



Effects Of Adoption Of Improved Onion Varieties On Farmers' Productivity In Kudan Local Government Area Of Kaduna State, Nigeria

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Abstract

Farmers' consistency in adopting improved crop varieties is capable of guaranteeing sustainable development via high productivity and enhanced food security. The study assessed the effects of adoption of Improved Onion Varieties (IOVs) on farmers' productivity in Kudan Local Government Area (LGA) of Kaduna State, Nigeria. Two-stage sampling procedure was used to select 111 onion farmers from four Wards in the LGA. Structured interview schedule was used to obtain required data. Descriptive statistics (frequency count and percentages), and ANOVA were used to analyse the data. Results shows that the average output before adoption was 3.29 while the mean after adoption was 4.55. ANOVA showed a significant difference between the adopters of improved onion varieties and non-adopters; $F(1,109) = 154.91$, $P < 0.001$. The major constraint to adoption of IOVs was high cost of improved seeds ($\bar{x} = 4.81$). This paper concludes that the adoption of IOVs has effect on the productivity of onion farmers. The National Agricultural Seed Council should ensure availability of improved seeds by fast-tracking seed multiplication and distribution to farmers so as to increase the sustainable adoption of IOVs.

INTRODUCTION

Increasing agricultural productivity in Nigeria is of urgent necessity, for instance through the introduction and use of improved seed varieties. Agricultural production and productivity using improved seed varieties has been identified as a precondition for achieving food security (Adedibe, Abdoulaye & Chikoye, 2017). The achievement of food security remains a major issues in the discourse about sustainable development. Seed is recognised to have the greatest ability of increasing on-farm productivity since seed determines the upper limit of crop yields and the productivity of all other agricultural inputs (Bernard, Jon, Nyikal & John, 2010). Agricultural productivity growth will not be possible without developing and disseminating cost effective yield-increasing technologies, since it is no longer possible to meet the needs of increasing numbers of people by expanding the area under cultivation alone (Kilelu, Klerkx & Leeuwis, 2013). The most important prerequisite for good crop production is the availability of quality seeds of high yielding varieties, adapted to the growing area, and preferred by the farmers. The quality of seeds alone is known to account for an increase in productivity of at least 10–15% (Garba 2019). To achieve this high quality, all the factors in production that will affect viability and genetic purity should be taken into account. The production techniques should be mastered and the environmental conditions (soil fertility and climate) should be known (Garba 2019). This means that, to increase and sustain productivity, it will be critical for farmers to adopt improved and high yielding seed varieties. One of the important measures for sustainable development is improved quality of life. Adoption of improved varieties usually leads to high productivity thereby increasing farmers' income, and subsequently, better livelihood.

Onion (*Allium cepa*) is a seasonal and perishable crop with a comparatively low storability due to its high moisture content at harvest (Dantata, 2011). Based on its widespread consumption and economic value to farmers, onion is among the most important and popular vegetable crops grown in commercial scale in Nigeria (Shehu and Muhammad, 2011). Its bulk of production is concentrated in the northern part of the country, with Sokoto and Kebbi States among the major commercial producing states (Gulma, 2012). Onion production in Nigeria is mainly during the dry season, between the months of September and April, with the peak harvesting season between the months of March and April (Jidda and Benjamin, 2016; Muhammad, 2011). In 2019 alone, it was estimated that about 250,000 tons of green onions and 1,380,000 tons of dry onions were produced in Nigeria. According to statistics and data research, Nigeria had a world share of 5.5% out of a total of 4,491,246 tons of green onions

produced in 2019 and a 1.4% share of a total of 99,068,016 tons of dry onions produced around the world in 2019 (FAOSTAT, 2019).

Sustainable improvement of crop productivity in sub-Saharan Africa depends on improved varieties that are adapted to diverse environments (Keyser, Eillitta, Dimithe, Ayoola & Sene, 2015). This is an area that the National Agricultural Seed Council (NASC) of Nigeria invested in to improve food security and enhance incomes of rural farmers in Nigeria (Awotide, Aliou & Alexander, 2013). About 5-10% of the national seed requirement in Nigeria comes from certified seed, whereas the rest of the seed represents locally produced seed or seed saved by farmers from their own crop (FMARD, 2010). With a few exceptions, most crop varieties being planted now in the country are improved, but often farmers plant such seeds for a long time without replacement (World Bank, 2014). Inadequate quantity of seed and high cost of seed of improved varieties have hampered their acceptance by farmers in Nigeria (World Bank, 2014). For decades, the government of Nigeria has sought to promote its agricultural sector by purchasing agricultural inputs and distributing them to the farmers.

Several factors are responsible for low productivity in onion viz. low yielding variety compared with other onion producing countries, lack of variation in local cultivar, lack of hybrid as well as Open Pollinated Varieties (OPV) high yielding varieties, low keeping quality of summer onion, disease and insect attack, adverse climate, non-availability of seeds (Christine et al., 2019). The use of improved seed in Nigeria is extremely low (Awotide et al., 2013). In 2011, only about 5-10% of the cultivated land was planted with improved seeds and about 10% of rural farmers used improved varieties (Keyser et al., 2015).

With the volume of onions produced in the study area, it is not yet clear whether the production can engender sustainable development. This underscore the need for this study. The broad objective of this study is to analyze the effect of adoption of Improved Onion Varieties (IOVs) on farmers' productivity in Kudan Local Government Area. The specific objectives are to:

- i. describe the socio-economic characteristics of the farmers;
- ii. examine the information sources used by onion farmers;
- iii. access the farmers' level of awareness of improved onion varieties;
- iv. determine the adoption level of improved onion varieties;
- v. identify the effect of adoption of IOVs on farmers' productivity, and
- vi. identify the constraints to adoption of improved onion varieties.

The information produced from this study is expected to be of some value for research institutes

(technology generators), extension agencies and policy makers. This is vital in providing empirical guides to farm-level policies oriented towards improving productivity through adoption of improved onion variety, particularly in onion producing areas in Africa, such as the North of Nigeria.

METHOD

Study area

Kudan Local Government Area (LGA) of Kaduna State was created in 1996. The LGA is located between latitudes 11°18' 27.57"N and 11°18' 34.13"N of the equator and longitudes 07°43'53.82"E and 07°43'57.09"E of the Greenwich meridian and is one of the major onion-producing local government area in Kaduna State. Hence, onion production is a means of sustenance for majority of the farmers. The local government is divided into ten (10) Wards namely: Kudan, Hunkuyi, Likoro, Doka, Kauranwali A, Kauranwali B, Zabin Kudan, Tabansani, Garu and Maraban Danja (Kudan satellite imagery, 2014). Kudan LGA is one of the major onion-producing areas in Kaduna State.



Figure.1: Map of study area

Sampling technique

Two-stage sampling procedure was used for the study. In the first stage, purposive sampling technique was used to select four (4) Wards known to be intensively involved in onion production in the LGA. These Wards which were already known to the researcher's previous knowledge of the area (Kudan, Hunkuyi, Likoro, Doka). Random sampling technique was used to select 10% of the onion farmers from each Ward, thus giving a total of 111 farmers as sample size out of 1,121 onion farmers in the study area for the study (Table 1).

Table 1. Sampling distribution of respondents

Selected Wards	Sample Frame	Sample Size (10%)
Hunkuyi	434	43
Jaja	331	31
Doka	210	21
Likoro	161	16
Total	1,121	111

Data collection and data analysis: Structured interview schedule was used to obtain required data for this study. Farmers were visited at home/farms for the data collection exercise. Data collected were analyzed using both descriptive and inferential statistics such as mean, standard deviation, percentages, frequency distribution and Analysis of Variance (ANOVA).

RESULT AND DISCUSSION

Socio-economic characteristics of onion farmers

The result in Table 2 showed that the majority (85%) of the farmers were males and 14% of the farmers were females. In similar finding Ayinde et al. (2017) reported that majority of the vegetable farmers in Southwest, Nigeria were male, married and polygamous. The dominance of farming by males may be due to crude implements and strenuous activities involved in farming in the study area. This implies that onion production could sustain the farming family. The mean age of farmers was 35years, this showed that majority of the farming population were young and in the active age group implying that the farmers can make positive contribution to agricultural production as well as serve as agents of innovation transfer in farming activities. It further reveals that 91% were married. This could be due to struggle to meet the needs of their families. Household size is one of the major indicators/determinants of social status of a farmer. The average household size was 10 persons. This implies that the respondents had medium household size which could be used as source of labour for onion production hence reducing the cost of labour and production.

Education as defined by many scholars is the wealth of knowledge acquired by an individual after studying particular subject matter or experiencing life lessons that provide an understanding of a particular subject. The level of education of the respondents revealed in the study majority (53%) of the respondents had Quranic education, while 19%, 12%, 7%, 7% had secondary, primary, tertiary, vocational respectively. This finding is in line with the finding of Yusuf (2009) who found that in Kaduna, the highest level of education of the respondents is Islamic education. Furthermore, the result showed a mean of 5.9 years farming

experience. This could have given the farmer the opportunity to know about different varieties as well as understand the productivity of each. Sanni (2009) reported that experience in fish farming influenced the adoption of recommended fish production practices and lead to high economic return. It was noted that the majority (68%) had farm size of <1 hectare, and an average farm size is 0.67 hectares. This implies that farmers are predominantly small-scale farmers as this can hinder the adoption of IOVs. Issa, Kagbu & Abdulkadir (2016) found similar result that small farm size is an impediment to adoption of improved practices.

Table 2. Socio-economic distribution of Onion farmers (n=111)

Socio-economic characteristics	Sub-variables	Frequency	Percentage	Mean (\bar{x})
Sex	Male	95	85	
	Female	16	14	
Age (years)	20 - 29	32	28	34.98
	30 - 39	46	41	
	40 - 49	23	20	
	50 and above	10	9	
Household Size	3 - 7	52	46	10
	8 - 12	34	30	
	13 and above	25	22	
Educational Qualification	Quranic/Vocational	67	60	
	Primary	14	12	
	Secondary	22	19	
	Tertiary	8	7	
Years of Onion Production	2 - 6	57	51	5.9
	7 - 11	31	27	
	>12	23	20	
Farm Size (Ha)	<1	75	68	0.67
	1-2	28	25	
	>2	8	7	
Land Acquisition method	Inheritance	70	63	
	Purchase	20	18	
	Lease	21	18	
Cropping system	Sole cropping	70	63	
	Mixed cropping	41	37	
Extension Visit	Fortnightly	12	10	
	Monthly	8	7	
	Once in a while	30	27	
	Never	61	54	

Source: Field Survey, 2021

Land is one of the key determinant/factor of agricultural production. The result in Table 2 showed that majority (63%) of the farmers in study area respectively acquired their land through inheritance, 18% farmers leased/rent land while 18% farmers acquired land through purchase for production purpose. This shows

that, inheritance is the major source of land acquisition by grain farmers and this is in conformity with findings of Garba (2019) in his study in Kano, who found inheritance to be the major mode of land acquisition, though there were increases in the rates of acquisition through rent and purchase.

Table 2 also established that 63% engage in sole cropping, and 37% engage in mixed cropping. This proves that a substantial number of onion farmers engage in sole cropping. The result also shows that only 10% of the respondents enjoyed the regular (fortnightly) extension visit while 54% never enjoyed extension agent throughout the year. This may result in little awareness of improved onion varieties. This is in line with the findings of Yusuf (2009) who found that poor extension contact affected the use of recommended technologies among women in Kaduna State.

Average yield of onion farmers within the past 3 years (2018-2020)

Table 3 shows that the average yield of farmers in 2018 was 9.86 bags, 26.02 bags in 2019 and 31.52 bags in 2020. Therefore, there was an increase in the production over a 3 years scale, hence, there is great tendency that with the adoption of IOVs by farmers in the study area, there will be a massive increase in onion production.

Table 3. Distribution of average yield of Onion farmers 2018-2020

Year	Average yield (bags)
2018	9.86
2019	26.02
2020	31.52

Source: Field Survey, 2021

Sources of information available to the farmers

Farmers' sources of information on Improved Onion Varieties were identified and the results are as presented in Table 4. It presents a summary of the finding on the sources of information. Friends and relatives ($\bar{x}=2.27$), other farmers ($\bar{x}=2.22$), Agro dealers ($\bar{x}=2.02$). Yaseen, Zu, Yu & Hassan (2016) in similar findings showed that the major source of information for farmers in rural areas are neighbors-friends-relatives, and this is due to the fact that the performance of extension agents is not encouraging. Hence, farmers will have to rely on the sources of information available to them as authentic. In effect, the use of credible sources of information to create awareness about improved onion varieties is desirable for adoption. Adoption research has found that, acceptance of new ideas are associated with the use of credible information sources to enhance sustainable development.

Table 4. Distribution of onion farmers by Sources of Information

Sources of information	Very Frequent	Frequent	Not frequent	Total	Mean (\bar{x})	Rank
Friends/relatives	174	50	28	252	2.27	1st
Other farmers	124	38	34	196	2.22	2nd
Agro-dealers	138	42	44	224	2.02	3rd
Demonstration/Field Day	30	106	48	184	1.66	4th
Internet	48	74	58	180	1.62	5th
Television	60	54	64	178	1.60	6th
Radio	54	78	54	166	1.49	7th
Research Institutes	39	34	81	154	1.39	8th
Extension bulletin	36	4	97	137	1.23	9th
Newspaper	0	22	100	122	1.09	10th
Salesmen/company	0	22	100	122	1.09	10th
Agricultural extension agents	0	8	107	115	1.04	11th

Source: Field Survey, 2021

Farmers' level of awareness of improved onion varieties

Type of onion seeds grown by farmers

In Table 5, majority (78.4%) of the respondents grow local onion seeds while 21.6% grow improved seeds. Farmers further agreed that the main reason for adopting local onion seeds is because of its low cost of production compared to improved seeds.

Table 5. Distribution on Type of Onion Seeds grown by farmers

Type of onion seed	Frequency	Percentage
Local	87	78.4
Improved	24	21.6
Total	111	100

Source: Field Survey, 2021

1. **Awareness level**

Table 6 showed the result for four varieties of improved onion and the awareness level of farmers. Red Tropicana F1 Hybrid, is the highest with 47% onion farmers aware and 52% unaware of this variety. The result shows that the awareness level of improved onion variety in the study area is very low. This could be due to inadequate information on improved onion varieties in the study area. Lwoga (2010) found that inadequate access to agricultural knowledge limits farmers from making rational decisions regarding agricultural production in a manner that encourages sustainable development.

Table 6. Distribution on onion farmers on level of Awareness

Improved Onion Varieties	Unaware		Aware	
	Freq	%	Freq	%
Red creole	69	6	42	3
		2		7
White creole	80	7	31	2
		2		7
Red Tropicana F1 Hybrid	58	5	53	4
		2		7
Bombay Red	84	7	27	2
		5		4

Source: Field Survey, 2021

2. **Adoption level of improved onion varieties**

The highest adopted variety is Red Tropicana F1 Hybrid with a total of 32% (15%; very often and 17%; seldom) onion farmers adopted. This could be as a result of its high yielding, large, red onion with firm pungent flesh. It is highly producing and adaptable hybrid that needs good management and also resistant to common fungal diseases (Oricha, 2019). The result in Table 7 also showed a case of low adoption of improved onion varieties and this is due to the low awareness of improved onion varieties in the study area. This result implies a threat to sustainable development.

Table 7. Distribution of onion farmers on level of Adoption

Onion varieties	Very often		Seldom		Never	
	Freq.	%	Freq.	%	Freq.	%
Red creole	8	7	10	9	93	83
White creole	0	0	6	5	105	94
Red Tropicana F1 Hybrid	17	15	19	17	75	67
Bombay Red	5	4	6	5	100	90

Source: Field Survey, 2021

Effect of adoption of improved onion varieties on farmers' productivity

Effect of output on income of farmers

Table 8 demonstrates that about 72% of respondents agree that the effect of adoption of improved onion varieties on their income was high. This is also in line with Anik and Salam (2015), who found that adopters enjoy higher gross returns, gross margin and net returns than non-adopters. The benefit-cost ratio for the improved variety growers is around 16% higher than traditional variety growers. This implies that adoption of IOVs can ensure sustainable development via increased productivity.

Table 8. Distribution of onion farmers on Effect of output on income

Effect of output on income	Frequency	Percentage
Low	19	17
Average	12	10
High	80	72
Total	111	100

Source: Field Survey, 2021

Effect of output on farmers' standard of living

In Table 9, 45% of onion farmers agreed that their standard of living was average due to their increased income from adoption of improved onion production. This implies that the adopters of improved onion varieties realized higher income and yield compared to non-adopters. The expected outcome of an increased income is improvement in the standard of living of onion farmers. Increased adoption level of Improved Onion Varieties will increase farmers' productivity and hence profit. Farmers enjoy better income and livelihood status (as an index of sustainable development) when they adopt improved seeds (Sirajo and Namu 2018).

Table 9. Distribution of onion farmers on Effect of Output on Farmers' Standard of Living

Effects of output on standard of living	Frequency	Percentage
Low	15	13
Average	50	45
High	46	41
Total	111	100

Source: Field Survey, 2021

Analysis of Variance

Results of ANOVA in Table 10 showed a significant effect of adoption of improved onion varieties on farmers productivity; $F(1,109) = 154.91, P < 0.001$. Hence, the null hypothesis that there is no effect of adoption of improved onion varieties on farmers' productivity is rejected and the alternative accepted. This suggests that

improved onion varieties contribute in enhancing the income and productivity of the adopters of improved onion varieties and therefore, non-adopters can increase their income and productivity level through its adoption.

Table 10: Analysis of Variance

Source	SS	Df
Between groups	18018.5881	1
Within groups	12678.2227	109

Constraints to adoption of improved onion varieties

The result on the severity of constraints to adoption of improved onion varieties is presented in Table 11. The result showed that high cost of improved seeds (\bar{x} =4.781) ranked 1st, which implies that a high fraction of the respondents could not adopt the use of IOVs because of the high cost of improved seeds. This must have been the reason that most of the farmers plant local seeds. Issa and Adiyu (2020) found high cost of inputs as a major constraint

to farming in Kaduna State. Abdullahi (2014) in his findings stated that the lower the cost of the recommended onion practices to the farmers; the higher its adoption. In adoption process, farmers are faced with several constraints but they differ from one farmer to another. Nisar, A.S., Ikram, S., Afzal, M. and Arshad, F. (2011) found that high input prices lead to low yield. Furthermore, high fertilizer requirement of improved onion seeds (\bar{x} =4.79) ranked 2nd while high cost of labour (\bar{x} =4.57) ranked 3rd. High fertilizer requirement is a special characteristic of improved varieties and therefore translates to increased production cost which lots of small farmers run away from. Meanwhile, result on high cost of labour corroborates with the findings of Sadiq (2012) who found that high cost of labour had a negative effect on adoption. This implies that labour is a source of discouragement to the adoption of improved onion variety. This also agrees with the findings of Benjamin (2010) who found that farmers resist agricultural technologies that are labour intensive.

Table 11. Distribution of Constraints to adoption of onion varieties

Constraints	Total	Mean(\bar{x})	Rank
High cost of improved seeds	534	4.81	1 st
High fertilizer requirement of improved onion varieties	526	4.73	2 nd
High cost of labour	508	4.57	3 rd
Unavailability of information on Improved onion varieties practice	488	4.39	4 th
Unaware of Improved Onion Varieties	470	4.23	5 th
Inadequate access to credit	469	4.22	6 th
Unavailability of Improved seeds in the vicinity	456	4.10	7 th
Poor marketing	425	3.82	8 th
Small size of land holding	394	3.54	9 th
Poor Extension services	394	3.54	10 th
Poor consumer preference	385	3.46	11 th
Low yield compared to traditional varieties	310	2.79	12 th

Source: Field Survey, 2021

CONCLUSION

Cultivation of improved onion varieties results in higher output, notwithstanding that it requires more capital, and ultimately results in significantly higher level of return, which is capable of guaranteeing sustainable development. Low level of awareness and adoption of IOVs affects onions productivity. Adoption of IOVs has brought about enhanced living status of farmers. Onion farmers have not enjoyed formal public institution as a source of information despite being confronted with many constraints bothering on high input costs. The following recommendations were made:

1. The National Agricultural Seed Council should ensure the availability of improved seeds by fast-tracking seed multiplication and distribution at subsidized rate to farmers so as to promote, intensify and sustain the adoption of IOVs for sustainable development.
2. Extension agencies and relevant NGOs should create more awareness on the importance of using improved varieties (using various platforms) in order to encourage farmers to adopt the improved varieties.

3. Extension workers should form onion farmers into viable groups so as to beat the high cost of inputs through cooperative actions.

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