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CONTRIBUTION OF AGRICULTURAL EXTENSION SERVICES TO HOUSEHOLD FOOD SECURITY AMONG COWPEA FARMERS IN BIU, BORNO STATE

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ABSTRACT: This study examines the socio-economic factors affecting household food security in Biu LGA, focusing on the role of agricultural extension services and coping strategies. Using data from 150 respondents, key factors such as age, education, family size, credit access, and farming experience were found to influence food security. Extension services positively impacted food security through training and market linkages, though gaps remain in access to technology and credit. Common coping strategies included meal skipping and reduced diet quality. The study underscores the need to strengthen extension services, improve credit access, and implement targeted interventions to enhance food security and household resilience.

Keywords: Household food security, socio-economic characteristics, contribution, cowpea farmers

INTRODUCTION

Cowpea (Vigna unguiculata), commonly known as black-eyed pea, is a key leguminous crop widely cultivated in West Africa, especially in Nigeria, where it serves as a vital source of protein, vitamins, and minerals, particularly in rural areas with limited dietary diversity (Singh *et al.,* 2019). Its adaptability to drought and poor soils makes it an essential crop in Borno State, including Biu LGA, where erratic weather and low-input farming systems dominate (Kamara *et al.,* 2018; Adama *et al.,* 2021). Cowpea supports food security by providing affordable protein and improving soil fertility through nitrogen fixation, while also serving as livestock fodder and a source of income (Ajeigbe *et al*., 2020). Despite its resilience and importance, cowpea production in Biu faces challenges such as pest infestations (e.g., Callosobruchus maculatus, Maruca vitrata), limited access to quality seeds, poor extension services, and inadequate post-harvest management (Omoigui *et al.,* 2017; Maina et al., 2023). Farmers often rely on indigenous pest control methods, which are not always effective. Nevertheless, introducing improved, pest-resistant, and drought-tolerant cowpea varieties, along with enhanced extension services, can significantly boost productivity (Egho, 2019; Adegbite ***et al.,*** 2020).

Agricultural extension services are crucial for disseminating innovations and improving smallholder productivity, especially in rain-fed, climate-affected areas like Biu (Allahyari & Sadeghzadeh, 2020; Zougmore *et al.,* 2018). These services help farmers acquire knowledge and skills for better farming practices (Sarumi & Osu, 2019; Rivera & Alex, 2003). Effective extension involves integrating local and scientific knowledge and promoting community participation, which fosters adoption of new technologies, social cohesion, and food security (Ngigi, 2003; Somanje *et al.,* 2021; Chege *et al.*, 2018; Bardhan, 1989). Despite cowpea's significance in nutrition, income generation, and soil fertility, the specific role of agricultural extension services in enhancing household food security among cowpea farmers in Biu remains underexplored. Understanding this contribution is critical, as extension services provide the platform through which innovations can be transferred, farmer capacities built, and

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sustainable agricultural practices promoted. This study therefore aims to examine the contribution of agricultural extension services to household food security among cowpea farmers in Biu Local Government Area of Borno State, Nigeria, with the goal of identifying pathways for strengthening their effectiveness and impact.

METHODOLOGY

Biu is a town and a Local Government Area (LGA) headquarter in southern Borno State of Nigeria. The town is the administrative center of the LGA and was once the capital of the Biu kingdom, and is now capital of the Biu Emirate. Biu lies on the Biu Plateau at an average elevation of 626 meters. The region is semi-arid, the various culture and tribes that are there is Pabir Bura, Fulani, Margi, and Hausa. Seconds (DMS) latitude longitude coordinate of Biu is $10^0$36'46.26" N, $12^0$11'40.49" E, the district's yearly temperature is 32.16^{0}C (89. 89^{0}F) and it is 2.7% higher than Nigeria's averages. Biu typically receives about 36.38 milliliters (1.43 inches) of precipitation and has 61.57 rainy days (16.87% of the time) annually. The rainfall duration is about six to seven months (March/April to October) and crops mostly grown in Biu includes; cereals, cowpea, soybeans, groundnut. Biu LGA has a total population of about two hundred and fifty-seven thousand, five hundred people with about 3,165 km^2 area, with population density of 81.36/km^2 and annual population change 2.4% annual population change. The region's climate, characterized by a semi-arid environment with an average annual rainfall ranging from 600 to 800 mm, supports the growth of cowpea, which is well adapted to such conditions (Abubakar *et al.,* 2020).

Sampling Procedure and Sample Size

A multi-stage random sampling proceduree was employed to select respondents for this study**.** The first stage involved purposive selection of five wards, considering financial constraints associated with the research. The second stage **v**villages within the selected wards were selected randomly selected based on their population distribution. The last stage involved simple random sampling technique used to select farmers from an established sampling frame, ensuring proportional representation from each ward. To achieve proportionality in the selection of farmers across the five wards, the number of respondents from each ward were determined using proportional allocation based on the total registered farmers. The sample size of 150 farmers is distributed as follows in Table.1

Table 1: Sampling Procedure and Sampling Size

S/N	Ward	No. of Villages	No. of Registered Farmers	Farmers Selected (Proportional)
1	Sil-Umthla	13	80	28
2	Yawi	8	75	26
3	Dugja	9	102	36
4	Miringa	12	94	33
5	Galdimare	7	76	27
Total			**425**	**150**

Source; Field Survey, 2024

Method of Data Analysis

Data for this study was analyzed using descriptive statistics. Descriptive statistic in the form of mean percentages and frequencies was used to achieve objectives (i and ii), while food security scale was used to achieve objective (iii and iv) See Appendix 1 for details. Multiple regression will be used to analyzed objective (v). Multiple regression is expressed thus; Y = F (X_1, X_2, X_3, X_4, X_5, X_6, e) = a + $\beta_1 + 1\ \beta_2 + 2\ \beta_3 + 3 + \beta_4 + 4 + \beta_5 + 5\ \beta_6 + 6 + e$ where: $Y =$ level of participation (activities participation score), $X_1 – X_9$ = independent variables, X_1 = Age (years), X_2 = educational level (Nom- formal education, senior secondary, first school leaving certificate, Bachelor degree and others. X_3 = family size (ha), X_4 = access to adequate space (Ha), X_5 = association membership (yes = 1; if otherwise = 0), X_6 = Primary occupation (farming=1, livestock =2 keeping=3 trading= 4, civil service=) X_7 = farming eexperience (years), X_8 = access to credit (1= access 0= no access), X_9 = marital status (marital =1 divorce =2, single =3 and e = error term.

RESULTS AND DISCUSSIONS

The socio-economic characteristics of cowpea farmers in Biu, Borno State, provide critical insights into their demographic and agricultural context. A significant proportion (46.66%) of the respondents are aged 20–30 years, representing a youthful and adaptable workforce. This age group is vital to agricultural innovation and

productivity, as younger farmers are more likely to adopt new practices (Christian 2025; Dada, 2025). Gender-wise, 56.66% are male and 43.33% female, showing relatively balanced involvement, though men still dominate decision-making.

Table 2. Distribution of Socio-economics Characteristics of the Respondents

Variables	Frequency	Percentage
Gender	85	56.66
Male	65	43.33
Female		
20 – 30 years	70	46.66
31- 40 years	35	23.33
51 years and above	23	15.33
41 – 50 years	22	14.66
Single	72	48.0
Married	58	38.66
Widow/widower	10	6.66
Divorced/separated	9	6.0
Others	1	0.66
Non-formal education	58	38.66
Bachelor's degree	38	25.33
Senior secondary school certificate	33	22.0
Others	16	10.66
First school leaving certificate	5	3.33
5 – 8	61	40.66
Less than 5	43	28.66
9 – 11	33	22.0
12 – 14	10	6.66
15 and above	3	2.0
Hiring	58	38.67
Inherited	53	35.33
Purchase	39	26.0
Years spent in Farming	64	42.66
Less than 5 years	47	31.33
Above 10 years	39	26.0
6 – 10 years		
Membership of Association	55	36.66
Yes	95	63.33
No		
Does not belong to any farmers association	95	63.33
Others	46	30.66
All Farmers Association of Nigeria AFAN	8	5.33
Maize Association of Nigeria MAAN	1	0.66
Access to credit	64	42.66
Yes	86	57.33
No		
Source of Credit	92	61.33
No Access to credits	25	16.66
NGOs	24	16.0
Family	7	4.66
Others	2	1.33
Bank		

Source; Field Survey, 2024

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The role of women remains crucial to household food security, consistent with FAO (2011). Marital status data reveal that 48% are single and 38.66% married, with implications for labor and resource allocation. Larger households, common among respondents, require more food resources, which can strain food security when resources are limited (Aidoo *et al.,* 2013).

Educational levels vary, with 38.66% having no formal education and only 25.33% holding bachelor's degrees. Limited education hampers access to agricultural information and technology adoption (Sarumi & Osu, 2019). Household sizes of 5–8 members were most common (40.66%), which can offer labor benefits but also increase consumption needs (Sani & Oladimiji, 2017). Regarding land tenure, 38.67% hire land while only 26% own it, potentially limiting long-term investment in land improvement (Asogwa et al., 2012).

Experience in farming is limited, with 42.66% having under five years, which may affect productivity, as more experienced farmers often achieve better outcomes (Mapiye et al., 2023). Only 36.66% belong to farmer associations, restricting access to collective resources and support systems vital for productivity and food security (Chege *et al.,* 2018). Similarly, just 42.66% have access to credit, a major barrier to investing in inputs and technologies (Onumah, 2002).

In summary, the respondents are young and active but face constraints in education, land access, farming experience, group participation, and credit all of which affect productivity and food security. Studies affirm that youth, education, land ownership, and institutional support are key enablers of agricultural innovation and resilience (Adesina & Baidu-Forson, 1995; Ekong, 2003).

Contributions of Agricultural extension to household food security

The data in Table 3 highlights the contributions of agricultural extension services to household food security among cowpea farmers in Biu, Borno State. However, only 30.66% of respondents had regular contact with extension services, limiting outreach and effectiveness. This limited access challenges the potential impact of extension on food security, aligning with Rivera and Alex (2003), who emphasize the importance of consistent farmer-extension interaction. Of those who accessed services, 36.66% received training, and 45.33% of these reported improved yields, showing the positive influence of training on productivity (Allahyari and Sadeghzadeh, 2020).

Extension-supported value addition initiatives benefited 62.33% of respondents, boosting income and food security through enhanced product value, consistent with Barbercheck (2020). Yet, these services remain limited in coverage. Credit support was accessed by 55.34% of respondents, enabling input purchases and improved productivity, though 44.66% still lacked access, a constraint noted by Onumah (2002).

Technological support was particularly low, reaching only 8.67%, which restricts the adoption of advanced farming practices (Adegbite *et al.,* 2020). Meanwhile, 65.33% received help with market linkages, improving income through better sales strategies, supporting Chege *et al.* (2018). Extension services positively impact food security through training, value addition, credit, and market access, limited reach particularly in training, credit, and technology reduces their broader effectiveness. Expanding these services would enhance their impact across the farming population.

Table 3 Women's Access to Agricultural Extension Services in Maize Production (n = 150)

Question/Variable	Frequency	Percentage (%)
Extension contacts		
No	104	69.33
Yes	45	30.66
Source of contact	105	70.0
NGOs	18	12.0
Extension agents	9	6.0
Neighbors	9	6.0
Others	9	6.0
Training received		
Yes	55	36.66
No	95	63.33
Training impact		
Boosts yield	68	45.33
No training	44	29.33

Reduces post-harvest loss	20	13.33
Increases market value	18	12.0
Value addition support		
Yes	94	62.33
No	56	37.66
Effect on income		
No effect	64	42.66
Balanced diet	29	19.33
Business sustainability	28	18.66
Additional income	22	14.66
Pays bills	7	4.66
Credit provided		
Yes	83	55.34
No	67	44.66
Credit & food security		
No effect	69	46.0
More harvest	33	22.0
Buy inputs	28	18.66
Better market outlet	20	13.33
Technology support		
No	137	91.33
Yes	13	8.67
Technology type		
None	140	93.33
Tractor supply	4	2.66
Machinery & improved variety	2	1.33
Drone systems	1	0.66
Modern machinery	1	0.66
Improved inputs (seed, fertilizer, herbicide)	1	0.67
Tabs & generators	1	0.67
Technology & food security		
High-yield seeds for family food	67	44.66
Beyond subsistence	29	19.33
Reduces labor cost	30	20.0
Safe, high-value harvest	24	16.0
Market linkage training		
Yes	98	65.33
No	52	34.67
Market linkage type		
Sell in lean season (high profit)	52	34.66
No training	52	34.66

Source: Field Survey, 2024

Table 4 presents a comprehensive analysis of food security among cowpea farmers in Biu, highlighting key indicators such as meal affordability, dietary diversity, and the psychological and physical impacts of food insecurity. A significant proportion of respondents (58.77%) reported an inability to afford balanced meals, pointing to economic constraints that limit access to nutritious food. Over half (56%) expressed concerns about food running out, indicating the psychological stress associated with food scarcity. Similarly, 53.33% had to skip meals or reduce portion sizes due to financial limitations, while 60% experienced hunger at least once in the past year.

Dietary monotony was also common, with 52.67% consuming the same types of food daily, reflecting limited access to diverse and nutrient-rich diets. Additionally, 65.34% relied on cheaper food options to manage their budgets, and 64.66% reported that household members occasionally went an entire day without eating.

Weight loss due to inadequate food intake was reported by 58.66% of respondents. These findings indicate high levels of food insecurity, affecting both mental well-being and physical health. They align with existing literature (Maxwell, 1996; Ruel, 2003; Bennett *et al.,* 2018; Maxwell & Caldwell, 2008) which emphasize the critical role of financial access, dietary diversity, and psychological stability in achieving food security. In conclusion, the

data reveal substantial vulnerabilities among cowpea farmers in Biu, calling for urgent interventions to enhance economic access to food, promote dietary diversity, and support nutritional education.

Table 4: Food Security Status of The Respondents.

Variables	Frequency	Percentage
Lack of balanced meals **Yes**	88	58.77
Lack of balanced meals **No**	62	41.33
Meal cut/skip due to no food **Yes**	80	53.33
Meal cut/skip due to no food **No**	70	46.67
Worried food will run out **Yes**	84	56.0
Worried food will run out **No**	66	44.0
Hungry but couldn't eat **Yes**	90	60.0
Hungry but couldn't eat **No**	60	40
Eating same food daily **Yes**	79	52.67
Eating same food daily **No**	71	47.33
Ate less than needed **Yes**	76	50.67
Ate less than needed **No**	74	49.33
Stop eating for a whole day **Yes**	97	64.66
Stop eating for a whole day **No**	53	35.33
Relied on low-cost food **Yes**	98	65.34
Relied on low-cost food **No**	52	34.66
Food bought didn't last **Yes**	97	64.66
Food bought didn't last **No**	53	35.33
Adult lost weight due to no food **Yes**	88	58.664
Adult lost weight due to no food **No**	62	41.33
Children lacked balanced/enough meals **Yes and No**	82	54.67
Children lacked balanced/enough meals; Enough but not always required	68 53	45.33 35.33
Household food consumption		
Household food consumption; **Always enough of what is required**	48 33	32.0 22.0
Household food consumption; **Sometimes enough food**	16	10.668
Household food consumption; **Often not enough food**		

Source; Field Survey, 2024

Table 5 outlines key coping strategies used by cowpea farmers in Biu, Borno State, to address food insecurity. These include reducing meal quality and quantity (58.77%), eating low-cost food (65.34%), skipping meals (64.66%), and selling assets highlighting the depth of food insecurity in the region. Such strategies offer short-term relief but pose long-term health and economic risks (Maxwell & Caldwell, 2008; Bennett et al., 2018). Severe methods like skipping meals and asset liquidation indicate critical vulnerability and declining household resilience (De Waal & Whiteside, 2003). These findings underscore the urgent need for sustainable interventions like credit, nutrition programs, and agricultural support. Despite the youthfulness of the farming population (46.66% aged 20–30), low education (38.66% uneducated) limits access to farming innovations (Sarumi & Osu, 2019). While extension services improve yields (45.33%) and income (62.33%), only 30.66% report regular contact, limiting overall impact (Rivera & Alex, 2003). Credit (55.34%) and technology access (8.67%) remain low, reducing productivity (Onumah, 2002; Adegbite et al., 2020). Food insecurity is widespread—58.77% lack balanced meals, 60% experience hunger, and 58.66% report weight loss, confirming both physical and psychological stress

(Maxwell, 1996; Ruel, 2003). Unsustainable coping methods reduce resilience and perpetuate poverty (Mastrorillo *et al.,* 2016). The study calls for targeted, long-term support to replace harmful strategies with sustainable food security solutions.

Table 5 Coping Strategy of The Respondents

Variables	Frequency	Percentage
Lack of balanced meals		
Yes	88	58.77
No	12	8.01
Lack of balanced meals		
No	62	41.33
Meal cut/skip due to no food		
Yes	80	53.33
Meal cut/skip due to no food		
No	70	46.67
Worried food will run out		
Yes	84	56.0
Worried food will run out		
No	66	44.0
Hungry but couldn't eat		
Yes	90	60.0
Hungry but couldn't eat		
No	60	40
Eating same food daily		
Yes	79	52.67
Eating same food daily		
No	71	47.33
Ate less than needed		
Yes	76	50.67
Ate less than needed		
No	74	49.33
Stop eating for a whole day		
Yes	97	64.66
Stop eating for a whole day		
No	53	35.33
Relied on low-cost food		
Yes	98	65.34
Relied on low-cost food		
No	52	34.66
Food bought didn't last		
Yes	97	64.66
Food bought didn't last		
No	53	35.33
Adult lost weight due to no food		
Yes	88	58.664
Adult lost weight due to no food		
No	62	41.33
Children lacked balanced/enough meals		
Yes	82	54.67
Children lacked balanced/enough meals		
No	68	45.33
Household food consumption; **Enough but not always required**	53	35.33
Household food consumption; **Always enough of what is required**	48	32.0
Household food consumption; **Sometimes enough food**	33	22.0
Household food consumption; **Often not enough food**	16	10.668

Source; Field Survey, 2024

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Table 6 presents regression results identifying key socio-economic factors affecting household food security in Biu LGA. Age (β=0.345, p<0.001) and education (β=0.412, p<0.001) significantly increase participation, reflecting the influence of experience and information access. Family size (β=0.128, p=0.039) also contributes, albeit modestly. Association membership (β=0.267, p=0.002) and farming experience (β=0.321, p<0.001) are strong predictors, highlighting the value of networks and knowledge. Access to credit (β=0.387, p<0.001) strongly boosts participation by enabling investment. Primary occupation (β=−0.145, p=0.053) is marginally significant, with non-agricultural jobs linked to lower participation. Access to space (β=0.098, p=0.082) and marital status (β=0.065, p=0.265) are not significant predictors. The findings point to critical roles for education, credit, and social capital, supporting targeted interventions to improve food security through enhanced participation.

Table 6: Socio-economic characteristics influencing household food security in Biu LGA.

Variables	Coefficient (β\beta)	t-Value	p-Value	Significance
Age	0.345	4.12	0.000***	Significant
Education	0.412	3.85	0.001***	Significant
Family Size	0.128	2.10	0.039**	Significant
Access to Space	0.098	1.76	0.082	Insignificant
Association Membership	0.267	3.42	0.002***	Significant
Primary Occupation	-0.145	-1.98	0.053*	Marginally Significant
Farming Experience	0.321	4.65	0.000***	Significant
Access to Credit	0.387	5.23	0.000***	Significant
Marital Status	0.065	1.12	0.265	Insignificant
Constant	1.302	6.45	0.000***	-

Source; Field Survey, 2024

CONCLUSION

Cowpea farmers in Biu face serious food insecurity, compounded by economic hardship and limited institutional support. While coping strategies help in the short term, they undermine long-term household resilience. Sustainable interventions—including improved credit access, nutrition programs, and agricultural extension—are urgently needed to reduce vulnerability and promote food security.

RECOMMENDATIONS

To address low education levels and improve food security, agricultural extension services should include literacy and practical training in modern farming techniques. Expanding the number of extension workers and adopting community-based models will enhance farmers' access to regular support, training, credit, and market opportunities—ultimately boosting productivity and resilience.

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