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The Hungry Farmer Paradox in Irrigated Agriculture: An Investigation into Food Insecurity among Farming Households in Suburban Communities around Zaria, Kaduna State, Nigeria

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Abstract

Approximately 80% of those facing food insecurity in Africa live in rural areas, and half are small-scale farmers, often managing marginal lands, thus, the "hungry farmer paradox". Over 70% of Nigerians are estimated to be poor, and a significant proportion of the population is food-insecure. This study aimed at investigating the socioeconomic factors that influence the Hungry Farmer Paradox among irrigated crop farming households in suburban communities in Zaria, Kaduna State, Nigeria. The survey was conducted in 5 irrigated farming communities in suburban Zaria: Hayin Mallam, Hayin Gada, Birnin Bokko, Shika and Likoro in Giwa and Kudan Local Government Areas of Kaduna State of Nigeria. Primary data was collected. Descriptive statistics and Binary logistic regression were used to achieve the study's objectives. Major findings of the study include: that all the respondents in the study area are male, and almost all (98.4%)are married, and that majority (84%) have attained some level of formal education; ppetty trading (69%) was the most common secondary occupation in the area, followed by paid employment, permanent (5%) and seasonal (4%). 22% were not engaged in any form of secondary occupation; the food situation among all respondents was generally "occasional food shortage" (54%) and "food shortage throughout the year" (28.4%). Only 17.6%, reported having enough food for their households in the previous year. Farm household food security in the survey area was significantly influenced by total farm size (0.481), household size (-0.135) and access to market (-1.030). The study concluded that farmers' socioeconomic characteristics does influence their household's food security level.

Keywords: *Hungry Farmer Paradox, Irrigated Agriculture, Small-Scale Farmers, Nigeria.*

INTRODUCTION

Nigeria's population has increased rapidly from 55 million according to the 1963 census figures, through 140 million as contained in the report of the 2006 national census to an estimated more than 170 million in 2015 (Ammani et al., 2015). Nigeria's population with a growth rate of 2.8% per annum between 1952 and 1991, is one of the fastest growing populations in the world, accounting for one in every five people in sub-Saharan (Tartiyus et al., 2015). The country's population is estimated to reach 400 million by 2050 (FAO, 2021). This rapid growth in population has increased substantially the demand for food in the country. Food is a basic human need. The right to food is fundamental and without it many other human rights cannot be enjoyed (Josanthony, 1999). However, the accessibility and availability of food in the desired quantity and quality throughout a given year remains a dream for many people around the world (Sen, 1995). Consequently, food insecurity is more common and is a defining characteristic of many developing countries (Wambua, Omoke, and Mutua, 2014). Over 70% of the Nigerians are estimated to be poor, and a significant proportion of the population is food-insecure IFDC (2001)

Food security is defined as "the provision of food to guarantee its sufficient supply for everyone to have active and healthy lifestyles" (Anderson, 2009; Vipham et al., 2020). According to FAO (2004), food Security refers to the situation where "food is available to feed everyone at all times" which means that everyone has the "means of access to it; and that it is nutritionally adequate in terms of quantity, quality and variety that is acceptable within the given culture". Conversely, food insecurity can be defined as the absence of food security. Approximately 80% of those facing food insecurity live in

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rural areas, and half are small-scale farmers, often managing marginal lands (FAO, 2013; Sanchez and Swaminathan, 2005). They fall under the category of what (Swaminathan, 2010) described as *producer–consumer*. Smallholders often do not produce enough food to last their household the full year and/or sell a portion of their subsistence crops after the harvest, when market prices are low and cash demands are pressing, and then cannot afford to buy food during the subsequent lean months when crop prices are typically higher (Devereux et al., 2008). Consequently, the majority of people facing food insecurity are small farmers living in extreme poverty, thus, the "hungry farmer paradox" (Bacon et al. 2014).

Widespread malnutrition and endemic hunger is expected to persist until the producer–consumer have enough food to consume.von Braun (2010) identified three different approaches employed in addressing food security and hunger. The development approach which "draws on economic, technological, and institutional strategies and innovations"; the charity approach which "emphasizes both private and public giving to the people in need, and the role of religious institutions is very strong"; and finally, the rights-based approach which "focuses on prioritizing actions – including legal actions and advocacy – that enhance basic human rights, such as access to adequate food". All the aforementioned three approaches require an understanding of the social factors that influence food security or insecurity to be effective. An understanding of the socioeconomic determinants of food security at the farm family level is both "crucial in designing appropriate interventions that will ensure food security" (Tefera and Tefera, 2014); and a "pre-requisite for accurate and effective design, monitoring and development of development projects" (Charleton, 2001).

A number of studies have reported significant relationship between small-scale farmers' socio-economic characteristics and food security/insecurity, across diverse geographic regions and cultures (Adenegan et al., 2004; Omotesho et al. 2006; Ibrahim et al., 2009; Faridi and Wadood, 2010; Shakeel et al., 2012; MDGs, 2013; Kumar et al., 2015; Ammani et al., 2016; Metu et al., 2016; Magana-Lemus et al., 2016; Ogundari, 2017; Danmaigoro and Gona, 2022).Very few of the studies are focused on the *hungry farmer paradox*i.e. food insecurity among farm households. This study intends to contribute to the literature on the socioeconomics of food insecurity among farm households focussing on the Nigerian small scale irrigation farmer living in suburban communities, who, by their specific circumstances can produce crops in both the dry and wet seasons, as well as engage in a number of off-farm economic activities. The Nigerian small scale irrigation farmer offers a compelling example of an interesting respondent in the understanding of the socioeconomic factors associated with the hungry farmer paradox.

METHODOLOGY

Study Area

The survey was conducted in 5 irrigated farming communities in suburban Zaria: Hayin Mallam, Hayin Gada, Birnin Bokko, Shika all located in the Giwa Local Government Area; thefifth community was Likoro in Kudan Local Government Area. All 5 communities are located in the Northern Guinea Savannah, within a 40km radius from the centre of Zaria metropolis. Giwa and Kudan are 2 of the 23 Local Government areas of Kaduna State of Nigeria. Average annual rainfall in the area ranged between 1151-1350mm. The soils type in the area are loamy sand to sandy clay loam texture, fine coarse sub-angular blocky structure and loose to hard consistency. The climate of the area is the tropical dry-and-wet type. The wet season lasts from May/June through to mid-October with a peak usually in August. The dry season extends from early November of one calendar-year to March of the following year. Crops are grown in both seasons, rain-fed during the wet season and under irrigation during the dry season. Wet season crops are mostly cereals (millet, rice, maize and sorghum); legumes (including cowpea; groundnut and soya bean). Dry season crops, grown under irrigation, involves mainly vegetables; tomatoes, pepper and onions. Maize is also grown under irrigation. The cropping systems in the area are dominated by mixed cropping, although sole cropping is practiced. Farmers in the area are also involved in livestock keeping under open grazing. From the foregoing, considering the diverse opportunities for income generation not only through farming in both wet and dry seasons, but also through employment in the many public and private institutions and businesses located in Zaria and environs, it should be clear that the study area is among the ones with the highest potential for the attainment of farm family household food security in the country.

Data Type and Collection

Primary data was collected and utilized in this study. The data was collected digitally during the field survey administration of the questionnaires designedspecifically for this study using ODK Collect, an android app that replaces paper forms or questionnaires used in survey-based data gathering.

Sample Size and Sampling Procedure

The procedure comprised of the purposive selection of the 5 communities covered in the study: Hayin Gada, Hayin Malam, Birnin Bakko, Shika, and Likoro. Respondents were randomly selected from each community, the sample size for each depends on the sampling frame developed for each community across the study area. Geographic location, sampling frame, and the sample size drawn from each community are presented in table 1.

Table 1. Communities, GPS Location, Sampling Frame and Sample Sizes

Community	GPS Location	Sampling Frame	Sample Size
Hayin Malam	11010'54.726"N, 7034'39.894"E	120	50
Hayin Gada	11011'41.196"N, 7034'35.34"E	160	50
Birnin Bakko	11010'31.38"N, 7034'26.22"E	95	50
Shika	11011'45.474"N, 7034'0.354"E	350	50
Likoro	1100.2'0.44"N, 707'9"E	280	50
	Total	1005	250

Analytical Technique

Descriptive statistics for synthesising the data and summarising the results obtained, and binary logistic regressionwereused to achieve the study's objectives.Table 2 presents the description, variables and a priori expectations from the explanatory variables used in the binary logistic model developed for this study.

Table 2. Description of variables used in the logit regression model

Variable	Description of variables / Covariates	Unit of Measurement	A priori expectation of relationship with farm household food security
Dependent Variable	Family food Consumption last year	Binary Enough = 1; Not enough = 0	Proxy for food security
Farmers' age	Farmers' age in years	Years	(+) and direct to some extent
Irrigation Experience	Years of experience in irrigated crop production	Years	(+) and direct
Number of wives	Number of wives	Number	(+/-) and direct/inverse
Years of Education	Years of formal education	Years	(+) and direct
Secondary Occupation	Secondary Occupation	Binary: Yes = 1; No = 0	(+) and direct
Farm size	Farm size in hectares	Hectares	(+) and direct
Household Size	Number of household member	Number	(+/-) and direct/inverse
Household Members Income	Household members with non-farm income	Number	(+) and direct
Access to credit	Access =1; No access = 0	Binary	(+) and direct
Association Membership	Yes = 1; No = 0	Number	(+) and direct
Membership Years	Years of membership of farmer associations	Number	(+) and direct
Access to Market	Access =1; No access = 0	Binary	(+) and direct
Access to Extension	Access =1; No access = 0	Binary	(+) and direct

RESULTS AND DISCUSSIONS

Socioeconomic Profile of Irrigated Crop Farmers in the Study Area

Socioeconomic variables provide background and basic information about the nature, characteristics of the respondent in a given area of study. Figure 1 indicates that all the respondents in the study area were male, and almost all were married. This suggest that suburban irrigated crop production in the area is entirely a male affair. It was observed that women were mostly involved in the aspect of processing and marketing of the farm products.

Figure 1. Sex and Marital Status of Household Heads

Figure 2, revealed that majority (84%) of the respondents have attained some level of formal education. This suggests the existence of a level of literacy, a fertile ground for the dissemination and utilization of extension publications written in English Language or a local vernacular. An interesting aspect of this study's findings was that the number of respondents that attended university level of education or equivalent was the same with those without any education (14%). This reveals a striking polarization in educational attainment among respondents. A plausible explanation for this phenomenon could be because the communities covered in the survey are suburban communities which are, by definition, located at the boundary of urban-rural divide. While urban residents may benefit from better access to educational institutions and resources, rural populations, usually underserved by public infrastructure, continue to face barriers to even basic education.

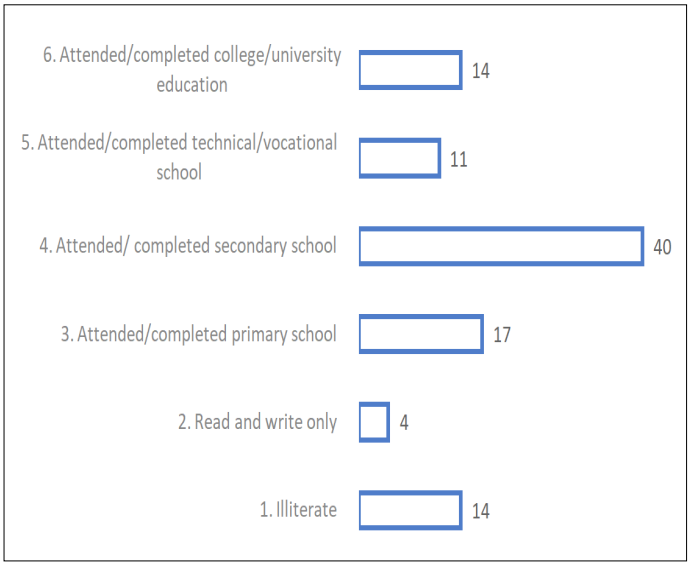

Figure 2. Household Heads Highest Level of Education (%)

Petty trading was the most common secondary occupation in the area (Fig 3). Followed by paid employment, permanent and seasonal respectively. Twenty-two percent of the respondents reported not engaged in any form of secondary occupation. This reliance on a single income source poses significant risks to their economic stability, food security and overall well-being makes them highly susceptible to shocks likely to result from crop failures, price volatility, and unfavourable climatic conditions; restricts opportunities for income diversification, which is crucial for mitigating risks associated with agricultural uncertainties; exposes them to risk of underemployment during off-peak farming seasons, leading to inefficient utilization of available labour resources; hinders their ability to invest in improved farming practices and technologies that could enhance productivity and food security.

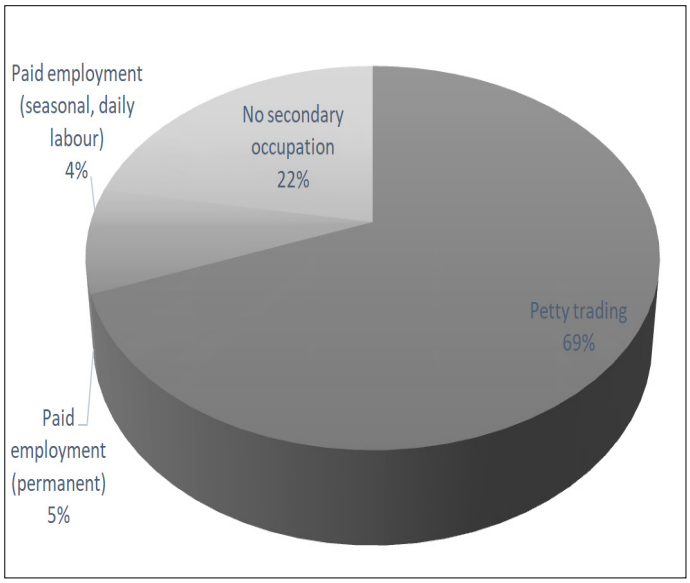

Figure 3. Percentage Distribution of Respondents according to having another occupation other than agriculture

Averages of other socio-economic characteristics of respondents' households such as age, number of wives, household size, years of experience in irrigated crop production, total land holding and years of membership of farmer association etc. are presented in table 3. The average age of the respondents was 44 years with a mode of 35 and a range of 55 years. This suggest that majority of the farmers were within their productive ages. The average farm holding in the study area was 1.3 hectares with a mode of 1 ha and a range of 8ha which suggests that majority of the farmers in the area were small scale farmers based on FGN (2014). The average years of experience in irrigated crop production of the respondents was 14.3 years with a mode of 5 and a range of 50 years. This suggest that majority of the farmers have experience in irrigation farming. The average years of membership of farmer-association in the study area was about 8.5 years with a range of 25 years which suggests that majority of the farmers have were experienced members and beneficiaries of famer-association.

Table 3. Household Socioeconomic Characteristics

Variable	Range	Minimum	Maximum	Mean	Median	Mode	Standard Deviation
Farmers' age	55	20	75	44.00	44	35	12.18
Irrigation Experience	50	0	50	14.30	12	5	10.10
Number of wives	4	0	4	1.57	2	1	0.68
Years of Education	14	1	15	9.36	12	12	4.82
Farm size	8	0	8	1.38	1	1	1.19
Household Size	31	0	31	10.96	10.5	7	6.25
Household Members with Non-farm Income	8	0	8	1.64	1	0	1.94
Years of Association Membership	25	0	25	8.48	6.5	0	6.64

Characterisation of Farm Households According to their Level of Food Security

Food situation, which is taken as proxy for food security in this study, among households in the survey area is presented in fig 4. The food situation among all respondents was generally 'occasional food shortage' (54%). Very few respondents reported food surplus (2.4%). The findings are in agreement with that of Devereux et al (2008), and UNECA (2018), that farmers often do not produce enough food to last their households the full year.

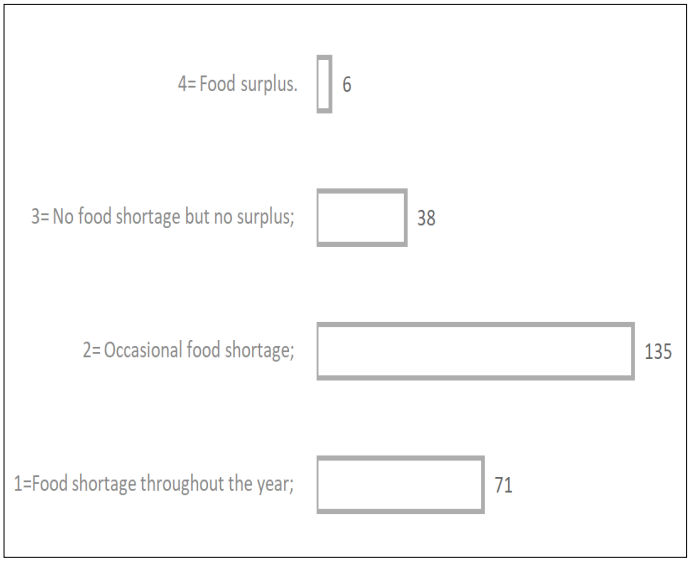

Figure 4. Distribution of respondents according to adequacy of family food consumption in the previous year

Figure 5 shows the distribution of respondents according to adequacy of family food consumption in the previous year. Only 44 of the 250 respondents, about 18%, reported having enough food. This finding agrees with previous findings that reported only a minority of respondents (less than 50%) had enough food all year round: 36.7% among rice farmers in Kebbi State, Nigeria (Danmaigoro and Gona, 2022); and 45.7% among small scale farmers in Oyo State, Nigeria (Adebayo, 2012). The finding contradicts those that reported a majority ofrespondents (more than 50%) having enough food all year round: 61.9% among rural maize farmers in Abuja Metropolis (Gomina et al, 2024); 59.5% among farming households in Jigawa State (Mamman, Wudi and Halliru, 2014); and 60.7% among farming households in Zangon Kataf Kaduna State (Ojeleye, Fadiji and Oyewole, 2015).

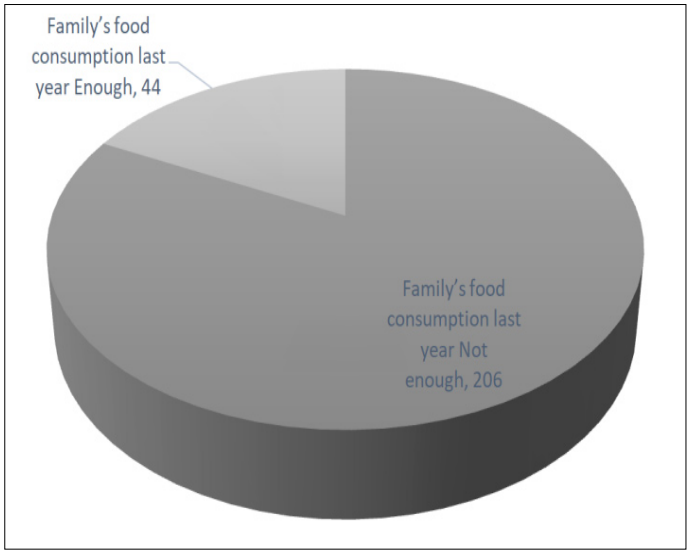

Figure 5. Distribution of respondents according to adequacy of family food consumption

Socioeconomic Factors of Household Heads that Determine Farm Households' Food Insecurity

The extent to which the socio-economic characteristics influence the level of farm household food security in the survey area is presented in table 4.The result of the Omnibus tests of model coefficients shows a Chi-square value of 45.454 which was found to be highly significant when viewed in relation to the computed p-value of 0.000, hence indicating that the model has an overall goodness of fit. The result of the Hosmer and Lemeshow Test had a Chi-square value of 6.831 with a computed p-value of 0.555, indicating that the model fits the data well.

The probability that an irrigated crop farmer's household in the survey area will have enough food for consumption throughout the year was significantly influenced (at the 10% level) by 3 socio-economic variables: farm size, household size and access to market. All the remaining variables in the model had no significant influence on farmers' household food securityin the study area. Some of the socioeconomic variables included in the equation were discussed briefly.

In the discussion that follows, the interpretation of the coefficient of the regressors was achieved in terms of odds, as demonstrated by Gujarati and Porter (2009). The odds were derived by taking the antilog of the various coefficients, and presented in the last column in the table.

The coefficient of farm size (0.481) was significant with a positive sign suggesting a direct relationship between farm family food security and farm size. This is as expected and in agreement with both our a priori expectation and Danmaigoro and Gona (2022) who reported similar finding among rice farming households in Kebbi State. The bigger the size of a family's farm holding, the higher the output and income expected. An interpretation of the coefficient of the regressor in terms of odds suggests that farmers with bigger size of farm holdings in the survey area are 162% more likely to have enough food for their families' consumption than farmers with smaller sizes of farm holdings, other things remaining the same. The coefficient of household size (-0.135) though significant, had a negative sign suggesting an inverse relationship between family having enough food consumption and household size. This is expected and in agreement with our a priori expectation. The bigger a farmer's household size, the more mouths that have to be fed, the less likely that the family will have enough food for consumption. This is attributable to farm families characterised with a higher dependency ratio with more non-earning members of the households such as children and the elderly, and lower per capita income. This finding contradicts Danmaigoro and Gona (2022) where a direct relationship is reported between farm household food security and household size among rice farmers in Kebbi State, suggesting that farm households benefitted from having more hands available for farming as well as non-farm income generating activities that contribute in increasing farm household's food availability and access. An interpretation of the coefficient of the regressor in terms of odds suggests that farmers with larger household sizes in the survey area are 87% less likely to have enough food for their families' consumption than farmers with smaller household sizes, other things remaining the same. The coefficient of access to farm produce market (-1.030) was significant with a negative sign suggesting an inverse relationship between farmers' households having enough food for consumption and access to market. This is contrary to our a priori expectation. An interpretation of the coefficient of the regressor in terms of odds suggests that farmers with access to market in the survey area are 36% less likely to have enough food for their families' consumption than farmers with no access to market, other things remaining the same. A possible explanation could be because irrigated crop farmers in the survey area usually produce for the markets, the income or revenue realised from the sale of the produce might be allocated more to non-food items such as consumer goods and services potentially at the expense of food purchase.

Apart from the significant factors, the following factors are worth discussing. The estimated coefficient for secondary occupation (0.637) was not significant and had a positive sign indicating the obvious relationship between having secondary occupation and having enough food for family consumption. This is expected and in agreement with our a priori expectation. A farmer with a secondary occupation has another source of income to feed his family. An interpretation of the coefficient of the regressor in terms of odds suggests that farmers' secondary occupation in the survey area are 189% more likely to have enough food for their families' consumption than farmers with no secondary occupation, other things remaining the same. The estimated coefficient for membership of farmer associations (0.232) was also not significant and had a positive sign indicating the relationship between membership of farmers' association and having enough food for family consumption. This is expected and in agreement with our a priori expectation. A farmer that belongs to a farmers' association stands to derive a number of benefits that could contribute to his ability to feed his household. An interpretation of the coefficient of the regressor in terms of odds suggests that farmers belonging to associations in the survey area are 126% more likely to have enough food for their families' consumption than farmers that do not belong to any, other things remaining the same. The coefficient of access to credit (0.108) was another factor that was not significant. Because it has a positive sign suggesting a direct relationship between farmers' household'sfood security and access to credit. This is in agreement with our a priori expectation. An interpretation of the coefficient of the regressor in terms of odds suggests that farmers with access to credit in the survey area are 111% more likely to have enough food for their families' consumption than farmers with no access to credit, other things remaining the same.

Table 4. Socio-economic variables influencing the Adequacy of Household Food Consumption

Variable	Coefficient	Std Error	Probability	Antilog of Slope of Coefficient
Marital status	1.203	1.324	0.363	3.331
Farmers' age	-0.030	0.030	0.307	0.970
Irrigation Experience	-0.005	0.040	0.900	0.995
Number of wives	0.223	0.521	0.669	1.250
Years of Education	0.004	0.058	0.944	1.004
Secondary Occupation	0.637	0.695	0.359	1.892
Farm size	0.481	0.225	0.033	1.617

Household Size	-0.135	0.074	0.067	0.873
Household Members with Non-farm Income	-0.208	0.160	0.193	0.812
Association Membership	0.232	0.730	0.751	1.261
Membership Years	-0.031	0.060	0.602	0.969
Access to credit	0.108	0.409	0.791	1.114
Access to Market	-1.030	0.431	0.017	0.357
Access to Extension	-0.429	0.545	0.432	0.651
Constant	-1.759	2.721	0.518	0.172

Cox & Snell R^2=0.168; Negelkerke R^2= 0. 274; Omnibus Tests (Chi-square =45.454; p-value =0.000); Hosmer and Lameshow Test (Chi-square = 6.831; p-value =0.555);Statistically significant statistics at α = 10%

CONCLUSION

The study aimed at investigating the socioeconomic determinants of Hungry Farmer Paradox among irrigated crop farming households in suburban communities in Zaria, Kaduna State, Nigeria. Highlights of the major findings of the study are as follows:The food situation among all respondents was generally 'occasional food shortage'. Very few respondents reported food surplus. Only 44 of the 250 respondents, about 18%, reported having enough food for their households in the previous year.The probability that an irrigated crop farmer's household in the survey area will have enough food for consumption was significantly influenced (at the 10% level) by 3 socio-economic variables: farm size, household size and access to market.There was a direct relationship between household farm size and farm household food security.There was an inverse relationship between, farm household food security and household size and access to market.The study concluded that farmers' socioeconomic characteristics does influence his household's food security level.

REFERENCE

1. Adebayo, O. O. (2012). Family Income Among Small Scale Farmers a Panacea for Household Food Security in Oyo State, Nigeria. Research on Humanities and Social Sciences. 2 (7): 32-36
2. Adenegan KO, Oladele OI, and Ekpo MN (2004). Impact of agricultural export on food security in Nigeria. Food, Agriculture & Environment. 2 (1):107-112.
3. Ammani, A. A., AbdulSalam, Z., Damisa, M. A. and Atala, T. K. (2015). Effects of Federal Government Agricultural Policies on Small-Scale Rice Production in Kaduna State, Nigeria. Savannah Journal of Agriculture, 10(1):25-34.
4. Ammani, A.A., AbdulSalam, Z., Damisa, M.A. and Atala, T.K. (2016). Socioeconomic Determinants of Rice Yield Among Small-scale Farmers in Kaduna State. Savannah Journal of Agriculture 11(1): 32 – 39
5. Anderson, M. (2009). A question of governance: To protect agribusiness profits or the right to food. Agribusiness Action Initiatives.
6. Bacon, C. M., Sundstrom, W. A., Gomez, M. E. F., Mendez, V. E., Santos, R., Barbara Goldoftas, B., and Dougherty, I. (2014). Explaining the 'hungry farmer paradox': Smallholders and fair trade cooperatives navigate seasonality and change in Nicaragua's corn and coffee markets. Global Environmental Change 25: 133-149. https://doi.org/10.1016/j.gloenvcha.2014.02.005.
7. Charleton, C. (2001). Constructing samples for characterizing household food security-monitoring and evaluating food security interventions. Food security in practice: Methods for rural development projects. International Food Policy Research Institute (IFPRI) p.77-78.
8. Danmaigoro, A., and A. Gona. (2022). Determinants of Food Security Status and Coping Strategies among Rice Farmers in Kebbi State, Nigeria. Shanlax International Journal of Economics. 10 (2): 17–24.
9. Devereux, S., Vaitla, B., Swan, S.H., 2008. Seasons of Hunger: Fighting Cycles of Quiet Starvation Among the World's Rural Poor. Pluto Press.
10. FAO (2004). The State of Food Insecurity in the World 2004: Monitoring Progress Towards the World Food Summit and Millennium Development Goals. Rome: FAO
11. FAO (2021) Nigeria Agriculture at a Glance. Food and Agriculture Organisation. https://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/
12. FAO, 2013. Resilient Livelihoods – Disaster Risk Reduction for Food and Nutrition Security Framework Programme. FAO, Rome.
13. Faridi R., and Wadood SN. (2010). An econometric assessment of household food security in Bangladesh. The Bangladesh Development Studies. 33 (3):97-111
14. FGN (2014). Nigeria Industrial Revolution Plan. Abuja: Federal Ministry of Industry, Trade, and Investment.
15. Frankenberger, T.R., and M.K. McCaston (1998). "The Household Livelihood Security Concept." Food Nutrition and Agriculture No 22,

16. Gomina, S. K., Gomina, E. O., Ogundipe, S. D., Ajibaye, O. T., Olowu, D. B. and Okorie, O. B. (2024). Labor utilization and food security among rural maize farmers in Abuja Metropolis, Nigeria: A careful analytical study. Global Journal of Engineering and Technology Advances 20 (01): 85–104

17. Gujarati, D. N. and Porter, D. C. (2009), Basic Econometrics 5th Edition. Boston: McGraw-Hill

18. Ibrahim H, Bello M, and Ibrahim H. (2009). Food security and resource allocation among farming households in North Central Nigeria. Pakistan Journal of Nutrition. 8(8):1235-1239.

19. IFDC (2001). Agricultural Input Markets in Nigeria: An Assessment and a Strategy for Development. Paper Series IFDC-P-23. Muscle Shoals, Alabama: International Fertilizer Development Centre

20. Josantony, J. (1999), Food: Christian perspective on Development Issues. Genprint: Ireland.

21. Kumar A, Ahmad MM, and Sharma P. (2015). Carbon emission and global food security: A cross country analysis. PENCIL Publication of Agricultural Sciences. 2015;2(1):7-24.

22. Magana-Lemus D., Ishdorj A., Parr Rosson, C and Lava-Alvarez, J. (2016). Determinants of household food insecurity in Mexico. Agricultural and Food Economics, 4 (10): 1–20.

23. Mamman, B. Y., Wudi, A. H. and M. Halliru (2014). Socio-economic Factors and Income Diversification Affecting Food Security Status of Farming Households in JIgawa State, Nigeria. Proceedings of the 1st International Conference on Dry-lands. Centre for Dry-lands Agriculture. Bayero University, Kano. 109-114

24. MDGs Report (2013). Nigeria Millennium Development Goals 2013 report, www.mdgs.gov.ng.

25. Metu, G.A., Okeyika, K.O and Maduka, O.D. (2016). Achieving sustainable food security in Nigeria: Challenges and way forward, 3rd International Conference on African Development Issues (CU-ICADI 2016), Covenant University, Nigeria.

26. Ogundari, K. (2017). Categorizing households into different food security states in Nigeria: the socioeconomic and demographic determinants. Agricultural and Food Economics, 5:8 DOI 10.1186/s40100-017-0076-y.

27. Ojeleye, O. A., Fadiji, T. O., and Oyewole, S. O. (2015). Determinants of Food Security Among the Farming Households in Zango-Kataf Local Government Area of Kaduna State. NSUK Journal of Science & Technology 5 (2): 118 - 122

28. Omotesho OA, Adewumi A, Mahammad-Lawal A, and Ayinde OE (2006). Determinants of food security among the rural farming households in Kwara State, Nigeria. African Journal of General Agriculture. 2(1):7-15.

29. Sanchez, P.A., Swaminathan, M.S., 2005. Cutting world hunger in half. Science 307 (5708) 357–359.

30. Sen, A. (1995). Poverty and Famine: An essay on entitlement and Deprivation. Oxford Press: Clarendon, New York

31. Shakeel A, Jamal A, and Zaidy MN (2012). A regional analysis of food security in Bundelkhand Region (Uttar Pradesh, India). Journal of Geography and Regional Planning 5(9):252-262.

32. Swaminathan, M. S. (2010). Achieving food security in times of crisis. New Biotechnology 27 (5): 453-460

33. Tartiyus, H., Mohammed, D., and Amade, P. (2015). Impact of Population Growth on Economic Growth in Nigeria. IOSR Journal of Humanities and Social Sciences. 20 (4), 115-123.

34. Tefera, T and Tefera, F. (2014). "Determinants of Households Food Security and Coping Strategies for Food Shortfall in Mareko District, Guraghe Zone Southern Ethiopia." Journal of Food Security, 2:(3):92-99.

35. UNECA (2018). Africa regional overview of food security and nutrition report (available at: www.uneca.org/publications/2018-africa-regional-overviewfood-security-and-nutrition-report

36. Vipham, J. L., Amenu, K., Alonso, S., Ndahetuye, J. B., Zereyesus, Y., Nishimwe, K., and Grace, D. (2020). No food security without food safety: Lessons from livestock related research. Global Food Security, 26, 100382. https://doi.org/10.1016/j.gfs.2020.100382

37. von Braun, J. (2010). Food insecurity, hunger and malnutrition: necessary policy and technology changes. New Biotechnology 27 (5): 449-452

38. Wambua, B.N., Omoke, K.J. and Mutua, T.M (2014). Effects of Socio-Economic Factors on Food Security Situation in Kenyan Dry Lands Ecosystem. Asian Journal of Agriculture and Food Science 2(1): 52-59