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EFFECT OF ADOPTION OF IMPROVED COWPEA PRODUCTION TECHNOLOGIES ON THE LIVELIHOOD OF COWPEA FARMERS IN SHONGOM LOCAL GOVERNMENT AREA OF GOMBE STATE, NIGERIA

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ABSTRACT
This research investigated the effect of adoption of improved cowpea production technologies on farmers' livelihood in Shongom LGA of Gombe State. The study described the socio-economic characteristics of cowpea farmers, determined the factors influencing adoption of improved cowpea production technologies on income of the farmers, and identified the constraints experienced by farmers in the adoption of improved cowpea technologies. The sample was selected using multistage sampling proceduretoelicit primary datafrom 120 respondents via structured questionnaire which was analyzed using descriptive and regression analysis. Result indicates that most (87%) of the respondents were male; about 71%falls between15-44 years of age. Farmers were mostly married(82%), havingone form of education or the other, and do not belong to cooperative society (55%), with farming experience of 6-10 years. Cowpea farmers were mostly small-scale farmers with fragmented inherited landholding earning ₦417, 6 averagely annually.Household size, access to seed, yield, improved seed tolerant, farm size and credit were the factors that significantly influenced adoption of improved cowpea production technologies. Thus, farmers with larger landholding are more likely to adopt innovative practices on their farms if they have access to improved seed, expecting higher yield. Constraints impeding adoption of improved cowpea production technologies were; scarcity of improved seed, inadequate storage facilities, pest and diseases attack, poor price of produce and high cost of labour.It is recommended that: farmers should form themselves into cooperative groups to benefit from the advantages of bulk purchase of inputs and market profit, culminating from farmers price control; and government and stakeholders should make availablecreditschemes to empower cowpea farmers considering the importance of cowpea to family livelihoods.

Keywords: Adoption, Cowpea, Gombe State, Livelihood, Shongom LGA,

1.0 INTRODUCTION

1.1 Background of the Study

Cowpea (*Vigna unguiculata* L. Walp) is one of the most ancient crops knownto man and a very salient pulse crop worldwide. In Africa, the bulk of the population live in the rural communities which is responsible for most of the food production for both human and animal, and

incomegeneration is mainly via agriculture(Ahmed *et al*., 2021). Cowpea, a leguminous crop plays an important nutritional role globally, especially in the diets of developing countries populace, where it serves as an essential source of protein, carbohydrate and vitamins (Oni *etal*., 2021). This makes cowpea the cheapest alternative source of plant protein in the diet of rural dwellers in the semi-arid regions across Africa. It is described as one of the most important food grains legume cultivated and consumed by both humans and animals (Mashat*et al.*, 2021). The crop can thrive in the Sahel zone, with minimal rainfall. It is drought tolerant and well adapted to sandy and poor soils(Singh, 2011). Nigeria is the largest cowpea producer in the world (FAOSTAT, 2013), withestimated 45% share of the global cowpea production, with over 55% of the production in Africa (Alene*et al*., 2015). It is also the largest consumer of the crop throughout the world.

Cowpea production is plagued by several issues responsible for low productivity, among which are heavy biotic pressures, like insect and other pest infestation which often affect the plant throughout its life cycle (Agwu, 2004). The author further mentioned other constraints to include poor seeds, sub-optimal planting dates, low plant population, poor weed control, mixed cropping, lack of acceptance and use of improved agricultural technologies by farmers and low soil fertility status. According to Alene and Manyong (2006),there are two channels in which technological change in agriculture can act on food security and livelihood. Firstly, it can directly aid in the improvement of food consumption and security by increasing food production by farmers through means of adoption of the technological innovation, thereby, causing a fall in price of the produce. Secondly, technological change can help improve food security and livelihood indirectly through the impact of adoption by both poor and non-poor farmers on the real income of others, mainly through lower prices of food for consuming households.

In Nigeria, cowpea is produced more in the Northern States, Gombe inclusive. However, cowpea yield has been in decline due to problems such as outdated farming practices and climate change(FAO, 2014). An effort to reverse this decline and improve cowpea production began over three decades ago through the establishment of research Institutes such as Institute for Agricultural Research (IAR),mandated to carry out research that can improve cowpea production (Tijjani *et al.*, 2015). One of their mandates was to develop some cowpea production

technologies suitable for different country's ecological zones. The Institute 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 Extension Agents in order to achieve quicker and vast adoption of the practices.

Not minding the above stimulus, the expected output on cowpea production in Nigeria has not been realized. Over three decades since the commencement of the program, there has been studies that attempted to explore the level of acceptance and adoption of these new cowpea production technologies in Nigeria. A study by Agwu (2004) researched on the factors influencing adoption of improved cowpea production technologies in Bauchi and Gombe States. Tijjani *et al*. (2015)investigated the adoption of recommended cowpea production practices in Rimi Local Government Area of Katsina State, with emphasis on innovative packages developed by IAR.No known study has investigated the effect of adopting these improved cowpea production technologies on livelihood of the farmers especially in Gombe and Shongom LGA in particular which is a huge producer of the crop. However, despite the comparative advantages offered by the use of these improved cowpea technologies, acceptance and use of the technologies by farmers to boost cowpea production vary and have been far from encouraging with emphasis on livelihood(Agwu, 2001). Therefore, this research aimed at investigating the effect of adopting improved cowpea production technologies by farmers on their livelihood in Shongom LGA of Gombe State, Nigeria. Specifically, the study: described the socio-economic characteristics of cowpea farmers in the study area; determined the factors influencing adoption of improved cowpeaproduction technologies on income of the farmers; and identified the constraints experienced by farmers in the adoption of improved cowpea technologies in the study area.

METHODOLOGY

3.1 The Study Area

The study took place in Shongom Local Government Area of Gombe State, Nigeria. It lies in the Northeast geopolitical zone of Nigeria. Gombe is lying between latitudes 9^{o} 30" and 11^{o} 15" N, and longitudes 10^{o} 30" and 11^{o} 15" E. It has a land area of 20,265km^2 (Onwuaroh *et al.*, 2021). As at 2006, the State had a population of 2,365,040 people (National Population Commission,

2007), projecting to 2024, using population growth rate of 3% yearly, the population is 4,145,785 people. Shongom LGA occupies a land mass of 922km² and with a population of 151,520 (National Population Commission, 2007). At 3% growth rate, population of Shongom LGA is 258,517 persons in 2024. Annual rainfall of 560 - 740 mm (July - October) is experienced in the area. The area is bounded to the north by Akko LGA and to the west by Kaltungo LGA, the south is bound by Billiri LGA while, Karin-Lamido and Alkaleri LGAs in both Taraba and Bauchi States forms the eastern boundaries of Shongom LGA (Dede *et al.*, 2005). It has sparse vegetation and enjoys hot weather climate most part of the year (Shamaki *et al.*, 2009). Majority of the residents are mainly farmers cultivating crops like cowpea, maize, groundnut, rice and soya bean.

The sample for the study was selected via multistage sampling procedure. Shongom LGA was purposively selected for the study due to the dominant production of cowpea in the State. A total of 120 respondents were randomly selected from eight cowpea producing communities for the research. Primary data were elicited through structured questionnaire. Both descriptive and inferential statistics were used to analyze data for of the study. Regression models were fitted to the data to select the most suitable based on *a priori* expectations, coefficient of determination (R^2), levels of significance, and the F-value for suitability of the data to the model, for further interpretation of the result. The explicit linear model is expressed as:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + e_1$$

Where:

Y = amount/quantity sold (Naira)
β_0 = constant term
$\beta_1 - \beta_{11}$ =regression coefficients
X_1 = age of farmer (years)
X_2 = farming experience (years)
X_3 = educational status (years)
X_4 = extension contact (dummy: yes = 1, otherwise = 0)
X_5 = Seed (kg)
X_6 = yield (quantity of cowpea harvested (kg)
X_7 = improved seed tolerant (dummy = 1 male; female 0)
X_8 = early maturity (dummy: yes = 1, otherwise = 0)
X_9 = marketability (dummy: yes = 1, otherwise = 0)
X_{10} = farm size (hectares)
X_{11} = credit (amount received, Naira)
e_1 = error term

4.0 RESULTS AND DISCUSSION

Table 1 shows that the majority of the respondents were male, making up around 87% of the sampled population. This indicates that the male population has a predominant role in the production of cowpea in the region. This phenomenon can be ascribed to the land tenure system and cultural customs prevalent in the region, wherein males are bestowed with a greater inheritance of land and landed assets compared to females. The cultural norm allows males to participate in the bulk of activities, while females are primarily responsible for sustaining the family and carrying out domestic tasks. Men enjoyed greater mobility and the flexibility to access many sources of learning, such as seminars, meetings, and training sessions, without any obstacles. In contrast, women were sometimes restricted by cultural and religious whips. The outcome aligns with the claim made by Onwuaroh *et al*. (2021), who documented the prevalence of male predominance in maize cultivation in Shongom LGA. Furthermore, these findings support with the research conducted by Harrison and Oguntunde (2021) on the influence of agricultural extension service delivery on cassava production in Kwami Local Government Area in Gombe State, Nigeria. Their study revealed a higher proportion of male farmers compared to female farmers in the same region.

The results of the study demonstrates that age which is a prominent aspect in farming activities as energy is highly disbursed throughout the farming operation, revealed that most of the farmers were youthful and energetic as they included roughly 71% (15-44 years) of the sampled population. The outcome suggests that cowpea cultivation will receive significant attention as a result of the enthusiastic nature of the farmers. Also, this might constitute a good occupation of the young men who might wish to make it in life via farming of cowpea, consequently, high attention will be paid to enhance cowpea production. Younger farmers contribute to the change of agriculture by being receptive to integrating new technologies, such as enhanced cowpea varieties, in order to boost productivity and better livelihood. In a similar vein, Bashir *et al*. (2018) discovered that more than three-quarters (75%) of the participants fell within the age range of 20 to 49, a demographic known for their adaptability and willingness to embrace advancements in technology. This is in line with the findings obtained by Sani *et al*. (2014), who showed that the young age farmers in the Bichi Local Government Area of Kano State, Nigeria, produced dual-purpose cowpeas on a very big scale.

It is impossible to exaggerate the relevance of education in all human efforts since it is a vital component of human capital that can be utilized to impact change. Educational status of the respondents show that most (44%) of the sampled population got secondary school education while about 33% had tertiary education. This means that majority of the respondents were literate and could grasp the need of adopting and producing upgraded cowpea technologies and get profit for maximal utility actualization. Education is vital when it comes to farmers making judgments on farming technologies. This is consistent with the conclusion of Bashir *et al*. (2018) that the majority of respondents (50%) had attained some type of schooling. According to Kamara *et al.* (2018), the degree of education of farmers and their usage of technology were substantially correlated.

The marital status of the respondents indicate that approximately 82% of the respondents were married, reflecting high nature of responsibility. In order to prevent poverty within their households, the respondents will be highly motivated to engage in farming activities especially using improved technologies. This act of responsibility could have stimulated the farmers to adopt innovations that could boost their cowpea productivity. This finding was identical with that of Ogunmefun and Achike (2015) which found that majority of the respondents were married in Odogbolu Local Government Area of Ogun State, Nigeria. Onwuaroh *et al*. (2021) obtained a related finding. The parallels as noticed in the preceding studies could be ascribed to the fact that both researches were conducted in rural areas which in most cases do have people marry at an early age to increase manpower.

Cooperative society membership could allow a member to benefit from the bulk purchasing of inputs and collective negotiating power for sale of farm produce. The statistics show that most of the respondents were not members of cooperative society, constituting roughly 55% of the sampled population. Cooperative membership is frequently exploited as a stand-in for social capital and can be helpful, especially when the issues presented during member meetings are pertinent to the difficulties they are experiencing. Additionally, cooperative organizations permit the sharing of knowledge regarding urgent and delicate problems as well as the best approaches to manage them, and some extension agents prefer to hold frequent meetings with cooperative

groups rather than with individuals. Nwaiwu (2015) showed that 80.7% of farmers in southeast Nigeria belong to cooperative groups, which is in contradiction to the findings of this study.

Majority (28%) of the respondents had farming experience of 6-10 years. This occurred as a result of the respondents' youthful age, as experience frequently grows with age. This means that cowpea farmers in the research area can quickly find upgraded technologies that can boost their production and increase revenue and livelihood. Their degree of competence can contribute in the adoption of improved cowpea technologies; it may be sufficient for a good and palpable output, and it can discern between excellent and bad technologies. A farmer's level of dedication to agriculture is usually demonstrated by how long they have been farming. Bashir *et al*. (2018) indicated in their analysis that the majority of the respondents had 6-15 years of farming experience in cowpea cultivation in Taraba State Nigeria.

Considering that a larger number of the studied farmers are young individuals and that most farming areas are owned by families, the size of the average farm cannot be particularly huge due to land fragmentation. According to the data, the bulk of the cowpea farmers in the research area are small farm owners, with 87% of the sampled respondents having less than 3 hectares of land. This has negative implications for investment and return on scale in terms of food security and livelihood enhancement. This has effect on cowpea productivity negatively compared to a huge scale of land. This conclusion is similar with the research of Rabe *et al*. (2022), which indicated that, with an average farm size of 3 ha, agriculture was the most significant activity for all respondents.

According to the Total Farm Income from cowpea output, 42% of cowpea farmers yearly earn ₦251,000 – ₦ 500,000 with an average income of ₦417,631. This shows that they are small scale farm owners who make little money. Also, they could be mixed farmers who may be intercropping, so their revenue is not from a single source. Also, due to the fact that many farmers do not maintain farm records, it is difficult to ascertain the income level of farmers. Farmers that make more money will produce more cowpea because they can afford the new technologies. The finding is identical with Tijjani *et al.* (2018) survey, which indicated that, in the most recent cropping season, most farmers (59.1%) earned between ₦201,000 - ₦400,000

while just 4.5% made ₦801,000 or more. The data suggests that 45% of the respondents had acquired land for cowpea farming via inheritance. Thus, the land is subject to fragmentation.

Table 1: Socio-Economic Characteristics of Respondents

Variable	Frequency	Percent	Mean
Sex			
Female	16	13.3	
Male	104	86.7	
Age			
15-24	18	15.0	
25-34	37	30.8	
35-44	30	25.0	
45-54	27	22.5	
55 and Above	8	6.7	
Educational status			
Primary	23	19.2	
Secondary	53	44.2	
Tertiary	39	32.5	
Quranic	5	4.1	
Marital status			
Single	22	18.3	
Married	98	81.7	
Cooperative society member			
No	66	55.0	
Yes	54	45.0	
Years of farming experience			
1-5	27	22.5	
6-10	34	28.3	
11-15	27	22.5	
16 and above	32	26.7	
Farm size			
<1 ha	42	35	
1-3 ha	62	51.7	
>3 ha	16	13.3	
Annual Income (₦)			
Below 250,000	43	45.0.	417,631.2
251,000 - 500,000	50	36.7	
501,000 - 700,000	15	12.5	
701,000 - 1,000,000	10	4.0	
1,000,001 - 10,000,000	1	0.8	
Method of land acquisition			
Inheritance	54	45.4	
Purchase	44	37.0	
Lease	15	12.6	
Others	6	5.0	
Total	**120**	**100.0**	

Source: Field survey, 2023

3.2 Factors influencing adoption of improved Cowpea production technologies on income of the farmers

The result reported in Table 2 demonstrated the parameters influencing adoption of improved cowpea production technologies in the study area. Technology adoption by farmers is a crucial

pre-requisite for economic growth in emerging countries. The coefficient of determination (R Square) of the equation was 0.57, meaning that 57% of the factors influencing adoption of better cowpea producing technologies were represented in the model. Also, the F-value statistic indicate a significant value of 3.4; implying the data complies with the model. The research shows that age, educational level, yield, enhanced seed tolerance and marketability were adversely signed; reflecting a fall in the income of the farmers. This conclusion shows that an increase in the age of the farmer would lead to lower likelihood of adoption of enhanced cowpea producing technologies. In other words, young farmers are predicted to be more keen in implementing rice technologies on their farms than older farmers, being that they are risk bearers in decision making. This is because, as farmers become older, there is an increase in risk aversion and a diminished interest in long-term investment in the farm. As a farmer advances in age their adoption rate for rice variety drops (Udimal *et al.,* 2017).

However, household size, access to seed, yield, better seed tolerance, farm size and credit were the elements that significantly influenced adoption of the improved cowpea production technologies in the area. This conclusion is in agreement to the study of Chandio and Yuansheng (2018), Abubakar *et al,* (2016), who found that farming experience was a significantly positive factor, meaning that with 1% increase in farming experience, adoption of enhanced cowpea technologies will also increase. Seed is the important input in agriculture and to a great extent the yield and quality of the crop depend on the quality of the seed planted (Awotide *et al*., 2012). Similarly, Chekene and Chancellor (2015) in their investigation on factors that affect adoption of improved rice varieties in the Southern part of Borno State, Nigeria, found a similar result that access to improved rice seed was positively and significantly affecting adoption of rice technologies.

Increased seed tolerance was found to strongly influenced adoption of enhanced rice technologies at 5% level of significance, resulting to increase income. Furthermore, farm size is projected to significantly influence adoption of enhanced cowpea technologies in the research area. Hence, farm size is favorably helping to participation of improved cowpea technologies significantly. This assertion shows that farmers with substantial landholding are more likely to implement enhanced cowpea technologies on their farms. They will be willing to utilize their

land to modern agricultural technologies compared to those with smaller landholdings; as supported by Abubakar *et al.* (2016), Kumar *et al.* (2016), Singh and Varshney, (2016) and Hussain, (2012). Credit was found to be important, showing that credit promotes adoption of better cowpea technologies in the study area. This is attributed to the fact that inputs and some of the upgraded technologies are purchased at high cost, consequently, the farmer needs money to compensate for the inputs.

Table 2: Factor influencing the adoption of improved cowpea technologies on income of the farmers

Coefficients	**B**	**Sig**
Farming experience	4984.27	.06*
Age	-115.21	.89
Educational Level	-28675.03	.17
Extension contact	31202.94	.27
Access to seed	61318.74	.09*
Yield	-1138.10	.09*
Improved Seed tolerant	-103700.90	.03**
Early maturity	21600.27	.53
Marketability	-37841.79	.26
Farm size	69098.93	.06*
Credit	2542.01	.04**
(Constant)	38742.65	.56

R-square = 0.57; F-value = 2.4; *, ** significant at 10% and 5% respectively
Source: computer print-out

3.3 Constraints experienced by farmers in the adoption of cowpea technologies

Constraints against the adoption of cowpea production technologies include; inadequate finance, unavailability of seed variety, inadequate storage facilities, attack by pest and diseases, unawareness of the cowpea technologies, poor price of product/produce, high cost of labor and harvesting problems (Table 3). Due to unavailability of cash by the farmers, producers are unable to acquire necessary farm inputs, which can postpone the adoption of enhanced cowpea technologies. Furthermore, farmers who are discouraged by scarcity of funds may not be able to purchase inputs and engage staff. Poor institutional financing accessibility is a significant impediment to the implementation of enhanced cowpea technologies in the study area. As money is required for the purchasing of cowpea technologies, it follows that having access to loans will considerably benefit in the adoption of improved cowpea technologies. This finding is analogous

to one made by Kadafur *et al*. (2020), who found that inadequate fund of modified maize seeds, fertilizer, pesticides, and herbicides inhibited the adoption of better maize varieties in Borno State Northern Guinea Savannah.

Pests and diseases were always to blame for the pre-harvest and post-harvest losses sustained by cowpea producers in the study area. Farmers are obliged to sell their cowpea bags at the moment of harvest as the damage this create makes it difficult for them to store their produce. This largely validates the claim stated by Bashir *et al*. (2018), which reveals that pest and disease assault is the most incredibly important constraint faced by cowpea producers in the study area. Unavailability of seed variety was highlighted as a constraint with about 85% agreeing to this limitation. This indicated that without suitable enhanced seed, adoption cannot take place even in the face of great awareness. Where the seeds are not available, adoption is impeded. High cost of labour was mentioned by 67% of the respondents. Inadequate storage facilities was indicated to be a restriction by 64% of the selected respondents however, inadequate pricing of produce was highlighted by 63% as a problem militating against production of cowpea in the study area.
Table 3: Constraints experienced by farmers in the adoption of cowpea technologies

Constraints	***Frequency**	**Percent**
Inadequate fund	107	89.9
Pest and diseases attack	95	79.8
Lack of awareness	82	68.9
Unavailability of seed variety	101	84.9
Poor price of product	75	63.0
High cost of labour	80	67.2
Inadequate storage facilities	76	63.9
Harvesting problems	68	57.1
Storage problems	67	56.7

Source: Field survey, 2023; *multiple response

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The research established that young married male dominate in cowpea production,thus, they might be willing to actively participate in farming activities as an enterprise to cater for their household and other duties, with adequate literacy to underscore the importance of improved

technology in agriculture especially in cowpea production. Farming on inherited family's lands has caused land fragmentation making them small-scale farmers. If recommended improved cowpea technologies are further utilized, the money accruing from cowpea production will override the minimum wage in Nigeria, signifying its reliability and self-sufficiency. Household size, access to seed, yield, better seed tolerance, farm size and credit were the elements that strongly influenced adoption of improved cowpea production technology in the area. Therefore, farmers with substantial landholding are more likely to implement improved cowpea technologies on their farms if they have access to enhanced tolerant seed and finance that might help in employment of labour and purchasing of inputs. Due to scarcity of cash, farmers may be unable to purchase necessary farm inputs, thereby delaying adoption of better cowpea technologies. Furthermore, farmers who are discouraged by scarcity of funds may not be able to acquire inputs and hire required labour timely. With infestation of pest and illnesses in both pre-harvest and post-harvest, farmers may be obliged to sell their cowpea yield as soon as they are harvested to prevent incurring more losses because preservation is very difficult.

4.2 Recommendations

It is recommended that;

1. Farmers should form themselves into cooperative groups to benefit from the advantages of bulk purchase of inputs and market profit culminating from the price control by the farmers;
2. Government and stakeholders should make availablecreditschemes to cowpea farmers, considering the importance of the crop to the economic development of the nation.
3. Silos and other grain storage facilities should be made available to the farmers by concern stakeholdersat subsidized rate.

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