*, 2021). Consequently, understanding the intersection of a farmer's socio-economic profile such as their age, education, and income as well as their preferred information channels is no longer just an academic exercise as it is now a necessity for food security.

The study therefore has the potential to transform extension policy from a one-size-fits-all model into a targeted, evidence-based strategy. By identifying why some technologies gain universal acceptance while others are ignored, it will help agencies like the Benue State Agricultural and Rural Development Authority (BNARDA) move beyond simple information delivery. According to Fadairo, Oladimeji, and Akinola (2023), the goal is to create a localized roadmap that leverages the most effective channels be it mobile phones or social cooperatives to ensure that every onion farmer, regardless of their economic standing, has the tools to thrive. Ultimately, this research seeks to empower farmers to transition from subsistence to a profitable, technology-driven enterprise (Tambo & Wünsch, 2021).

METHODOLOGY

The study was carried out in Gboko LGA, Benue State within the north central part of Nigeria. The survey research method was adopted along side a multi-stage sampling procedure. The first stage involved the purposive selection of five (5) council wards known for high onion production followed by the second stage which selected two (2) villages randomly within the council wards, and finally stage involved the administration of eleven (11) questionnaire to onions farmers in each selected village giving total respondents size of one hundred and ten (110). The data collected were analyzed using descriptive statistics, including frequency distribution, percentages, mean score and standard deviation. Ranking was further used for grading while standard deviation helped to show heterogeneity of the result.

RESULTS AND DISCUSSION

Socio-economic profile of respondents

The result of Table 1 shows the socio-economic profile of the respondents which revealed a compelling narrative regarding the modernization of onion value chains in North-Central Nigeria. The socio-economic landscape presents a demographic that recorded mean age of 45 years which signifies a cohort that occupies the sweet spot of agricultural entrepreneurship possessing the physical stamina for labour intensive onion cultivation while maintaining the psychological resilience required for risk taking. This finding is consistent with the work of Adeoye and Adedokun (2021), but gains depth when viewed through the lens of Anani and Onumah (2025), who posit that middle-aged farmers act as innovation bridges, translating traditional experience into modern productivity.

The staggering 80% literacy rate acts as a catalyst that should ordinarily propel a transition from manual to mechanized farming. Beyond merely reducing the cognitive cost of technology according to Akinola & Adekunle, (2019), the high literacy levels facilitate functional agency, allowing farmers to independently interpret pesticide labels and digital advisories. The observed gender parity (50.9% male; 49.1% female) is particularly striking and challenges the patriarchal stereotypes often associated with commercial horticulture. It suggests that onion production in Benue has evolved into a gender-neutral economic sanctuary, though as Obinne *et al.* (2022) cautioned that equal participation in labour does not always translate to equal control over the derived lump-sum income.

Sources of information on improved onion technologies

The result of table 2 shows the respondents source of information about improved onions production technologies which shows a radical paradigm shift in the information ecosystem with the dominance of mobile phones (97.3%) and the internet (67.3%) over traditional extension agents (36.4%) which marks the dawn of a digital extension revolution in Benue state. This trend reflects a broader global shift where smallholders are bypassing crumbling public advisory systems in favour of real-time, peer-validated data.

According to Fadairo *et al.* (2023) the cost-effectiveness of these platforms is the reason behind their preference with Gouroubera *et al.* (2025) adding that this digital leapfrogging is essential for climate-smart transitions among farmers. Furthermore, the massive reliance on friends and neighbours (95.5%) underscores the enduring power of the social learning theory. In the absence of frequent extension visits, the farm gate becomes the new classroom, where trust-based networks facilitate a contagion effect of innovation adoption (Agbamu, 2019).

Table 1 Distribution of Respondent according to Socio-Economic Characteristics (n = 110)

Variables	Frequency	Percentage	Mean
Age			45
≤251	8	7.3	
26-45	51	46.4	
46-65	41	37.3	
60 above	10	9.1	
Sex			
Male	56	50.9	
Female	54	49.1	
Marital status			
Married	82	74.5	
Single	28	25.5	
Level of education			
Formal	88	80.0	
Non formal	22	20.0	
Farm size (hectares)			2ha
≤ 1.00	53	48.2	
2.00 - 3.00	52	47.3	
4.00+	5	4.5	
Household size (persons)			9
≤ 2.00	21	19.1	
3.00 - 7.00	28	25.5	
8.00 - 12.00	36	32.7	
13.00 - 17.00	17	15.5	
18.00+	8	7.3	
Farm experience (years)			3 yrs
≤ 1.00	25	22.7	
2.00 - 3.00	66	60.0	
4.00 - 5.00	16	14.5	
6.00+	3	2.7	
Annual income (Naira)			447,790.00
≤ 500000.00	72	65.5	
500001.00 - 1000000.00	30	27.3	
1000001.00+	8	7.3	

Source: Field survey 2025

Table 2. Distribution of respondents based on sources of information on improved onion technologies.

Sources	Frequency	Percentage (%)	Rank
Radio	81	73.6	4 th
Friends	105	95.5	2 nd
Extension Agents	40	36.4	8 th
News	47	42.7	7 th
Television	90	81.8	3 rd
Magazine	35	31.8	9 th
Circulars	26	23.6	10 th
Mobile Phones	107	97.3	1 st
Onion Association	81	73.6	4 th
Internet	74	67.3	6 th

Source: Field survey, 2025. Multiple responses recorded

Adoption level of improved onion production technologies

The result of table 3 of the adoption levels of improved onions production technologies revealed a sobering technological dichotomy with a seamless uptake of nursery preparation ($x=2.84$) and IPDM ($x=2.60$), categorized here as knowledge-intensive but pocket-friendly innovations which offer immediate biological feedback, healthier seedlings and fewer pests with minimal financial outlay (Okeke & Nwachukwu, 2021).

In contrast, the capital-intensive frontier mechanization ($x=1.64$) and aerated storage ($x=1.59$) remain largely unconquered. The low adoption here reflects liquidity traps and technical anxiety. According to Tiamiyu *et al.* (2024), the transition to mechanized agriculture in Nigeria is stalled not by a lack of will among farmers, but by the absence of service-provider models that make expensive machinery accessible to those on a smallholder budget. One can safely say that without intervention to lower these entry barriers, the adoption gap of mechanized farming will continue to widen, leaving the most transformative technologies out of reach for the very farmers who need them most.

CONCLUSION AND RECOMMENDATIONS

The study established that onions cultivation in the region has almost equal gender distribution, mostly carried out by younger persons who possess high literacy level which shows a profile of farmers that can easily adopt innovation. The farmers mostly source their information about onions through digital platforms which presents a huge opportunity of the Benue state Agricultural extension outfit to increase their e-Extension operations.

The farmers adoption level reveal shows more preference for pocket friendly innovation and less of the capital intensive ones indicating a need for subsidy, input support and credit line stimulate better adoption of improved onion production technologies among farmers in Gboko LGA of Benue state.

Based on the findings it is therefore recommended that;

1. The Agricultural Extension agencies digitize their outreach by formalizing WhatsApp-based and other digital advisory channels to leverage the mobile phone usage of the farmers.
2. Since individual farmers cannot afford tractors, the government should promote tractor hiring clusters through farmers associations and cooperative societies
3. Low-interest loans should be targeted specifically at post-harvest technologies (aerated storage and processing) to reduce the adoption mean in value addition.

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