

ASSESSMENT OF COMMERCIALIZATION OF PEARL MILLET AMONG FARMING HOUSEHOLDS IN SELECTED NORTHERN NIGERIA STATES

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Abstract. This study assessed pearl millet commercialization among farming households in selected Northern Nigeria states. Multistage stratified random sampling procedure with replacement was employed to select 1,302 respondents for the study, the data was collected in 2020. Data analysis of this study was done using descriptive statistics, Household Commercialization Index (HCI), and Ordinary Least Square (OLS) regression. The result of the data analysis revealed that Pearl Millet commercialization was found to be low across the study area. Extension contact, years of farming experience, age of the respondent, total farm size, and distance to the market were the determinants of the level of commercialization across the Savannahs. Pearl millet commercialization to household income was 89.36% (0-50% Category), 4.26% (51-70% Category), 6.38% (71-100% Category). It is alarming that pearl millet, with all its advantages, is still being grown majorly on a subsistence basis throughout Northern Nigeria. Consequently, its commercialization, according to the findings of the research study, is low. It is therefore recommended that collective efforts should be made, and existing collaborations should be bettered to improve high yielding Pearl millet seed varieties. Farming households produce the crop majorly on a subsistent level.

Keywords: Pearl millet, Commercialization Index, Savannah, Regression.

INTRODUCTION

The Poaceae family includes the versatile cereal crop known as pearl millet (*Pennisetum glaucum* L.R. Br.). After maize, rice, wheat, and sorghum, the crop is still the fifth most popular cereal in the world (Rai et al., 2007; Gloria, 2013). Grown in 30 nations across arid, semi-arid regions, and subtropical parts of Asia, Africa, and the Caribbean, it stretches over approximately 31 million hectares globally (ICRISAT, 2015). Nearly half of all millets produced worldwide are pearl millet. With 1.5 million tonnes produced annually, Nigeria is the world's fifth-largest producer (FAOSTAT, 2016). A great deal of land is used in the Western and Central Africa (WCA) region for millet farming, with over 90% of that millet being Pearl millet. From 2014 to 2016, Nigeria produced 1.15 to 1.55 million metric tonnes of pearl millet per year, accounting for about five per cent of global output. With an average productivity of 903 kg ha⁻¹, Nigeria was the third-largest producer in the world, after Niger and India (Ajeigbe et al., 2019).

Pearl millet (*Pennisetum glaucum* L.R. Br.), popularly known in northern Nigeria as 'gero', is a vital but severely underused crop that has been deemed to be well suited to heat and aridity. It is a very nutritious grain that provides nearly all of the nutrients that people require. It is mostly planted in arid regions with poor soils and little rainfall, wherein other important staple cereal crops are unable to grow successfully (Izge et al., 2007; ICRISAT, 2019). In addition to being used for human

consumption, the crop is also used for animal feed, beverage production, and several other regional purposes such as tuwo, fura, and kununzaki.

Nigeria has vast arable land of 34 million hectares (Statista, 2020). A large percentage of this land is dedicated to agricultural production, out of which the northern region contributes massively more than any other region in the country. However, a substantial share of agricultural production is still done on subsistence level. Despite the vast amount of land available for agricultural production, this has to a large extent continually widen the gap between demand and supply, therefore increasing the levels of importation.

It is crucial to increase output by going from subsistence to commercial levels in order to close the gaps between supply and demand for agricultural products and lower imports. Nonetheless, increased productivity, increased earnings, increased employment, and a decrease in poverty can result from commercialization of agriculture (Von Braun and Kennedy, 1994; Barrett 2008; Tipraqsa and Schreinemachers 2009; Muriithi and Matz 2015; Carletto et al. 2017; Muricho et al. 2017). In the long run, these factors would enhance agriculture's economic contribution. The process of increasing productivity per unit of farmland (as well as labour) by farmers through the commercialization of agriculture results in larger surpluses that can be sold on the market, which in turn encourages farmers to participate in the market and raises their standards of living and incomes (Jayne et al., 2011). Better crops, improved animal breeds, improved methods, fertilisers, and expertise are all necessary for commercialization to succeed. The approach is really about increasing agricultural production and growth, which suggests a process that connects a significant section of rural farmers to highly valuable commercial chains (Jayne and Muyanga, 2011).

A few studies have steered their attention to the significance of pearl millet in improving nutrition/food security, generating income in poor and marginalized households (Africa Development Bank, 2015). On the other hand, the degree of commercialization of pearl millet production in the research region has not been thoroughly studied. Thus, the purpose of this study was to evaluate the commercialization of pearl millet among farming households in a few states in Northern Nigeria. The specific objectives were to analyze pearl millet commercialization, identify the determinants of pearl millet commercialization, and determine the contribution of pearl millet commercialization to household cash incomes in the study area.

METHODOLOGY

Area of study

Between latitudes 9° and 14° North and longitudes 3° and 15° East is where you'll find Nigeria's northern region. Sokoto, Zamfara, Kebbi, Jigawa, Katsina, Borno, Kano, Yobe, Bauchi, Gombe, Kwara, Adamawa, Plateau, Niger, Taraba, Federal Capital Territory (FCT), Nassarawa, Kogi, and Benue are among the states that are situated in this zone (Worldometer, 2019). The Hausa, Gwari, Fulani, Borim, Kanuri, Jakun, Tiv, and other ethnic tribes occupy the majority of Northern Nigeria. There are two different seasons in this region: the lengthy dry season and the rainy season. The average monthly daytime temperature is more than 36°C, while the average monthly night time temperature is as low as 22°C.



Fig. 1. A map showing the Surveyed States in the course of this study

Data collection and sampling technique

Primary data were collected using a well-structured questionnaire which was administered in a computer-assisted personal interview. The target population of this study were pearl millet farming households in selected Northern Nigeria states.

A multi-stage stratified sampling procedure with replacement was adopted for this study. Figure 1 shows the surveyed states for the study, and Table 1 explains the distribution of respondents for the study. Three (3) agro-ecological zones were considered: Guinea Savannah, Sudan savanna, and Sahel Savannah. The surveyed states were Kano, Katsina, Jigawa, Kebbi, Niger, Gombe, Bauchi, Borno and Yobe. Thirty-one (31) Local Government Areas were selected in total across the States. In each LGA, sampling frames were developed through quick listings in the village/community within the LGA through Focus Group Discussion. In all, the total number of respondents was 1,302.

Table 1

Distribution of Respondents				
Agro-Ecological Zone	Selected States	LGAs	Sample Size	
Sahel Savannah	Yobe	Fika (Sahel Savannah)	41	
		Potiskum (Sahel Savannah)	41	
		Nguru (Sahel Savannah)	41	
			Sub -Total:	124
	Borno	Bayo (Sahel Savannah)	42	
		Shani (Sahel Savannah)	42	
		Kwaya kusar (Sahel Savannah)	42	
Sub-Total :		126		
Sudan Savannah	Kano	Dawakin Tofa (Sudan Savannah)	43	
		Dambatta (Sudan Savannah)	43	

		Gwarzo (Sudan Savannah)	43
		Gezawa (Sudan Savannah)	43
		Sub-Total:	173
	Jigawa	Taura (Sudan Savannah)	41
		Babura (Sudan savannah)	41
		Kiyawa (Sudan Savaannah)	41
		Gumel (Sudan Savannah)	41
		Sub-Total:	166
	Kebbi	Kalgo (Sudan Savannah)	41
		Dandi (Sudan Savannah)	41
		Yauri (Sudan Savannah)	47
		Sub-Total:	130
	Katsina	Charanchi (Sudan Savannah)	42
		Malufashi (Sudan Savannah)	42
		Bakori (Sudan Savannah)	42
		Daura (Sudan Savannah)	43
		Sub-Total:	169
Guinea Savannah	Niger	Mokwa (Guinea Savannah)	41
		Wushishi (Guinea Savannah)	41
		Lapai (Guinea Savannah)	41
		Agae (Guinea Savannah)	41
		Sub-Total	166
	Bauchi	Toro (Guinea Savannah)	40
		Alkaleri (Guinea Savannah)	41
		Ganjuwa (Guinea Savannah)	42
		Sub-Total:	124
	Gombe	Billiri (Guinea savannah)	41
		Dukku (Sudan Savannah)	41
		Yama-letu debba (Guinea savannah)	41
		Sub-Total:	124
		Total:	1302

Source: field survey, 2021

Data analysis

Descriptive statistics, the Household Commercialization Index (HCI), and linear regression were used to analyse the acquired data. The socioeconomic characteristics of the farmers were described using descriptive statistical analysis. The HCI was used to determine the level of pearl millet commercialization as used by Govereh *et al.*

(1999), Strasberg *et al.* (1999), and Agwu *et al.* (2012a). The method is to take into account the portion of agricultural production that a farm or family markets. The commercialization index was computed as shown in Equation 1 for each household, and this was further categorized into three levels viz: low, medium, and high.

$$HCI = \frac{\text{Quantity of Pearl Millet Sold (Kg)}}{\text{Quantity of Pearl Millet Harvested (Kg)}} \times 100 \quad (1)$$

Where;

0-49% = Low Commercialization

50-70% = Medium Commercialization

71-100% = High Commercialization.

The measure is intended to measure commercialization in a scale-neutral manner, independent of the household's wealth (Rios *et al.*, 2008).

Regression analysis

In this study, Multinomial Logistic regression model was used to analyze the factors influencing Pearl Millet Commercialization in the study area. In addition, it was used to draw inferences on the causal factors for the commercialization of households in the context of household characteristics captured by the \mathbf{X}_i 's.

The model is given as;

$$\Pr(Y_i = j) = \frac{e^{\beta_j' X_i}}{1 + \sum_{k=1}^J e^{\beta_k' X_i}} \quad \text{for } j = 1 \dots n \quad (2)$$

$$Y_i = \beta_0 + \beta_i X_i + \varepsilon \quad (3)$$

Where,

$$Y_i = Y_1 - Y_3$$

Y_1 = Low Household Commercialization Y_2 = Medium Household Commercialization

Y_3 = High Household Commercialization

$$Y_j = \frac{e^z}{1 + e^z} \quad j = 1, \dots, 3 \quad (4)$$

$$Y = X_i \beta$$

Y_1 = Low Household Commercialization Index, Y_2 = Medium Household Commercialization Index, Y_3 = High Household Commercialization Index, X_1 = Gender (Male = 1, Female = 0), X_2 = Marital status of household head (Married=1, others =0), X_3 = Membership in association of the household head (Yes =1, No= 0), X_4 = Level of education of household head (Years of schooling), X_5 = Household size (Numbers), X_6 = Distance to nearest village market (Km), X_7 = Primary occupation of household head (Non-farming =1, farming =0), X_8 = Total Pearl millet produced (Kg), X_9 = Total land used in producing Pearl millet (Hectares), X_{10} = Farming experience (Years), X_{11} = Age of the household head (Years), X_{12} = Phone Ownership (Yes=1, No=0), X_{13} = Price of Pearl Millet per 100Kg Bag (Naira), X_{14} = Number of household members as full-time workers on farm (Numbers), X_{15} = Credit Access (Yes=1, No=0), X_{16} = Access to Agricultural/Market Information (Yes=1, No=0), μ_i = Error term

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondents

The socioeconomic characteristics of the Respondents across Guinea, Sudan, Sahel Savannah, is shown in Table 2. The table showed that 93.17%, 95.17%, and 92.86% were male across the regions, respectively. This implies that majority of the Pearl millet farming households in the study are male-headed. The mean average of age of respondents across the region is 42.92 years. Which is an indication that most of the farming household heads are still within an active age range to involve in agricultural activities, agricultural intensification, and market participation. The tables showed that majority of the respondents across the study area have Islamic education (35.14%, 34.62%, 37.86%). The main source of livelihood of the respondents across the study area was crop and livestock farming (81.26%, 77.62%, 88.57%). Furthermore, the average years of Pearl millet farming experience of respondents are 23.10, 23.39, 21.04 years indicating that the respondents are well experienced in Pearl millet production. Furthermore, Majority of the respondents across the study area belong to cooperative association (56.40%, 47.34%, 49.29%). Olwande's (2010) study found a clear correlation between membership in groups and organisations and information accessibility crucial for production and marketing choices. 69.25%, 73.79%, and 79.43% of the participants farmed land with an extent between 0.5 to 3 hectares.

Table 2

Socioeconomic characteristics of respondents in the study area

Variables	Guinea Savannah			Sudan Savannah			Sahel Savannah			Mean Average
	Frequency	Percent age	Mean	Frequency	Percent age	Mean	Frequency	Percent age	Mean	
Marital Status of Household Head										
Married	524	94.41		591	95.17		130	92.86		
Single	31	5.59		30	4.83		10	7.14		
Gender of Household Head										
Male	518	93.17		588	94.53		129	91.49		
Female	38	6.83		34	5.47		12	8.51		
Age of Household Head										
<30	122	21.94		102	16.40		33	23.40		
31-50	284	51.08	43.21	349	56.11	44.10	75	53.19	41.45	42.92
51-70	143	25.72		159	25.56		30	21.28		
70>	7	1.26		12	1.93		3	2.13		
Education Level of Household Head										

Islamic Education	195	35.14		215	34.62		53	37.86		
Primary Education	69	12.43		80	12.88		19	13.57		
Secondary Education	127	22.88		146	23.51		47	33.57		
Tertiary Education	135	24.32		151	24.32		14	10.00		
No Education	29	5.23		29	4.67		7	5.00		
Primary Source of Livelihood of Household Head										
Crop and Livestock Farming	451	81.26		482	77.62		124	88.57		
Off-farm	5	0.90		11	1.77		1	0.71		
Temporary Employment										
Permanent Employment	37	6.67		55	8.86		6	4.29		
Servant of Business owned by another	9	1.62		15	2.42		2	1.43		
Petty trading	36	6.49		50	8.05		6	4.29		
Others	17	3.06		8	1.29		1	0.71		
Membership in Associations										
Members	313	56.40		294	47.34		69	49.29		
Non-Members	242	43.60		327	52.66		71	50.71		
Years of farming Pearl Millet <20	296	53.24		337	54.18		86	60.99		
21-40	224	40.29	23.10	230	36.98	23.39	46	32.62	21.04	22.51

41-60	34	6.12		54	8.68		9	6.38		
60>	2	0.36		1	0.16					
Household Size										
<10	323	58.09		366	58.84		97	68.79	8.92	
11-20	178	32.01	11.4	205	32.96	10.7	37	26.24	10.37	
21-30	42	7.55	2	42	6.75	9	6	4.26		
31-40	11	1.98		9	1.45		1	0.71		
40>	2	0.36								
Farm Size (Hectares)										
0.5-3	385	69.25	3.42	459	73.79	2.82	112	79.43	2.56	2.93
3.5-6	98	17.63		117	18.81		20	14.18		
6>	73	13.13		46	7.40		9	6.38		

Source: field survey, 2021

Level of pearl millet commercialization

The level of Pearl Millet commercialization attained among respondents in the Guinea, Sudan, and Sahel savannahs was examined in tables 3. Table 3 showed that 70.68% of the respondents in Guinea savannah have Low level of Pearl millet commercialization. The table also showed that 82.15% of respondents in the Sudan savannah have low level of Pearl Millet commercialization. It was also shown that majority of the respondents in the Sahel savannah (83.69%) have low level of Pearl millet commercialization. On the average, Households across the savannahs have a Pearl Millet Commercialization index of 40.75%, 36.12%, and 20.82% respectively. These results showed that, the level of pearl millet commercialization is low across the study area. This is an indication that majority of the Pearl millet producing households aim at self-sufficiency and produce at subsistence levels.

Table 3

Classification	Guinea Savannah				Sudan Savannah				Sahel Savannah			
	Household Commercialization Frequency (N=556)	Percentage (%)	Mean		Household Commercialization Frequency (N=622)	Percentage (%)	Mean		Household Commercialization Frequency (N=141)	Percentage (%)	Mean	
Low Commercialization	0-49	39	70.6	40.7	0-49	51	82.1	36.1	0-49	11	83.6	20.8
Medium Commercialization	50-70	93	16.7		50-70	80	12.8		50-70	14	9.93	
			3				6					

High Commercialization	71	70	12.5	71	31	4.98	71	9	6.38
	-		9	-			-		
	10			10			10		
	0			0			0		

Source: field survey, 2021

Factors influencing the commercialization of pearl millet

Table 4 shows the Determinants of Pearl Millet Commercialization across the study area (Guinea savannah, Sudan savannah, Sahel Savannah), which was examined using multinomial logistic regression analysis.

Results of the multinomial logistic regression as shown in table 4 revealed that most of the variables tested for the probability of factors influencing Pearl millet commercialization among farming households met the a prior expected sign. For households with low commercialization indexes, phone ownership ($P < 0.10$), price of Pearl millet per 100Kg bag ($P < 0.001$), and credit access ($P < 0.10$) were significant. Other factors that were positively related to households with low commercialization indexes include; gender of the household head, membership of association of the respondent, farm size, years of farming experience, primary source of livelihood, phone ownership, and credit access, though they were not significant. Furthermore, farming households that commercialize on medium levels, as depicted by the results, few variables were positively related with medium commercialization indexes, out of which; gender of the respondent ($P < 0.005$), membership of association of respondent ($P < 0.005$), and phone ownership ($P < 0.005$). Some factors were inversely related, but, not significant which include; marital status of the respondent, level of education, household size, distance to the nearest market, among others.

For households with high levels of commercialization, quantity of Pearl millet produced (Kg) ($P < 0.10$), and price of Pearl millet per 100Kg bag ($P < 0.01$) were significant, and positively related variables. Other variables that were positively related to high Pearl millet commercialization indexes include; Marital status of the respondent, level of education of the respondent, household size, distance to the nearest village market, number of household members available as full-time workers on the farm, and access to agricultural/market information. Gender of the respondent have negative effect on households in low commercialization and high commercialization categories, but, increases the probability of being a medium pearl millet commercialization household.

Membership of association of the respondent have negative effect on being in low commercialization category, but, increases the tendency of respondent being in medium commercialization category. Jagwe (2011) in a study; belonging to a farmer's group had a substantial impact on how much a farmer participated in banana markets. This study examined the impact of transaction costs on the involvement of small-scale farmers and middlemen in the banana markets of Burundi, Democratic Republic of the Congo, and Rwanda. This is in contrast with results for households in low commercialization categories, but, similar for households in medium commercialization categories. The results showed that farmers in medium commercialization category who belonged to a farmers' group had the cohesion to gain and share knowledge and capacity to produce more for a marketable surplus. Whereas

those in low commercialization categories, since the produce majorly for self-sufficiency and household consumption tend to be inversely related to this factor.

Quantity of Pearl Millet produced by farming households (Kg) has a tendency of increasing household market participation. A unit increase in Pearl millet per Kg produced increases the tendency of households in high commercialization category to commercialize by 0.00776%. But, that is not the case for households in low and medium commercialization categories, as a unit (Kg) increase in the quantity of the crop produced reduce the tendency of their market participation by 0.00429% and 0.00346% respectively. Phone ownership has an inverse relation with household in low commercialization category, but, increases the probability of households in medium commercialization category to participate in the market. Price of Pearl millet per 100Kg bag has inverse effect on households in low commercialization and medium commercialization category, but, has a positive effect on households in high commercialization category. A unit increase in price of Pearl millet per 100kg bag reduces market participation of households in low commercialization and medium commercialization categories by 0.0141% and 0.00322% respectively. While a unit increase in the price of the crop per 100Kg bag increases the market participation tendency of households in high commercialization category by 0.01732%. This results showed that households in low commercialization and medium commercialization categories tend to hold on to their produce for household consumption when there is hike in the market price of the crop rather than exchange it for cash in the market. This fact solidify the assumption that households in the region plant the food crop for self-sufficiency.

Table 4

Determinants of pearl millet commercialization in the study area

Variables	Low Commercialization		Medium Commercialization		High Commercialization	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
Gender of the respondent	.5609071	0.152	.8949471**	0.050	-0.5609071	0.152
Marital Status of the respondent	-.4099939	0.442	-.706216	0.201	0.4099939	0.442
Membership of Association of respondent	.219847	0.336	.5740125**	0.018	-0.219847	0.336
Level of Education of respondent	-.0073853	0.936	-.0333294	0.734	0.0073853	0.936
Household Size	-.0073074	0.731	-.0064407	0.775	0.0073074	0.731
Distance to the nearest village market	-.0105659	0.317	-.0098004	0.390	0.0105659	0.317
Source of Livelihood of household head	.0132622	0.882	.0669419	0.472	-0.0132622	0.882
Quantity of Pearl Millet Produced (Kg)	-	0.008	-.0000346	0.239	0.0000776***	0.008

Agricoltura	no. 1- 2 (129-130)/2024					Agriculture
Farm Size (Hectares)	.0125168	0.632	.0074724	0.784	-0.0125168	0.632
Years of Farming Experience	.0108985	0.507	-.0041219	0.814	-0.0108985	0.507
Age of the Respondent	.0099315	0.532	.0131392	0.438	-0.0099315	0.532
Phone Ownership	.3147904	0.345	.837454**	0.032	-0.3147904	0.345
Price of Pearl Millet per 100Kg bag	-	0.000	-.0000322	0.112	0.0001732***	0.000
Number of Household Members as full-time members on farm	-.0092813	0.832	-.0060805	0.897	0.0092813	0.832
Credit Access	.1166063	0.817	.5748706	0.261	-0.1166063	0.817
Access to Agricultural/Market Information	-.1495223	0.504	-.2659026	0.263	0.1495223	0.504
Constant	2.886411	0.000	.0296345	0.973	-2.886411	0.000

Source: The variables fitted into the multinomial regression model were tested at P<0.10, P<0.05 and P<0.01 significance levels. *, **, ***.

Contribution of pearl millet commercialization to household cash incomes

The contribution of Pearl Millet commercialization to the cash incomes among Farming households and the percentage of contribution of Pearl millet commercialization in the study area in the 20219-2020 season. In Table 5, Income generated from Pearl millet commercialization, Income generated from Livestock sales, and Income generated from other sources (Remittances, Monthly Salary, Paid Labour, Petty trading, and so on) are shown in table 5 for respondents in the Guinea savannah. Majority of the farming households (81.65%) generated income within the range of 0-200,000, and 11.33% has income between 201,000-400,000, 3.06% has income between 401,000-600,000, while 3.96% has income above 600,000 from the commercialization of Pearl millet. In addition, the mean Income generated from Pearl millet commercialization is N134,300.50. A large percentage of the Farming households (87.23%) has an income from the sales of livestock within the range of 0-100,000 from livestock sales, and 10.70% has income between 101,000-200,000, while 2.70% has income above 200,000. As a result, the mean of income generated by Farming households in the Guinea savannah of from Livestock sales is N33,039.30.

The results showed that 69.42% of the farming households generate income from other Sources (Remittances, Salary, Paid labour, etc.) between 0 – N200,000, and 13.67% within the range of N201,000-N400,000 , while 7.91% and 8.99% have income between N401,000-N600,000 and N600,000 above respectively. Thus, the mean of income generated from other sources among farming households is N229,106.8. 45.86%, 21.76%, 12.77%, and 19.60% have within Total household income of 0-200,000, 201,000-400,000, 401,000-600,000, and 600,000 above

respectively. As shown in Table 5, a large percentage of the Farming households in the Sudan savannah (88.42%) has an income from Pearl millet commercialization within the range of 0-200,000, while 6.11% has an income between 201,000-400,000, 1.44% has an income between 401,000-600,000, and 4.16% has an income above 600,000. Therefore, the mean Income generated from Pearl millet commercialization is N115,305.40.

Majority of the Farming households (90.51%) generated an income from Livestock sales within the range of 0 - N100,000, while 5.63% has an income between N101,000 - N200,000, and 3.86% has an income above N200,000, the mean of Income generated by Pearl Millet farming households in the Sudan Savannah from Livestock sales N33,729.62. 69.45% of the farming households have income from other sources within the range of 0-200,000, and 14.79% has an income between N201,000-400,000. In comparison, 8.84% and 6.91% generate income between N401,000-600,000 and N600,000 above. Thus, the mean of income generated from other sources among farming households in the Sudan savannah is N183,657.5. About 53.05%, 18.33%, 11.25%, and 17.36% have within Total household income of 0 - N200,000, N201,000 - N400,000, N401,000 - N600,000, and N600,000 above respectively. In addition, the mean of Total Household Income generated in the Sudan savannah is N332,692.6. In the Sahel savannah area of the study area, a large percentage of the farming households (95.74%) generate an income within the range of 0 - N200,000, while 2.84% has an income between N201,000 - N400,000, 0.71% has an income between N401,000 - N600,000, and 0.71% has an income above 600,000. Thus, mean Income generated from Pearl millet commercialization in the Sudan savannah is N36,728.51.

The result also showed that 87.94% of the Pearl millet farming households generated an income from Livestock sales within the range of 0 - N100,000, while 9.93% has an income between N101,000 - N200,000, and 2.13% has an income above N200,000. Thus, mean of Income generated by Farming households from Livestock sales N30,095.74. Majority of the Pearl millet Farming households (77.30%) in the Sahel savannah has an income from other sources within the range of 0 - N200,000, and 5.67% has an income between N201,000 - N400,000, while 7.09% and 9.94% have an income between N401,000 - N600,000 and N600,000 above respectively. Thus, the mean of income generated from other sources among farming households is N267,811.3. Almost 62.41%, 15.60%, 5.67%, and 16.11% of Pearl millet farming households in the Sahel savannah of the study area have within Total household income of 0 - N200,000, N201,000 - N400,000, N401,000 - N600,000, and N600,000 above respectively. Therefore, the mean of Total Household Income of respondents in the Sahel savannah is N374,532.50.

Table 5
Contribution of pearl millet commercialization to household cash incomes

Household Income Sources	Guinea Savannah			Sudan Savannah			Sahel Savannah		
	Frequency (N=55)	Percentage (%)	Mean	Frequency (N=62)	Percentage (%)	Mean	Frequency (N=14)	Percentage (%)	Mean
Income generated from Pearl Millet	6			2			1		

commercialization (N)									
0-200,000	454	81.65	1343 00.5	550	88.42	115,3 05.4	135	95.74	36,72 8.51
201,000-400,000	63	11.33		38	6.11		4	2.84	
401,000-600,000	17	3.06		9	1.44		1	0.71	
601,000>	22	3.96		25	4.16		1	0.71	
Income generated from Livestock sales (N)									
0-100,000	485	87.23	33,03 9.3	563	90.51		124	87.94	30,09 5.74
101,000-200,000	56	10.7		35	5.63		14	9.93	
201,000>	15	2.70		24	3.86	33729 .62	3	2.13	
Income generated from other Sources (Income from other Crops, Remittances, Salary, Paid Labour, etc.)									
0-200,000	386	69.42		432	69.45	183,6 57.5	109	77.30	
201,000-400,000	76	13.67		92	14.79		8	5.67	267,8 11.3
401,000-600,000	44	7.91		55	8.84		10	7.09	
601,000>	50	8.99	2291 06.8	43	6.91		14	9.94	
Total Household Income									
0-200,000	255	45.86		330	53.05		88	62.41	
201,000-400,000	121	21.76	3964 46.7	114	18.33		22	15.60	37453 2.5
401,000-600,000	71	12.77		70	11.25	332,6 92.6	8	5.67	
601,000>	109	19.60		108	17.36		23	16.31	

Source: field survey, 2021

Contribution of pearl millet commercialization to household income

Table 6 showed the percentage of contribution of Pearl millet commercialization to household cash incomes in the study area for 2019-2020 farming season. In the

Guinea savannah, 64.93% of the farming households has low level of contribution, and 10.25% are in the category of medium level, while 24.82% has an income contribution in the high level category. Futhermore, in the Sudan Savannah, 77.81% of the farming households has low level of Pearl Millet Income contribution, and 6.43% are in medium level category, while 15.76% has high levels of Income contribution from Pearl millet commercialization. In the Sahel savannah, 89.36% of the households has a Pearl Millet Income contribution of low level category, while 4.26% has an income contribution in the medium level category, and 6.38% of the farming households have high levels of income contributions from pearl millet commercialization at high level.

Table 6

Percentage of contribution of pearl millet production to household cash incomes

Categories	Guinea Savannah		Sudan Savannah		Sahel Savannah	
	Frequency (N=556)	Percentage (%)	Frequency (N=622)	Percentage (%)	Frequency (N=141)	Percentage (%)
0-50	361	64.93	484	77.81	126	89.36
51-70	57	10.25	40	6.43	6	4.26
71-100	138	24.82	98	15.76	9	6.38

Source: field survey, 2021

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that Pearl millet is still grown majorly on a subsistence basis throughout Northern Nigeria, and its commercialization is low. Seemingly, the contribution of the crop to household income is also on low levels. In the view of these findings, it is recommended that:

Efforts should be made by stakeholders, research institutions, and government, at enhancing commercialization among Pearl millet farming households by bettering market linkages, since majority of them are not well integrated into the market system. Furthermore, efforts should also be made to integrate Pearl millet farming households to the market by through the use of technical advice and capacity building. As shown by the findings of the research, access to credit by farming households in low and medium commercialization levels will lead to reduction in market participation. Therefore, the capacity building can take form of subsidizing and making available fertilizer, herbicides, sprayers, seed varieties, and other inputs through cooperative associations. So as for the associations to be able to keep tabs on farming households in order achieve the desired effect. Conclusively, collective efforts should be made, and existing collaborations should be bettered to improve high yielding Pearl millet seed varieties. Farming households produce the crop majorly on a subsistent level. However, better yielding varieties will increase their productivity, help them better attain self-sufficiency, and also have a surplus for sale.

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