



ASSESSMENT OF ADOPTION STAGE OF SOME IMPROVED COWPEA
PRODUCTION TECHNOLOGIES AMONG FARMERS IN ADP ZONE-THREE,
JIGAWA STATE, NIGERIA

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ABSTRACT

The study investigated adoption-stage of some available improved-cowpea production technologies among farmers in ADP Zone-Three, Jigawa State, Nigeria. A sample-unit of 120 respondents was used through a multistage sampling procedure. Data were analyzed using both descriptive and inferential statistics. Majority were males (91.7%), married (75.0%), with main occupation farming (83.3%). Majority were with secondary education (66.7%), primary education (16.7%) and Islamic education (10.8%) respectively. The mean age of respondents is 34 years, farming experience of 11 years, farm size of 7 hectares, household size of 5 persons and monthly income of ₦30,673.51k. Greater proportion (93.3%) were none-members of any cooperative group and no presence of extension-services (91.7%). Available technologies were Tilling and Harrowing Machine with Draft Animal, intercropping with cereals like Millet/Maize, Sun drying/Cleaning/Packaging, pre-planting and pre-emergence use of herbicides (92.5%) amongst others. Adoption stage is at a trial stage ($\bar{x}=3.953$). Major constraints are Lack of Resistant Varieties better than Local Breed, Striga infestation, Insecurity and Inadequate Finance (95.8%) amongst others. The result of the Chi-square analysis showed positive relationship between the educational qualification (0.179), household size (0.281), farming experience (0.277) and average monthly income (0.411) @ $p \leq 0.05$. It was concluded that extension services efforts are not felt by the respondents and some important technologies. It was recommended sustained capacity building trainings and more extension services presence be instituted to achieve full adoption.

Keywords: Adoption, Cowpea, Farmers, Stage and Technologies

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is one of the main significant leguminous crop for livestock nutrition and human consumption. It is extensively cultivated by smallholder farmers, meaningfully contributing to reasonably to healthy diets of rural families and income generation for both women and men households in West Africa. Cowpea grains and leaves have high protein content, up to 32% and 43%, respectively (Boukar *et al.*, 2019a) and provide micro-nutrients (Fe, Zn), vitamins (Desire *et al.*, 2021; Mekonnen *et al.*, 2022) and other essential minerals for human nutrition while its biomass (haulms) provides nutritious fodder for ruminants in the Sahel regions of West Africa. Because of its hardiness, it can grow on marginal lands and under extreme weather conditions, making cowpea one of the most climate-resilient crops (Togola *et al.*, 2023).

Tijjani *et al.* (2015) posited that cowpea is one of the most important staple food crops in sub-Saharan Africa, especially in Nigeria. With protein content of 25%, cowpea remains one of the cheapest sources of protein in the diet of many Nigerians, in addition to its several mineral and vitamins contents (International Institute of Tropical Agriculture-IITA, 2014). Cowpea is also one of the most important economic crops in the tropics for the fact that all of its parts are useful for human consumption and for the provision of livestock feed. It performs well in a wide variety of soils and can tolerate drought. Similarly, the bacteria in the root

nodules improves soil fertility via fixation of nitrogen into the soil and production of organic matter (Ibrahim *et al.*, 2016). It is a major staple food and cash crop in the most states. The crop has a tremendous potential to contribute to the alleviation of malnutrition among resource-poor farmers and to enhance food security and the productivity and sustainability of the crop-livestock system (Mbavai, 2025). As such, cowpea is broadly cultivated around the world. According to FAO (2014), Nigeria, with an estimated annual production of 2.17 million tons, is the highest producer of cowpea in the world. The Nigerian northern region produces around 1.7 million tons over an estimated 4 million hectares of land, which represents over 60% of total national production (FAO, 2014). Notable cowpea producing states in northern Nigeria are Katsina, Kano, Jigawa and Borno.

Cowpea outputs however, in these States has been in decline as a result of problems from obsolete farming-practices, parasitic-weeds, insects and diseases (FAO, 2014; Muhammad *et al.*, 2023) amongst others. An effort to reverse this decline and improve cowpea production in the country began in the 1988 when the Federal Government of Nigeria mandated two agricultural research institutes – International Institute of Tropical Agriculture (IITA), Ibadan and Institute for Agricultural Research, Zaria – to develop some cowpea production technologies suitable for different country's ecological zones (Chiroma *et al.*, 2024). The research project came up with some improved practices for cowpea production and the task of propagating and demonstrating the application of these innovative practices to farmers is the responsibility of Agricultural Development Programs of various states of the federation (Tijjani *et al.*, 2015; Mbavai *et al.*, 2025).

Adoption is an individual or group decision made to use a technology or an innovation in a continuous manner (Orisakwe and Agomuo, 2011; Mohammed *et al.*, 2020). The systematic application of scientific or other organized body of knowledge to practical purposes is termed Technology (Orisakwe and Agomuo, 2011). Among the various are inventions, new ideas, techniques, innovations, materials and methods. The position of technology to agricultural development is cardinal and extensively recognized especially in less developed countries. Hence, studies have reported declining production as opined by Tijjani *et al.* (2015) who revealed decline in cowpea production in cowpea producing states of Katsina, Kano, Jigawa and Borno, due to problems such as outdated farming practices, none adoption of improved seeds and others. In view of the declining cowpea production in Nigeria, it becomes paramount to intensify efforts towards improving its production (Bashir, 2018). The study thus becomes imperative because it seeks to examine the adoption stage of some improved cowpea production technologies among farmers in ADP Zone Three, Jigawa State, Nigeria. The specific objectives are to:

- (i) describe the socio-economic characteristics of the cowpea farmers;
- (ii) identify the available cowpea production technologies to the respondents;
- (iii) examine the stage of adoption of cowpea production technologies among respondents;
- (iv) identify the constraints to adoption of cowpea production technologies.

Hypothesis:

H₀₁: The socioeconomic characteristics of the farmers do not affect their adoption of available improved cowpea production technologies.

MATERIALS AND METHODS

The Study Area

The study was carried out in Jigawa state, Nigeria. The population for the study was mainly all the youth cowpea farmers in ADP Zone Three, Jigawa State. The state is one of



thirty-six states that constitute Federal Republic of Nigeria. It is situated in the north-western part of the country between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E. The state has a total land area of approximately 22,410 square kilometres with twenty-seven (27) local government (NPC, 2006). The topography is characterized by high land areas which is almost 750meters. Soil tends to be fertile ranging from sandy-loamy with many pockets of fadama and alluvial plains suitable for the cultivation of rice, sugar-cane, millet, vegetables and sorghum etc.

The state shares common boundaries with three (3) states and Niger Republic. There are usually two seasons in the state viz the rainy season lasting from June through October and dry season spanning from November to May. The mean temperature ranges from 35°c in October to about 50°c in May, while mean annual rainfall varies from 700mm to over 1000mm and can last up to 200days in some lowland parts of the state. The months of November to March are particularly cold due to dry harmattan wind. Jigawa state is predominantly an Agrarian state with over 80% of the population involved in Agriculture. The major rain fed crops grown in the state includes millet, sorghum, cowpea, groundnut, cocoyam, soya beans. Dry crops include sugarcane, Hot pepper, okra, tomatoes, onions and spinach. The major livestock kept in the state includes, small ruminants (sheep and goat), poultry, cattle etc. The major rivers in the state that provide water for irrigation activities are the Hadejia and Katagum rivers. The Hadejia-Nguru river has the largest fadama area in Nigeria. Jigawa state is divided into four ADP Zones 1, 2, 3 and 4. Zone III, with headquarters in Hadejia comprises of the following eight local government areas: Briniuwa, Kirikasamma, Kafin-Hause, Auyo, Guri, Malamadori, Kaugama, Hadejia.

Sampling Procedure and Sample Size

A multistage sampling technique was employed in picking respondents for the study. The first stage was a purposive selection of ADP zones three based on high proportion of farmers engaged in the cultivation of cowpea as sole crop or as mixed crop with other complementary crops. The second stage engaged a purposive choice of five local governments from the eight LGAs in the ADP zone three (that is Kirikasamma, Auyo, Guri, Kafin-Hausa and Hadejia LGAs) where cowpea farmers abound.

The third stage involved a simple random selection of three communities each from the selected local governments areas to make a total of fifteen (15) communities while the fourth stage was a simple random selection eight (8) respondents each from the selected communities to make a sample size of 120 respondents for the research. Data for the study were collected using a structured questionnaire and interview schedule by trained enumerators from the state Ministry of Agriculture and Rural Development (JARDA).

Analytical Techniques

Descriptive statistical tools like; frequency counts, percentages, mean score, standard deviation and tabulation, while hypothesis tested using Chi-square as inferential statistical tool.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The result in Table 1 shows the socioeconomic characteristics of the respondents. It shows that, majority (98.3%) of the respondents were within the age of 31-40 years with a mean age of 34 years. This is in line with the findings of Nasiru *et al.* (2017) who reported that the mean ages of youth in adoption of rice production and processing technologies in Jigawa state is 34 years.



Table 1: Distribution of the respondents based on their socio-economic characteristics

Variables	Frequency	Percentage	$\bar{x} \pm \delta$
Age (Years)			
0-20	5	4.2	42.2±6.5
21-40	15	12.5	
41-50	99	82.5	
≥ 51	1	0.8	
Sex			
Male	116	96.7	
Female	4	3.3	
Marital Status			
Single	15	12.5	
Married	102	85.0	
Widowed	2	1.6	
Divorced	1	0.8	
Primary Occupation			
Farming	110	91.7	
Civil Servant	2	1.6	
Artisan	8	6.7	
Farming Experience (Years)			
0-5	3	2.5	9.3±2.9
6-10	88	73.3	
11-15	25	20.8	
16-20	3	2.5	
≥ 21	1	0.8	
Educational Qualifications			
No Formal Education	3	2.5	
Primary Education	11	9.2	
Secondary Education	91	75.8	
Tertiary Education	2	1.6	
Islamic Education	13	10.8	
Average Monthly Income (₦)			
1-10,000	1	0.8	33,245.84±18,233.44
11,000-20,000	3	2.5	
21,000-30,000	28	23.3	
31,000-40,000	79	65.8	
41,000-50,000	8	6.7	
≥ 51,000	1	0.8	
Farm Size (ha)			
0-2	98	81.7	1.53±1.12
3-4	18	15.0	
5-6	3	2.5	
≥ 6	1	0.8	
Household Size (persons)			
1-4	16	13.3	6.1±2.3
5-8	101	84.2	
9-12	2	1.6	
≥ 13	1	0.8	
Membership of Social Group			
No	1	0.8	
Yes	119	99.2	
Presence of Extension Services			
Yes	2	1.6	
No	118	98.4	

Source: Field Survey (2025) $\bar{x} \pm \delta$ = Mean ± Standard Deviation

Similarly, Muhammad *et al.* (2023) posited a mean age of 35 years in their study on adoption of recommended agrochemical practices among cowpea farmers in Kontagora and Mashegu Local Government Areas of Niger State, Nigeria.

Majority (75.0%) were married while 91.7% were males. This was in line with findings of Ehien *et al.* (2017) who reported that marriage confers responsibility. Major occupation is farming (83.3%) with mean farming experience of 11 years. Meaning that they are experienced farmers judging from their year of farming experience. Mean farm size of 7.0ha and household size is 5 persons. This was in line with the finding of Muhammad *et al.* (2023) and the work of Orifah and Fadairo (2015) who found that average household size of cassava youth farmers was within 5-6 persons. Significant proportion (66.7%) of the respondents had secondary education followed by primary education (16.7%). This was consistent with the conclusion of Bashir *et al.* (2018) that the majority of farmers (50.0%) had attained one form of education or the other. The average monthly income of famers was ₦30,637.51. Most (93.3%) of the youths were engaged in cooperative movement as their mean of mobilizing savings. The services of extension agent saddled with the responsibility of bring or disseminating improved practices on cowpea was not felt in the study area (91.7%).

Available Cowpea Production Technologies in the Study Area

The result in Table 2 shows the respondents available production technologies on cowpea. Amongst the array of production technologies, the most available technology to the youths' farmers are; tilling and harrowing machines/draft animal, intercropping with cereals, sun drying/cleaning/packaging and pre-planting/pre-emergence use of herbicides (92.5%). Next to these technologies mentioned are use of drought tolerant varieties, application of organic/inorganic fertilizers and use of triple bagging for storage (84.2%). Also available are use of pre and post flowering insecticides, use of threshing machine, compliance to cultural practices like plant spacing, weed control, pest and diseases, and use of insect resistant varieties (80.0%).

Table 2: Distribution of the respondents based on available cowpea production technologies

Variables	Frequency	Percentage	Rank
Tilling and Harrowing Machine/Draft Animal	111	92.5	1 st
Intercropping with cereals like Millet or Maize	111	92.5	1 st
Use of pre and post flowering insecticides	96	80.0	3 rd
Application of Organic & inorganic Fertilizer	101	84.2	2 nd
Combined Harvester	30	25.0	6 th
Machine Drier (Solar Heater)	21	17.5	7 th
Storage (Triple Bagging)	101	84.2	2 nd
Safe Handling for Storage and Processing	58	48.3	5 th
Threshing Machine	96	80.0	3 rd
Manual Winnowing/threshing	66	55.0	4 th
Biocontrol technology cowpea pest (<i>Maruca vitrata</i>)	30	25.0	6 th
Drought tolerant varieties	101	84.2	2 nd
Sun drying/Cleaning/Packaging	111	92.5	1 st
Planting spacing/weed control/pest and diseases	96	80.0	3 rd
Sorting and grading	30	25.0	6 th
Cultural practices: pre-planting and pre-emergence use of herbicides	111	92.5	1 st
Use of Insect resistant varieties	96	80.0	3 rd
Use of Row and Column planting methods	66	55.0	4 th

Source: Field Survey (2025)

These was followed again by use of manual winnowing/threshing methods and use of row and column planting methods (55.0%). Below average proportion (48.3%) of the respondents agreed that safe handling for storage and processing are available while combined

harvesters, biocontrol technology/sorting/grading (25.0%) as well as machine drier (17.5%) were not available to the respondents in the study area. This agreed with the view of Bashir (2018) on the adoption of cowpea production technologies among farmers in Taraba State, Nigeria. However, the result also agreed with the findings of Togola *et al.* (2023) in their study on recent advances in cowpea IPM in West Africa. Mbavai, *et al.* (2025) observed same in their study on factors influencing the adoption of improved cowpea varieties in the Sudan Savannas of Northern Nigeria.

Adoption Stage of Cowpea Production Technologies among Farmers

As indicated in the Table 3 and going through the five (5) stages of adoption process, it can be seen that the respondents featured in all the stages of the adoption process. At the initial stage (Awareness stage) only machine drier ($\bar{x}=1.250$) and biocontrol technology ($\bar{x}=1.908$) were seen. At the second stage (Interest stage) of the adoption, use of combined harvester ($\bar{x}=2.283$) and sorting and grading ($\bar{x}=2.225$) were the only technologies adopted. Looking at the third stage (Evaluation stage), cultural practices like pre-planting and pre-emergence ($\bar{x}=3.042$) was the only technology adopted while at the fourth stage (Trial stage), application of organic and inorganic fertilizer ($\bar{x}=3.808$), planting insect resistant varieties ($\bar{x}=4.100$) and use of row and column planting methods ($\bar{x}=3.808$) were the adopted ones. At the fifth stage (Adoption stage), majority of the technologies were at this stage and these technologies are; tilling and harrowing machines ($\bar{x}=4.975$), intercropping with cereals ($\bar{x}=4.933$), use of pre and post flowering insecticides ($\bar{x}=4.708$), triple bagging storage ($\bar{x}=4.875$), safe handling for storage and processing ($\bar{x}=4.800$), threshing machine ($\bar{x}=4.975$), manual winnowing/threshing ($\bar{x}=4.883$), drought tolerant ($\bar{x}=4.758$) and planting spacing/weed control/pest and diseases ($\bar{x}=4.917$). From the grand total of the mean of the responses on adoption, the adoption index was calculated to be $71.156/18=3.953$. Therefore, adoption index of 3.953 is an indication that the available cowpea production technologies to the youths is in the fourth stage (Trial Stage) of the adoption process.

Table 3: Distribution of the respondents based on adoption stage of the cowpea production technologies

Variables	AW	I	E	T	AD	\bar{x}	D
Tilling and Harrowing Machine/Draft Animal	0	0	1	1	118	4.975	AD
Intercropping with cereals like Millet or Maize	1	1	0	1	117	4.933	AD
Use of pre and post flowering insecticides	2	5	6	0	107	4.708	AD
Application of Organic & inorganic Fertilizer	0	6	14	97	3	3.808	T
Combined Harvester	0	90	26	4	0	2.283	I
Machine Drier (Solar Heater)	111	2	0	0	7	1.250	AW
Storage (Triple Bagging)	2	1	1	2	114	4.875	AD
Safe Handling for Storage and Processing	2	1	1	11	105	4.800	AD
Threshing Machine	0	0	1	1	118	4.975	AD
Manual Winnowing/threshing	0	1	1	9	109	4.883	AD
Biocontrol technology cowpea pest (<i>Maruca vitrata</i>)	29	80	4	7	0	1.908	AW
Drought tolerant	2	1	0	18	99	4.758	AD
Sun drying/Cleaning/Packaging	1	1	1	2	115	4.908	AD
Planting spacing/weed control/pest and diseases	1	1	1	1	116	4.917	AD
Sorting and grading	5	96	12	1	6	2.225	I
Cultural practices: pre-planting and pre-emergence use of herbicides	3	0	108	7	2	3.042	E
Insect resistant variety	2	1	0	97	20	4.100	T
Use of Row and Column planting methods	0	6	14	97	3	3.808	T
Total						71.156	
Adoption Index						3.953	T

Source: Field Survey (2025)

This corroborated the findings of Mbavai *et al.* (2025) on factors influencing the adoption of improved cowpea varieties in the Sudan Savanna areas of Northern Nigeria. Chiroma *et al.* (2024) posited same in their study on effect of adoption of improved cowpea production technologies on the livelihood of cowpea farmers in Shongom Local Government Area of Gombe State, Nigeria.

Constraints of the respondents to adoption of cowpea production technologies

Constraints of the respondents to adoption of cowpea production technologies were shown in Table 4. The most severe among the constraints was financial drawback, lack of resistant varieties better than the local available once, striga infestation and insecurity/killing attached to present farming activities in the northwest zone of the country (95.8%). There was also low literacy level, high cost of inputs/agrochemicals/tractors, infrastructural issues and inadequate improved seeds of cowpea (92.5%). The lack of education depicted in table 1 in which majority (66.7%) were with secondary school education and primary education too (16.7%) is seen as a problem among the respondents. This implies that the respondents were not really educated. Further, there is also inadequate extension services shouldered with the responsibility of passing information on improved practices and innovation to farmers. The impact was not felt as well as poor market information systems (83.3%). Land tenure system which implies the system of land ownership also operating in the study area (82.5%). This implies that most of the youths does not have access to cultivable land for agricultural activities in the study area. Financial bottleneck, high cost of tractor hiring charges which is the reason why the youth depend solely on bull cat on their farms is a limitation too in the study area.

Finally, there is pest and diseases attacks (*Maruca vitrata*) on cowpea (66.7%) causing huge economic losses to the farmers in the study area. Similar constraints were observed in Chiroma, *et al.* (2024) posited same in their study on effect of adoption of improved cowpea production technologies on the livelihood of cowpea farmers in Shongom Local Government Area of Gombe State, Nigeria. This is in congruent with the submission of Mbavai *et al.* (2025) on factors influencing the adoption of improved cowpea varieties in the Sudan Savannas of Northern Nigeria.

Table 4: Distribution of the respondents based on Constraints to Adoption of Cowpea Production Technologies

Variables	Frequency	Percentage	Rank
Low literacy level	111	92.5	2 nd
Inadequate Finance	115	95.8	1 st
Inadequate Extension contact	100	83.3	3 rd
Land Tenure system (Ownership)	99	82.5	4 th
High cost of Inputs/agrochemicals/tractors	111	92.5	2 nd
Infrastructural issues (Transportation)	111	92.5	2 nd
Poor Market Information System	100	83.3	3 th
Pest and Diseases attacks (<i>Maruca vitrata</i>)	80	66.7	5 th
Inadequate Improved Seeds of cowpea	111	92.5	2 nd
Lack of Resistant Varieties better then Local Breed	115	95.8	1 th
Parasitic Striga infestation (<i>Striga gesnerioides</i>)	115	95.8	1 st
Insecurity/killings attached with present farming activities	115	95.8	1 st

Source: Field Survey (2025)

Chi-square Analysis between the Socioeconomic Characteristics of the Respondents and the Adoption Stage of Available Cowpea Production Technologies

It can be seen from the Chi-square result in Table 5, on the socioeconomic characteristics and the respondents' adoption stage of available cowpea production technologies, that only educational qualifications, average monthly income, farming experience and household size shows positive significant relationship with the youths' adoption

of available cowpea production technologies. The implication of this is that the higher the educational level, average monthly income, farming experience and household size of the respondents the higher the youth adoption of the available cowpea production technologies. If the monthly income accrued from the sales of cowpea is higher then, there will be more money to adopt improved technologies on cowpea. The higher the educational level the more their understanding of the technicalities accrued to improved technologies and hence adoption as well as readiness to accept improved innovations (technologies) on cowpea production. The higher the household size the more the available man power for put technologies into operation hence adoption. Finally, the higher the farming experiences the more the youths' adoption of available cowpea production technologies. This is in line with the findings of Sharada (1999), who opined that there is great scope for increasing productivity and adoption through higher levels of formal schooling among youth, despite the traditional nature of rural farming. Debashis and Kanungo (2016) posited that a good number of socioeconomic variables such as average monthly income, educational level, household size among others had positive significant impact on the adoption level of farmers regarding various production related technologies in agriculture. Similar outcome was observed in Mbavai *et al.* (2025) on the factors influencing the adoption of improved cowpea varieties in the Sudan Savannas of Northern Nigeria.

Table 5: Chi-square analysis between the socio-economic characteristics and adoption of available cowpea production technologies

Variables	X ² -value	d.f	P-value	Remarks
Average Monthly Income	0.411 *	5	0.028	Significant
Educational Qualification	0.179 *	4	0.049	Significant
Household Size	0.281 *	3	0.023	Significant
Farming Experience	0.277 *	4	0.041	Significant
Age	-0.114	3	0.399	Not Significant
Marital Status	-0.211	3	0.408	Not Significant

Source: Field Survey (2025) $P \leq 0.05$

CONCLUSION AND RECOMMENDATIONS

Based on the result, the following conclusions can be adduced: extension services efforts are not felt by the respondents in the study area and this was why improved innovations and agricultural technologies on cowpea production were not passed to the respondents at the appropriate time. Important technologies like Combined Harvesters, biocontrol of pests, sorting and grading, machine drier was not available and adopted by the respondents.

The study therefore recommended that:

- Enough Capacity building training is needed to be organized for the cowpea farmers to make them to be up to date in the current cowpea production technologies, saving mobilization culture, farm record keeping and business plan so that they can be up to date with the global agriculture practices.
- Enough extension personnel and subject matter specialists both male and female should be employed and trained by the ADP (JARDA) of the state Ministry of Agriculture to be able to get and solve problems of the cowpea farmers on their constraint areas.
- Improved cowpea seeds should be made available with adequate enlightenment on the handling and safe use of same with technologies compactable with the socioeconomic background of the people.



- (iv) Government should put in-place financial institutional framework such as the community and Micro-finance banks to help the people at the local levels throughout the state to increase adoption from trial stage to full adoption.

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