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COMPARATIVE ASSESSMENT OF GROWTH PERFORMANCE, ECONOMIC VIABILITY, AND FARMERS PERCEPTION OF DAN-MALAYSIA AND CONVENTIONAL ONION SEED VARIETIES IN SOKOTO STATE, NIGERIA

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ABSTRACT

Onion (Allium cepa) production is a major agricultural activity in Sokoto State, Nigeria, contributing significantly to farmers' income and household food security. The study assessed farmers' perceptions, growth performance, and economic viability of the Dan-Malaysia onion variety compared with conventional local varieties across Wamakko, Gidan Madi, and Gada. Using a qualitative descriptive survey design, 375 farmers were selected through stratified and convenience sampling. Data were collected via structured interviews focusing on varietal adoption, reasons for preference, seed sources, agronomic performance, and adoption constraints. Findings indicate that conventional varieties remain dominant, cultivated exclusively by 60.5% of respondents, while 15.2% adopted Dan-Malaysia only and 23.7% cultivated both. Early maturity (42.9%) and lower production cost (24.3%) motivated farmers to choose Dan-Malaysia, whereas conventional varieties were preferred for familiar management (40%), tradition/local seed use (24%), and larger bulb size (20.8%). Seed sourcing was largely informal, with 49.6% relying on own-saved seeds and 33.9% on local markets, while certified dealers and extension services played a limited role. Agronomic comparisons showed conventional onions achieved taller plants, larger bulbs, higher yield (26,000-29,000 kg/ha), and shorter crop duration (3 months), whereas Dan-Malaysia produced medium bulbs, lower yield (21,000-23,000 kg/ha), and matured over 4-5 months. Key constraints to Dan-Malaysia adoption included limited quality seeds (34.7%), low awareness (29.1%), market preference (22.4%), and fear of small bulb size (13.8%). The study concluded that while Dan-Malaysia offers early maturity and cost advantages, adoption is hindered by structural, informational, and market factors. Improving seed availability, farmer awareness, and extension support were recommended to enhance adoption of improved onion varieties and sustain productivity.

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INTRODUCTION

Onions (*Allium cepa*) are one of the most widely cultivated vegetable crops in the world, playing a vital role in human nutrition and agricultural economies. In Nigeria, onion production is particularly significant in the northern states, where the semi-arid climate, sandy-loam soils, and irrigation systems

support large-scale cultivation (Abubakar, Ibrahim, & Sani, 2020). Among these states, Sokoto is recognized as a leading onion-producing region, with thousands of small- and large-scale farmers engaged in onion farming as a primary source of income. The crop is not only a staple in Nigerian households and food industries but also serves as a major export commodity to neighboring countries such as Niger, Chad, and Cameroon (Bukar & Bello, 2019).

Traditional or conventional onion varieties cultivated in Sokoto are characterized by their large bulb size, high market value, and consumer preference. However, these varieties have longer maturation periods (90-120 days), require frequent irrigation, and are susceptible to pest and disease attacks, particularly thrips, onion maggots, and fungal infections (Yusuf, Ahmed, & Garba, 2018). As a result, farmers spend more on pesticides, labor, and irrigation costs, making onion production relatively expensive. Additionally, rising fuel prices in Nigeria have increased the cost of running water pumping machines, further straining onion farmers financially.

In response to these challenges, a new onion variety locally called *Dan-Malaysia* or *Balakura* has been introduced into the Nigerian agricultural landscape. This variety, reportedly originating from Malaysia, has gained considerable attention among onion farmers in Sokoto due to its faster germination period (5 days), natural resistance to pests, and lower water requirements (Mustapha *et al*., 2023). Unlike conventional varieties, which require consistent watering for several months, Dan-Malaysia appears to thrive with less irrigation, making it a potential cost-saving alternative for farmers struggling with water scarcity and high fuel costs.

Despite these promising attributes, several concerns have emerged regarding the economic viability of Dan-Malaysia. One of the major limitations reported by farmers is its small bulb size, which remains unchanged regardless of extended growing periods or additional irrigation (Mustapha *et al*., 2023). In contrast, conventional onion varieties increase in bulb size over time, making them more attractive to buyers in the Nigerian market, where larger onions are often preferred. Additionally, while Dan-Malaysia offers pest resistance, there is limited research on its overall yield potential and storage quality compared to conventional varieties.

PROBLEM STATEMENT

Onion (*Allium cepa*) production is a major agricultural enterprise in Sokoto State and contributes significantly to farmers' income and household food security (Obalola and Ayinde, 2018). Despite the importance of onion farming, many farmers still rely on conventional local varieties characterized by moderate yield, longer maturity period, and variable market performance (Priya *et al*., 2025). Recently,

the Dan-Malaysia variety has been introduced and is reportedly associated with improved growth performance, higher bulb yield, and better market value (Mahmutović and Velić, 2023). However, empirical data comparing the agronomic performance and economic returns of Dan-Malaysia and conventional varieties under the agro-ecological conditions of Sokoto State remain limited. Furthermore, farmers' perception plays a crucial role in adoption decisions, yet there is insufficient documented evidence evaluating how farmers view the productivity, profitability, and adaptability of these two varieties (Oladele et al., 2025). Without a comparative assessment, extension agencies, policymakers, and farmers lack adequate scientific information to guide variety selection, investment decisions, and agricultural development planning. Therefore, this study seeks to comparatively assess the growth performance, economic viability, and farmers' perception of Dan-Malaysia and conventional onion varieties in Sokoto State.

RESEARCH QUESTIONS

The following were the research questions that guided the survey participated in by farmers in Wamakko, Gidan Madi, and Gada.

1. What onion varieties are cultivated by farmers across?
2. What are the reasons for farmers choosing Dan-Malaysia onions?
3. What are the reasons for farmers preferring conventional onion varieties?
4. What are the primary sources of onion seeds among farmers ?
5. How do Dan-Malaysia and conventional onion varieties compare in terms of growth and yield characteristics?
6. What are the constraints to adopting Dan-Malaysia onion seed among farmers?

METHODOLOGY

Research Design

The study adopted a qualitative research design with a descriptive survey approach. This design was selected to explore farmers' perceptions, practices, and constraints regarding *Dan-Malaysia* and conventional onion varieties in Sokoto State. Qualitative methods were appropriate because the study

focused on understanding farmers' experiences, reasoning for varietal choices, and challenges in adoption rather than measuring statistical differences. Data were collected primarily through interviews, enabling in-depth exploration of farmers' knowledge, attitudes, and practices.

Study Area

The study was conducted in Sokoto State, Nigeria, a key agricultural region in the Sudano-Sahelian ecological zone characterized by a semi-arid climate, sandy-loam soils, and heavy reliance on irrigation. Sokoto is one of Nigeria's major onion-producing states, with both smallholder and commercial farmers. The study focused on Wamakko, Tangaza, and Gada, selected based on high participation in onion farming, irrigation access, and economic dependence on onions. Gada is noted for fertile alluvial soils and high yields, Tangaza benefits from the Gidan Madi Fadama irrigation system, and Wamakko serves as a key distribution hub near Sokoto metropolis.

Population of the Study

The population of the study consisted of an estimated 10,567 onion farmers across the three local government areas of Wamakko, Tangaza, and Gada. These farmers cultivate either conventional or improved onion varieties, with some practicing mixed cultivation. The large population size warranted a sample size that could provide reliable representation while remaining manageable for qualitative data collection.

Sample and Sampling Techniques

The sample size of 375 farmers was determined using the Krejcie and Morgan (1970) table at a 5% confidence level, which provides recommended sample sizes for populations of this magnitude. The total sample was split equally among the three purposively selected towns, with 125 respondents from each town, ensuring equal representation across Wamakko, Gidan Madi, and Gada. These towns were selected because they are the local government headquarters of the local government areas and serve as central hubs for onion farming activities. This allocation provided a balanced and comparable dataset for analyzing varietal adoption, agronomic practices, and adoption constraints in each location.

A combination of stratified and convenience sampling techniques was employed. Stratified sampling was used to group farmers into categories based on the varieties they cultivated: Dan-Malaysia only, conventional only, or both varieties, ensuring that all categories of farmers were proportionally represented in the sample. Within each stratum, convenience sampling was applied, selecting farmers based on availability and willingness to participate in interviews. This approach was justified because

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some farmers were not easily accessible due to irrigation schedules, market activities, or farm locations, and it allowed for practical and efficient data collection while capturing responses from active participants.

Instrumentation

Data were collected using a structured interview guide, specifically designed to capture farmers' experiences, varietal preferences, agronomic practices, seed sources, economic considerations, and adoption constraints. A total of 125 farmers were interviewed in each of the three towns: Wamakko, Gidan Madi, and Gada, ensuring a comprehensive understanding of local practices and perceptions. The interview guide was rigorously validated by three experts in Agricultural Economics and Agronomy to ensure its relevance, clarity, and reliability.

Method of Data Collection

Interviews were conducted face-to-face with 375 farmers across the three towns. The interview schedule captured:

1. Onion varieties cultivated (Dan-Malaysia, conventional, or both)
2. Reasons for variety choice (e.g., early maturity, lower production cost, disease tolerance, familiar management, tradition)
3. Seed sources (own saved seeds, local market, certified dealers, extension/NGO)
4. Agronomic performance (plant height, bulb size, yield, crop duration)
5. Constraints to adopting Dan-Malaysia seeds

Methods of Data Analysis

Data were analyzed using descriptive qualitative techniques, with results presented in tables showing frequencies and percentages. This approach provided a clear understanding of farmers' perceptions and practices, facilitating comparison between Dan-Malaysia and conventional onion varieties.

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RESULTS

Research Question 1

What onion varieties are cultivated by farmers across Wamakko, Gidan Madi, and Gada?

Table 1: Onion Varieties Cultivated Across Study Sites

Variety	Wamakko	Gidan Madi	Gada	Total
Dan-Malaysia only	21	16	20	57
Conventional only	78	81	68	227
Both Dan-Malaysia & Conventional	26	28	35	89
Other improved	0	0	2	2
Total	**125**	**125**	**125**	**375**

Table 1 shows the distribution of maize varieties cultivated in Wamakko, Gidan Madi, and Gada, with 125 respondents selected from each town (total = 375). The majority of farmers (227) (60.5%) cultivate conventional varieties only, making it the dominant type across all three towns, with Gidan Madi recording the highest number (81), followed by Wamakko (78) and Gada (68). Farmers cultivating both Dan-Malaysia and conventional varieties constitute 89 respondents (23.7%), indicating moderate but cautious adoption of improved seeds alongside traditional ones, while 57 respondents (15.2%) cultivate Dan-Malaysia only, showing relatively low exclusive adoption of the improved variety. Other improved varieties are almost nonexistent, with only 2 respondents (0.5%), both from Gada. Thus, conventional maize clearly remains the most preferred variety, while improved varieties are being integrated gradually rather than fully replacing traditional types.

Research Question 2

What are the reasons for farmers choosing Dan-Malaysia onions?

Table 2: Reasons for Choosing Dan-Malaysia

Reason	Wamakko	Gidan Madi	Gada	Total
Early maturity	54	49	58	161
Lower production cost	30	28	33	91
Disease tolerance	20	22	18	60
Extension advice	12	15	10	37
Seed availability	9	11	6	26
Total	**125**	**125**	**125**	**375**

Table 2 presents the distribution of farmers' primary reasons for choosing particular maize varieties in Wamakko, Gidan Madi, and Gada, with 125 respondents from each town (total = 375). The most frequently cited reason is early maturity, reported by 161 farmers (42.9%), with Gada recording the highest number (58), followed by Wamakko (54) and Gidan Madi (49), indicating that farmers strongly prioritize varieties that mature quickly, likely due to climatic and seasonal considerations. Lower production cost ranks second, with 91 respondents (24.3%), showing that cost efficiency is also a major determinant of variety choice. Disease tolerance accounts for 60 respondents (16.0%), suggesting moderate concern for crop resilience, while extension advice influences 37 farmers (9.9%), reflecting some but limited impact of agricultural advisory services. Seed availability is the least cited factor, with 26 respondents (6.9%), indicating that access to seed is less of a constraint compared to agronomic and economic considerations. Thus, the pattern shows that farmers are primarily motivated by practical production advantages, especially early maturity and cost reduction, rather than institutional influence or mere seed access.

Research Question 3

What are the reasons for farmers preferring conventional onion varieties?

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Table 3: Reasons for Choosing Conventional Variety

Reason	Wamakko	Gidan Madi	Gada	Total
Familiar management	50	52	48	150
Tradition/local seeds	30	32	28	90
Larger bulb size	25	23	30	78
Better market price	20	18	19	57
Total	**125**	**125**	**125**	**375**

Table 3 presents the distribution of farmers' reasons for their variety preference in Wamakko, Gidan Madi, and Gada, with 125 respondents drawn from each town, giving a total of 375 respondents. The most frequently reported reason is familiar management, cited by 150 farmers representing 40.0 percent of the total sample, with Gidan Madi recording the highest number at 52, followed by Wamakko with 50 and Gada with 48, indicating that farmers strongly prefer varieties they already understand and can manage effectively. Tradition or preference for local seeds follows with 90 respondents representing 24.0 percent, showing that cultural attachment and long standing practices still significantly influence decision making. Larger bulb size accounts for 78 respondents representing 20.8 percent, suggesting that yield attributes also play an important role in variety selection, particularly in Gada which recorded the highest figure of 30 in this category. Better market price is the least cited reason with 57 respondents representing 15.2 percent, indicating that although income considerations matter, they are secondary to familiarity and tradition. Therefore, the pattern shows that farmers' choices are largely shaped by experience and established practices rather than purely market driven factors.

Research Question 4

What are the primary sources of onion seeds among farmers in Wamakko, Gidan Madi, and Gada?

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Table 4: Main Seed Source

Seed Source	Wamakko	Gidan Madi	Gada	Total
Own saved seeds	61	67	58	186
Local market	42	39	46	127
Certified dealers	18	15	17	50
Extension/NGOs	4	4	4	12
Total	**125**	**125**	**125**	**375**

Table 4 presents the distribution of maize seed sources among farmers in Wamakko, Gidan Madi, and Gada, with 125 respondents from each town making a total of 375. The majority of farmers, 186 representing 49.6 percent, rely on their own saved seeds, with Gidan Madi recording the highest number at 67, followed by Wamakko with 61 and Gada with 58. This shows strong dependence on traditional seed preservation practices. The local market is the second most common source, accounting for 127 respondents or 33.9 percent, indicating that a substantial proportion of farmers purchase seeds informally within their communities. Only 50 farmers representing 13.3 percent obtain seeds from certified dealers, suggesting relatively low engagement with formal seed systems. The least utilized source is extension services and NGOs, with just 12 respondents or 3.2 percent across all three towns. Thus, the pattern reveals that most farmers depend on informal and self managed seed systems, while formal and institutional channels play a limited role in seed supply within the study area..

Research Question 5

How do Dan-Malaysia and conventional onion varieties compare in terms of growth and yield characteristics?

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Table 5: Farmer-Estimated Growth and Yield Characteristics

Variety	Plant Height (cm)	Bulb Size	Yield (kg/ha)	Crop Duration (months)
Dan-Malaysia	44–48	Medium	21,000–23,000	4–5
Conventional	58–65	Large	26,000–29,000	3

Table 5 compares the agronomic characteristics of Dan-Malaysia and Conventional maize varieties. Dan-Malaysia records a shorter plant height ranging from 44 to 48 cm, produces medium bulb size, yields between 21,000 and 23,000 kg per hectare, and has a crop duration of 4 to 5 months. In contrast, the Conventional variety grows taller, with plant height ranging from 58 to 65 cm, produces larger bulbs, achieves higher yields between 26,000 and 29,000 kg per hectare, and matures faster within 3 months. This comparison shows that although Dan-Malaysia is relatively shorter and takes a longer period to mature, the Conventional variety demonstrates clear advantages in terms of plant height, bulb size, yield output, and shorter crop duration. The pattern suggests that farmers seeking higher productivity and quicker harvest are more likely to prefer the Conventional variety, while Dan-Malaysia may appeal in contexts where moderate size and extended growth duration are considered beneficial.

Research Question 6

What are the constraints to adopting Dan-Malaysia onion seed variety among farmers?

Table 6: Constraints to Adopting Dan-Malaysia Onion Seed Variety

Constraint	Frequency (n)	Percentage (%)
Lack of quality seeds	130	34.7
Limited awareness	109	29.1
Market preference	84	22.4
Fear of low bulb size	52	13.8
Total	**375**	**100.0**

Table 6 presents the distribution of constraints affecting the adoption of the Dan-Malaysia onion variety among 375 farmers across Wamakko, Gidan Madi, and Gada. The findings reveal that the most significant constraint is the lack of quality seeds, reported by 130 respondents (34.7%), indicating that input accessibility remains a major structural barrier to adoption. Limited awareness ranks second, with

109 farmers (29.1%), suggesting inadequate dissemination of information and extension services regarding the improved variety. Market preference accounts for 22.4% of responses, reflecting concerns about consumer demand and established market patterns. Fear of low bulb size is the least cited constraint (13.8%), indicating that yield characteristics are comparatively less influential in adoption decisions. Therefore, the results demonstrate that institutional and informational constraints, rather than agronomic performance concerns, constitute the primary barriers to widespread adoption of the Dan-Malaysia onion variety in the study area.

DISCUSSION

The pattern of onion variety adoption across Wamakko, Gidan Madi, and Gada (Research Question 1) shows that conventional varieties remain the dominant type, with 60.5 % of farmers cultivating them exclusively, while Dan‑Malaysia is grown by a smaller share. Similar patterns have been documented in smallholder systems where improved technology adoption is gradual and traditional varieties persist. In Bangladesh, Anik and Salam found that even when improved onion varieties are available, many farmers continue to cultivate traditional types due to familiarity and perceived reliability, reflecting gradual technology uptake rather than rapid replacement of local varieties (Anik & Salam 2015). In Nigeria, Mailumo and Onuwa reported that recommended onion production practices, including improved seed use, showed varied adoption rates across villages, with many farmers still relying on conventional practices, highlighting that improved variety adoption is constrained by farmers' preferences and local conditions (Mailumo & Onuwa 2022). These studies confirm that the dominance of conventional onions in your study area mirrors broader smallholder trends where local practices persist in the face of improved options.

When considering why farmers choose Dan‑Malaysia (Research Question 2), early maturity and lower production cost were the most cited reasons. These motivations correspond with empirical evidence that farmers prioritize agronomic and economic advantages when adopting new varieties. In Tanzania, research by Said, Kidudu and Busindeli showed that farmers valued improved onion seed production options when they translated into practical benefits such as reduced costs and improved crop performance, even when formal support structures were limited (Said, Kidudu & Busindeli 2025). Similarly, Issa and Nti reported that in Kaduna State farmers were willing to adopt improved onion varieties when they perceived early maturation and yield advantages that could improve returns, but limited access and cost constraints moderated adoption (Issa & Nti 2023). These findings align with your results, showing that practical production benefits rather than institutional directives are central to farmer decisions in adopting Dan‑Malaysia.

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Farmers' reasons for preferring conventional varieties (Research Question 3) were grounded in familiar management, tradition/local seed use, and favorable agronomic traits such as larger bulb size. This emphasis on familiarity and experience resonates with studies on farmer varietal preferences in comparable contexts. In Ethiopia, Fikre and Mensa found that farmers often preferred local onion cultivars due to familiarity with their management requirements and consistent performance under local environmental conditions, even when improved options were introduced (Fikre & Mensa 2024). Mitiku's adaptability study in South Omo Zone reported that while improved varieties can yield well, farmers valued traits such as predictable response to local soil and climate conditions that they already understood in local types (Mitiku 2017). Both studies support the conclusion that farmers' preferences are shaped by experience and long‑standing practices, which helps explain the continued prominence of conventional varieties in your sites.

Analysis of seed sources (Research Question 4) showed a strong reliance on own‑saved seeds and local markets, with certified dealers and extension/NGO sources playing a limited role. This reliance on informal seed systems is well documented. Anik and Salam reported that many smallholder onion growers in Bangladesh depended on saved and locally obtained seed due to cost and availability barriers, noting that formal seed sources were underutilized in many areas (Anik & Salam 2015). Similarly, Said, Kidudu and Busindeli found that in Tanzania farmers mainly accessed onion seed through informal channels because formal certified seed outlets were limited or too expensive, leading to continued dominance of self‑sourced seed (Said, Kidudu & Busindeli 2025). These results are consistent with your finding that informal seed systems are the backbone of onion seed provisioning among smallholders in the study area.

Comparison of growth and yield characteristics between Dan‑Malaysia and conventional varieties (Research Question 5) showed that conventional types tended to have taller plant height, larger bulbs, higher yield estimates, and shorter crop duration. This reflects documented differences in varietal performance reported in agronomic studies. In Ethiopia, research by Yebirzaf Yeshiwas and Adgo demonstrated that onion cultivars differed significantly in yield and related traits, with some local checks outperforming improved lines under certain conditions, reinforcing that performance variation among varieties is real and context‑dependent (Yebirzaf Yeshiwas & Adgo 2024). Fikre and Mensa also reported that varietal performance traits such as bulb size and yield influenced farmers' acceptance and preference, with traits that matched local preferences more likely to be adopted (Fikre & Mensa 2024). These studies support the interpretation that agronomic performance characteristics substantially affect farmers' varietal choices, explaining the continued preference for conventional onions in the study area.

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The constraints to adopting Dan-Malaysia (Research Question 6) were primarily lack of quality seeds and limited awareness, followed by market preference and fear of low bulb size. These structural and informational barriers are consistent with other empirical findings. Mailumo and Onuwa found that limited access to quality improved seed and weak extension linkages were key barriers to the adoption of improved onion technologies in Nigeria (Mailumo & Onuwa 2022). In Tanzania, Said, Kidudu and Busindeli reported that inadequate awareness and limited access to certified seeds constrained farmers' willingness to adopt more sustainable onion seed production practices (Said, Kidudu & Busindeli 2025). Both studies reinforce that beyond performance traits, institutional support, seed availability, and information access are critical determinants of adoption among smallholder onion farmers.

CONCLUSION

The study found that conventional onion varieties remain the most widely cultivated in Wamakko, Gidan Madi, and Gada, while adoption of Dan-Malaysia is limited and primarily motivated by early maturity and lower production cost. Farmers depend largely on own-saved seeds and local markets, with minimal reliance on formal seed suppliers and extension services. Key constraints to Dan-Malaysia adoption include limited seed availability, low awareness, and market preferences. Addressing these structural and informational barriers is essential to promote broader adoption of improved onion varieties and improve productivity among smallholder farmers.

RECOMMENDATIONS

1. Government agencies, research institutions and private seed companies should improve the availability and affordability of certified, high-quality onion seeds.

2. Investment in efficient irrigation infrastructure and farmer training on soil fertility management is essential to mitigate drought stress and sustain onion productivity in the dry season.

3. Extension services should be intensified to provide farmers with practical guidance on improved agronomic practices.

4. Farmers should be encouraged to adopt onion varieties with high yield production just like the conventional variety in the present research.

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