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Evaluation of Food Security Status Among Rice Farming Households in Kano State, Nigeria

Ma Dingchou[1,a], Bello Nasiru Abdullahi[1,b], Sani Saidu Barau[2,c]

[1]College of Finance and Economics, Gansu Agricultural University,
Lanzhou 730070, China

[2]Department of Agricultural Economics, Federal University Dutsinma, Katsina, Nigeria

[a-c]E-mail address: madc@gsau.edu.cn , bellonasiru1990@gmail.com ,
saninbichi@gmail.com

ABSTRACT

This article evaluated food security status of rice farming households in Kano State, Nigeria. Descriptive statistics, food security index and binary logistic regression were employed for data analysis. A sample of 660 respondents was chosen using multi-stage sampling procedure. Descriptive statistics showed that males have higher percentage of engagement than the females with 85% and 15% for males and females respectively. 72.6% of the respondents were food secure households while 27.4% were food insecure households with calculated food security index of 51,439.59. Binary logistic result revealed that age, household education, experience, household size and farm size were the significant determinants of food security in the study area with -0.134, 0.002, 0.121, -1.671 and 0.078 coefficients at 10%, 10%, 5%, 10% and 10% significance level respectively. The challenges encountered by the farmers in addressing food security condition were high fertilizer cost, diseases and pests, unequipped storage facilities, high labor cost, poor access to credit facilities, high cost of insecticides, inadequate visit by extension agent and high cost of rent. The study highlighted that, since resources are limited, farmer-extension agent relationship should be encouraged so that farmers would be opportune to learn more new production technologies and how to utilize limited resources efficiently to get higher output from the production and hence improve food security condition.

Keywords: Food Security, Binary logistic, Rice farming households, Challenges

1. INTRODUCTION

Food is one of the fundamental needs of human life. Adequate intake of qualitative and quantitative food will surely results in peaceful and healthy life. Shortage of qualitative and quantitative food intake results in hunger and starvation which finally end up with unhealthy life and war (Haddabi, Ndehfru and Aliyu, 2019). In Nigeria, food occupies larger portion of the household expenditure. Food quality can be measured when the taken food have essential nutrients of proteins, carbohydrates, vitamins, fats and oil and minerals in appropriate proportion (Irohibe and Agwu, 2014).

Food security is a situation whereby all people at any convenient time can afford enough and nutritious food for healthy life (Adewuyi et al., 2014). Also, Food security is the ability of people to get sufficient food on daily basis (Gani, Olayemi and Inoni, 2019). Food security is defined as getting food accessibility, food availability, stability and utilization of food for healthy life (Hyacinth and Kwabena, 2015).

In Sub-Saharan Africa, the available average food amount per individual person per day is 1,300 calories while the world wide average food amount per person is 2,700 calories (Haddabi, Ndehfru and Aliyu, 2019). FAO (2004) find out that African continent is the only continent that has highest number of countries that are food in secured.

In Nigeria, the demand of food for the populace has entirely grew up faster than either total supply or food production (Adereti and Fasina, 2017). It is analyzed that there is a linking factor between food security levels and level of poverty in rural communities in Nigeria. Also, in Nigeria in 1986 18% of the households were found to be food insecure and also, in 2005 above 40% were found to be insecure (Bukar *et al.*, 2017). (Adereti and Fasina, 2017) revealed that from 2000-2002, 9% of the population in Nigeria were chronically undernourished.

The objectives of this article are to:

1) Describe the socio-economic characteristics of small scale farming households.

2) Evaluates the status of food security among small scale farming households.

3) Analyze the determinants of food security status of small scale farming households.

4) Identify the production challenges encountered by the farmers in addressing food security situation.

2. LITERATURE REVIEW

Empirical review

(Huang and Zou, 2018) observed that intensive rice production in China resulted in high productivity which played an important role in national food security. (Huang and Zou, 2018) also observed that by 2030, there will be an increase in rice productivity of about 20% which will meet the demand of growing population for food. A research by (Deaton, Scholz and Lipka, 2020) on assessment of food security in Canada was conducted using primary data. Regression analysis was used to examine the factors responsible for food insecurity. It was examined that mental health and gender were associated with food insecurity at household levels.

According to review study by (McKay, Haines and Dunn, 2019) food insecurity in Australia ranges from 2% to 9%. The authors suggestion was that there is demand for high consistent measurement of food insecurity, because it will help future researchers to have a

clear knowledge about Australian food insecurity and hence it will help them to create proper policies that will address the issue. Also, (Pakravan-Charvadeh, Khan and Flora, 2020) analyzed food security in Iran using spatial analysis. Logistic regression was used to evaluate the relationship between caloric intake and socio-economic determinants among rural peoples in all the provinces in Iran. The study analyzed caloric intake as a proxy of food security in Iran. The examined spatial analysis suggested that each province should have its own policy on food security than centralized policy for the whole country which will have more direct positive impact to low income households.

(Ghanian, 2016) measured food insecurity extent in Iran using primary data of 166 respondents as sample size. It was find out that more than 50% of the respondents were food insecure which was as a result of low level of income and low level of education.

(Alvares and Amaral, 2014) evaluated food insecurity and the factors responsible for it in Portugal. A sample of 3,552 respondents were analyzed using logistic regression and chi-square test. 16.5% of the respondents were food insecure. The factors responsible for food insecurity in Portugal were low income and low level of education.

Also, (Ahmed *et al.*, 2017) measured food security status using dietary intake in rural areas of Pakistan. 25% of the rural households were food insecure. The findings showed that farming households perceived increase in health expenses, inadequate irrigation water, food prices and crop diseases. The factors influencing food security status were debt, health expenses, food prices and monthly income. It was suggested that there is demand for local food security to be enhanced. According to (Wegren, Nikulin and Trotsuk, 2017) traditional measures showed that majority of the Russian people were food secure.

(Feeney and MacClay, 2016) observed that, Argentina does not have simultaneous problems serving as a food exporter and food provider to its own population. The only problem Argentina has was failure to access food to its vast population. Examined food insecurity among small-scale farmers in Poland. A sample size of 710 respondents was taken using structured questionnaires. 9% of the respondents were severe food insecurity and 43% were food insecurity. Regression result showed that, higher education, high land productivity and high age of the farm manager were negatively significant.

(Suharyanto and Indrasti, 2017) investigated food security among rice farmers in Bali province. A sample of 216 farmers was used. It is observed that, 49.07%, 37.9%, 8.7% and 4.17% of the respondents were categorized as secure, vulnerable, insufficient and insecure respectively. Logistic regression result showed that, incomes, household food reserve and housewives education were positively significant influencing the level of food security. Also, a research was observed by (Ngema, Sibanda and Musemwa, 2018) on household food security in Maphumulo of South Africa. Stratified random sampling was adopted with sample of 495 respondents. Binary logistic showed that irrigation, education and participation were positively significant influencing food security of the households. While access to credit and household income were negatively correlated. The authors proposed that efforts by government and non-governmental agencies should be made to enhance food security through special interventions on food security as well as investment in agricultural infrastructure (irrigation) and education.

(Mutea *et al.*, 2019) assessed rural household food security in North-western region of Kenya. 600 respondents were randomly selected from 3 agro ecological zones. Food security was assessed using food security index. Linear regression was used to identify factors influencing food security. (Mutea *et al.*, 2019) also found that 32% and 68% of the respondents were food secure and food insecure respectively. Regression result showed that only crops

infestation was positively significant. (Kuwornu, Suleyman and Amegashie, 2013) examined food security among farming households in central region of Ghana. Data were obtained from 120 respondents using questionnaires. Result showed that, 60% of the farming households were food insecure. Logit regression revealed that increase in income of the households, more credit access and increase in production improve farming household's food security in central region of Ghana. Also, a study by (Ngongi, Urassa and Lecturer, 2014) was observed on food insecurity among farming households in Kahama district of Tanzania. Analysis showed that the selected respondents were food insecure. Result of multiple regression analysis revealed that household food supply was influenced by annual income.

3. MATERIALS AND METHODS

Kano is among densely populated states with total number of 9,401,288 inhabitants in Nigeria and Africa at large (NPC, 2006). Kano boarders Katsina, Jigawa, Bauchi and Kaduna States to the northwest, northeast, southeast and southwest respectively. Kano has three senatorial zones namely; Kano central, Kano north and Kano south. Kano located at latitude 11°30'N and longitude 8°30'E.

Figure 1. Map of Kano State

Kano is intensely engaged in agricultural production and supply with potential of practicing both commercial and subsistence agricultural production depending on the farmer's capability. The food crops cultivated in Kano include sorghum, millet, maize, rice and cowpea. The crops for industrial purposes and export are cotton and groundnut. In Nigeria, Kano is the highest producer of garlic, cotton, soyabean, sesame, chill pepper and hides and skin. Kano has 3 main seasons namely; cool and dry season, hot and dry season and wet season. Kano lies 484m above sea level with little rainfall throughout the year. April is the warmest month with mean temperature of 30.9 °C. The coldest month is January with mean temperature of 21.5 °C. Temperatures differ by 48.9 F (9.4 °C) throughout the year. There is almost 800 mm of average annual rainfall in Kano central. Kano south has almost 1000 mm average annual rainfall while Northern Kano has average annual rainfall below 800 mm (Mustapha *et al.*, 2014).

3. 1. Sampling procedure

Kano State has 44 local governments with three senatorial zones namely; Kano central, Kano north and Kano south. These 44 local governments were classified either in one the three senatorial zones. Two local governments were purposively selected from each senatorial zone, followed by multi-stage sampling procedure. From Kano central Kura and Madobi local governments were chosen. In Kano north, Bichi and Bagwai local governments were selected while in Kano south Doguwa and Wudil were also chosen. Six local governments from three senatorial zones were selected namely; Kura, Madobi, Bichi, Bagwai, Doguwa and Wudil. A sample of 121, 99, 106, 114, 132 and 88 respondents were randomly selected from Kura, Madobi, Bichi, Bagwai, Doguwa and Wudil respectively. At the end, a total sample size of 660 respondents was gleaned with aid of multi-stage sampling technique.

3. 2. Data collection method

Primary data from field survey was gleaned using structured questionnaires. The questionnaires were administered to small scale rice farming households in six selected local governments out of 44 local local governments of the state from three senatorial zones. The questions in the questionnaire were based on the objectives of this article.

3. 3. Analytical tools

Descriptive statistics (Frequency and percentage), Food security index (FSI) and Binary logistic were used as analytical tools. Descriptive statistics was used for objective 1 and 4, Food security index was used for objective 2 and Binary logistic regression was used to accomplish objective 3. Food security status of the respondents was examined using food security index as it was used by (Haddabi, Ndehfru and Aliyu, 2019). The respondents were categorized into food secure house heads and food insecure house heads. Food security index is mathematically expressed as:

$$\text{Fi} = \frac{\text{per capita food expenditure for the ith household}}{2/3 \text{ mean per capita food expenditure of all households}} \qquad (1)$$

where: Fi = food security index,   when Fi > 1 = food secure ith household.
                                                     Fi < 1 = food insecure ith household.

A household is said to be food secure when his monthly per capita food expenditure is higher than or equivalent to 2/3 mean per capita food expenditure while a household is said to be food insecure when his monthly per capita food expenditure is lower than 2/3 mean per capita food expenditure.

Food security determinants were analyzed using binary logistic regression as it was applied by (Adewuy, Babatunde and Bankole, 2014). Binary logistic model is expressed explicitly as:

$$Fi = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7X7 + b8X8 + b9X9 \quad (2)$$

where
Fi = Food security status (Dummy, where 1 = food secure household; 0 = food insecure household)
X1 = household Age (years)
X2 = household level of education (years)
X3 = Marital Status (dummy, 1 = married, and 0 = not married)
X4 = Experience in farming (years)
X5 = Gender (Male =1, Female = 2)
X6 = Labor (man- day)
X7 = Household size (total number of persons per household)
X8 = Farm size (hectares)
X9 = income (per month in ₦)

4. RESULTS AND DISCUSSIONS

4. 1. Respondents socio-economic traits

Table 1 presents distribution of rice farming households Socio-economic traits. The Socio-economic traits include; Age, household education, experience in rice farming, household size, gender, marital status, occupation, credit access and social organization participation.

The table reported that 21.5%, 30.2% and 21.5% of the respondents goes to (20-30) years, (31-40) years and (41-50) years ages range respectively. While respondents with 50 years and above occupied 26.8% of the age distribution of the respondents. Also, 39.69 was estimated as the mean age, entailing that the farmers are energetic and capable of discharging their farming activities to produce bulky food output that will sustain their family and also prevent their family from food insecurity. This concur to (Haddabi, Ndehfru and Aliyu, 2019) where the farmers are in their energetic age of agricultural production which will help enormously in preventing households from food insecurity. Also, 23.9% and 35.5% obtained primary and secondary education respectively while 25.4% have tertiary education. 15.2% of the respondents have never been to formal education.

This showed that majority of the farmers have formal education with 84.8%, indicating that they are exposed to adopt new production practices and also help them to identify the challenges affecting their production activities and hence improve their food security situation. This agrees with (Irohibe and Agwu, 2014) who revealed that formal education assist farmers in adopting new farming practices in addressing food security situation. The table also tells that

57.7% have 1-5 years of experience, 21.4% have 11-20 years of experience, 15.1% have 21-30 years of experience while 5.8% have above 30 years of experience in rice production. 12.5 years was calculated as mean years of experience in rice farming. This entails that the producers have acquired more experience in agro production which will assist the farmers in multiplying their level of output and hence assist in alleviating food insecurity.

This concur to (Adewuy, Babatunde and Bankole, 2014) findings who revealed that the farmers acquired more experience which assist the farmers in solving so many challenges affecting the production venture. The respondents with 1-5 persons occupied 54.2% of the distribution, 6-10 persons occupied 24.3%, 11-15 persons occupied 12.7% while 8.8% have more than 15 persons household size. The mean size of the household was 6.30 persons showing that there were many people relying on each household head. This tally to (Adereti and Fasina, 2017) findings who observed that, as the number of household size increases the chance of food security decreases thereby increasing food insecurity. Also, 85% of the rice farmers were males while 15% were females, this is similar to (Kuwornu, Suleyman and Amegashie, 2013) findings who revealed that the minority were females while males were the majority. This indicates that males contribute more than the females farmers in increasing food security level because males are stronger than the females. It also presents that 82.3% of the rice farmers were married while 17.7% were not married.

Also, farming as an occupation occupied 64.2% of the distribution while 35.8% have other occupations apart from farming entailing that agriculture gives more occupation opportunity for rural households than any occupation in rural areas. This is not in contradiction with (Bukar *et al.*, 2017) result who revealed that farming is the major occupation of rural households in Nigeria. The respondents that had credit were access were 20.9% of the distribution while 79.1% had no credit access, this shows that those with credit access will have more chance of expanding their production capacities than those with no credit access. This concur with (Ngema, Sibanda and Musemwa, 2018) who observed that respondents with no credit access are higher than those with credit access. Also, 32.7% of the farmers have social group membership while 67.3% have no membership of social group.

Table 1. Socio-economic Traits of the Respondents.

Variable	Frequency	Percentage	Mean
Age (years)			**39.69**
20-30	142	21.5	
31-40	199	30.2	
41-50	142	21.5	
51-60	107	16.2	
Above 60	70	10.6	
Total	**660**	**100**	
Household Education(years)			
Primary	158	23.9	
Secondary	234	35.5	

tertiary	168	25.4	
Non-formal	100	15.2	
Total	**660**	**100**	
Experience in Rice farming (years)			**12.50**
1-10	381	57.7	
11-20	141	21.4	
21-30	100	15.1	
Above 30	38	5.8	
Total	**660**	**100**	
Household size			**6.30**
1-5	358	54.2	
6-10	160	24.3	
11-15	84	12.7	
Above 15	58	8.8	
Total	**660**	**100**	
Gender			
Male	561	85	
Female	99	15	
Total	**660**	**100**	
Marital status			
Unmarried	117	17.7	
Married	543	82.3	
Total	**660**	**100**	
Occupation			
Farming	424	64.2	
Otherwise	236	35.8	
Total	**660**	**100**	
Credit Access			
Yes	138	20.9	
No	522	79.1	
Total	**660**	**100**	
Social organization participation			
Yes	216	32.7	
No	444	67.3	
Total	**660**	**100**	

4. 2. Food Security Status of the Respondents

Table 2 presents food security situation of the respondents. The respondents were categorized into food secure house heads and food insecure house heads. A household is said to be food secure when his monthly per capita food expenditure is higher than or equivalent to 2/3 mean per capita food expenditure while a household is said to be food insecure when his monthly per capita food expenditure is lower than 2/3 mean per capita food expenditure. 51,439.59 was calculated as mean per capita expenditure of food per month which is equivalent to food security index. It reveals that 72.6% were food secure while 27.4% were food insecure. This is contrary to (Alpízar *et al.*, 2020) who analyzed that 56% of the respondents faced recurrent insecurity of food.

Table 2. Description of Food security status of the respondents

Variable	Frequency	Percentage
Food insecure	49	27.4
Food secure	611	72.6
Total	**660**	**100**
Food security index(monthly mean per capita) = 51,439.59		

4. 3. Food Security Determinants of the Respondents

Table 3 presents binary logistic model result for food security determinants among rice farming households in Kano, Nigeria. The analysis output showed that household age, household education, experience, household size and farm size were statistically significant while marital status, gender, labor and income were not significant.

The table presented that age was statistically significant at 10% level with negative coefficient, implying that younger age households are more likely to food security than older age households because households with younger age are stronger and energetic than those that are older in discharging their production activities efficiently for greater production output and also have chance of getting off-farm jobs as an additional source of income. This agrees to (Haddabi, Ndehfru and Aliyu, 2019) who observed that younger age household have more capability of producing higher output than older age households.

The table reported that Household education has positive coefficient and was significant at 10% level, indicating that the households with higher level of formal education have more chance of bridging the gap of food insecurity because they are exposed and have more knowledge than those with lower level of education in adoption of technologies that will boast production and hence assist in addressing food security challenges, this concur to (Suharyanto and Indrasti, 2017) findings.

Experience has positive coefficient which was significant at 5% level. This entails that, households with higher years of experience will have more ability and capability of identifying

production challenges and the way forward in addressing the challenges for better production output than households with lower experience which will assists in decreasing food insecurity.

This is not in contrary to (Bukar *et al.*, 2017) result who observed that those with higher years of experience are capable of producing higher output than those with less experience in the production venture.

Also, the coefficient of household size was negative which was significant at 10% level, indicating that households with larger family size will likely have food insecurity than those with smaller family size. This supports (Adewuy, Babatunde and Bankole, 2014) result.

From Table 3 the coefficient of farm size was positive and significant at10% level, showing that household heads with larger farm size will have higher output than those with smaller farm size. Households with higher output level are more likely to address insecurity of food issues than those with smaller output level. This supports (Okon *et. al.,* 2017) result, who revealed that the larger the size of the farm the higher the productivity.

Table 3. Binary logistic regression of food security determinants

Variables	Coefficients	Standard Error	Wald	Sig
Household Age	-0.134	0.081	2.721	0.099[*]
Household Education	0.002	0.051	0.002	0.035[*]
Marital status	-0.536	0.478	1.257	0.262
Experience	0.121	0.087	1.960	0.006[**]
Gender	-0.086	0.108	0.626	0.429
Labor	0.005	0.016	0.094	0.759
Household size	-1.671	0.760	4.827	0.028[*]
Farm size	0.078	1.810	0.002	0.096[*]
Income	0.000	0.000	0.021	0.886
Constant	1.068	1.990	0.288	0.591

(*) = Significant at 10%, (**) = Significant at 5%

4. 4. Production challenges encountered by the farmers in addressing food security situation

Table 4 presents respondents distribution based on challenges encountered by the farmers in addressing food security situation. According to severity order, the table presents that high cost of rent (87.8%), poor credit access (85.1%), high cost of insecticides (76.9%), high labor cost (69.2%), high fertilizer cost (57.8%), inadequate visit by extension agents (53.7%), diseases and pests (42.3%) and unequipped storage facilities (22.5%) were ranked 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th respectively. This shows that 6 out of 8 challenges encountered by the famers affect more than 50% of the farmers implying that the problems disturb vast number of the farmers. This contradicts result who find out that land scarcity is the major challenge affecting the farmers.

Table 4. Respondents distribution based on production challenges encountered by the farmers in addressing food security situation.

Problems	Frequency	Percentage	Ranking Order
Diseases and pests	279	42.3	7th
High fertilizer cost	381	57.8	5th
Unequipped storage facilities	146	22.5	8th
High labor cost	457	69.2	4th
Poor credit access	562	85.1	2nd
High cost of insecticides	508	76.9	3rd
Inadequate visit by extension agents	354	53.7	6th
High cost of rent	579	87.8	1st

Source: Field Survey, 2020

5. CONCLUSION AND RECOMMENDATIONS

From the findings, 85% of the rice farming households were males with energetic ages. The mean monthly per capita expenditure was equivalent to 51,439.59 which was used to identify households that are food secure and those that are food insecure. It showed that 72.6% of the respondents were food secure households with high cost of labor as the major challenge encountered by the farmers. Binary logistic result revealed that age, household education, experience, household size and farm size were the significant determinants of food security in the study area. Furthermore, the figured problems encountered by farmers should be overcome efficiently so as to maintain and improve the food security situation in the study area. Inefficient efforts in addressing the challenges will results in food insecurity and hence affects the study area negatively in many other ways.

Recommendations

The following are the suggested recommendations to improve food security condition among rice farming households in the study area. They include:

1) Government should introduce new policy that will reduce rent cost so that many people will get opportunity of taking part in the business and those that are in the venture will increase their production capacity which will assist in maintaining and improving food security condition.

2) Credit facilities access should be at ease so that many farmers would get opportunity of increasing their small scale level of production to a larger scale which would enhance food security condition.

3) Agrochemicals especially insecticides should be supplied at subsidized rate by the government to the farmers.

4) Since resources are limited, farmer-extension agent relationship should be encouraged so that farmers would be opportune to learn more new production technologies and how to utilize limited resources efficiently to get higher output from the production and hence improve food security condition. Sani Saidu Barau also contributed greatly in discussing the results of this article.

References

[1]   Adereti, D. T. and Fasina, O. O. (2017). Gender analysis of food security status of rural households in Ondo State, Nigeria. *Russian Agricultural Sciences*, 43(4), 353-360. doi: 10.3103/s1068367417040024

[2]   Adeolu O. Adewuyi, M. Adetunji Babatunde and Abiodun S. Bankole (2014). A Global Value Chain Analysis of Cocoa and Garment in Nigeria. *Journal of Sustainable Development in Africa* 16(6), 1-20

[3]   Ahmed UI, Ying L, Bashir MK, Abid M, Zulfiqar F (2017). Status and determinants of small farming households' food security and role of market access in enhancing food security in rural Pakistan. *PLoS ONE* 12(10): e0185466. https://doi.org/10.1371/journal.pone.0185466

[4]   Alpízar, F. *et al.* (2020). Determinants of food insecurity among smallholder farmer households in Central America: recurrent versus extreme weather-driven events. *Regional Environmental Change*, 20(1). doi: 10.1007/s10113-020-01592-y

[5]   Alvares, L. and Amaral, T. F. (2014) 'Food insecurity and associated factors in the Portuguese population. *Food and Nutrition Bulletin*, 35(4), pp. 395–402. doi: 10.1177/156482651403500401

[6]   Bukar, D. M. U. *et al.* (2017). Analysis of Food Security Among Smallholder Farming Households In Arid Areas Of Borno State, Nigeria To Cite This Version : Among Smallholder Farming Households In Arid Areas Of Borno State, Hal Id: Hal-01326657', Pp. 0–8. Doi: 10.5707/Cjae.201

[7]   Deaton, B. J., Scholz, A. and Lipka, B. (2020). An empirical assessment of food security on First Nations in Canada. *Canadian Journal of Agricultural Economics*, 68(1), 5-19. doi: 10.1111/cjag.12208

[8]   Feeney, R. and MacClay, P. (2016). Food security in Argentina: A production or distribution problem? *International Food and Agribusiness Management Review*, 19(2), 1-32

[9]   Gani, B., Olayemi, J. and Inoni, O. (2019). Livelihood diversification strategies and food insecurity status of rural farming households in North-Eastern Nigeria. *Ekonomika Poljoprivrede*, 66(1), 281-295. doi: 10.5937/ekopolj1901281g

[10] Ghanian, M. (2016). Assessment of Households' Food Insecurity through use of a USDA Questionnaire. *Advances in Plants & Agriculture Research*, 4(5), pp. 379-386. doi: 10.15406/apar.2016.04.00155

[11] Haddabi, A. S., Ndehfru, N. J. and Aliyu, A. (2019). Analysis of Food Security Status Among Rural Farming Households in Mubi North Local Government Area of Adamawa State, Nigeria. *International Journal of Research - GRANTHAALAYAH*. Granthaalayah Publications and Printers, 7(7), 226-246. doi: 10.29121/granthaalayah.v7.i7.2019.757

[12] Huang, M. and Zou, Y. (2018). Integrating mechanization with agronomy and breeding to ensure food security in China. *Field Crops Research*. 224, 22-27. doi: 10.1016/j.fcr.2018.05.001

[13] Hyacinth, O. E. and Kwabena, G. B. (2015). Determinants of change and household responses to food insecurity: Empirical evidence from Nigeria. *African Journal of Agricultural Research*, 10(5), 423-433. doi: 10.5897/ajar2014.9037

[14] Irohibe, I. J. and Agwu, A. E. (2014). Assessment of food security situation among farming households in rural areas of Kano State, Nigeria. *Journal of Central European Agriculture*. Journal of Central European Agriculture, 15(1), 94-107. doi: 10.5513/JCEA01/15.1.1418

[15] Kuwornu, J. K. M., Suleyman, D. M. and Amegashie, D. P. K. (2013). Analysis of Food Security Status of Farming Households in the Forest Belt of the Central Region of Ghana. *Russian Journal of Agricultural and Socio-Economic Sciences*, 13(1), 26-42. doi: 10.18551/rjoas.2013-01.04

[16] McKay, F. H., Haines, B. C. and Dunn, M. (2019). Measuring and understanding food insecurity in Australia: A systematic review. *International Journal of Environmental Research and Public Health*, 16(3). doi: 10.3390/ijerph16030476

[17] Mustapha, A. *et al.* (2014). Overview Of The Physical And Human Setting Of Kano. *Research Journal's Journal of Geography*, 1(5), 1-12

[18] Mutea, E. *et al.* (2019). Livelihoods and Food Security Among Rural Households in the North-Western Mount Kenya Region. *Frontiers in Sustainable Food Systems*, 3(November). doi: 10.3389/fsufs.2019.00098

[19] Ngema, P. Z., Sibanda, M. and Musemwa, L. (2018). Household food security status and its determinants in Maphumulo local municipality, South Africa. *Sustainability (Switzerland)*, 10(9), 1-23. doi: 10.3390/su10093307

[20] Ngongi, A. M., Urassa, J. K. and Lecturer, S. (2014). Farm Households Food Production and Households' Food Security Status: A Case of Kahama District, Tanzania. *Tanzania Journal of Agricultural Sciences*, 13(2), 40-58

[21] Okon, U.E., Frank, N.N., Etowa, E.B., and Nkeme, K.K. (2017). Household Level Food Security States and it's determinants among rural farmers in Akwa Ibom State, Nigeria. *Agricultural Science Journal* Vol.7 (10): 297-303

[22] Pakravan-Charvadeh, M. R., Khan, H. A. and Flora, C. (2020). Spatial analysis of food security in Iran: associated factors and governmental support policies. *Journal of Public Health Policy* 41(3), 351-374. doi: 10.1057/s41271-020-00221-6

[23] Suharyanto, S. and Indrasti, R. (2017). Assessment of Food Security Determinants Among Rice Farming Households in Bali Province. *KnE Life Sciences*, 2(6), 658. doi: 10.18502/kls.v2i6.1088

[24] Wegren, S. K., Nikulin, A. M. and Trotsuk, I. (2017). The Russian Variant of Food Security. *Problems of Post-Communism*, 64(1), 47-62. doi: 10.1080/10758216.2016.1163229