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Nomad-Farmer Conflict and Food Security among Arable Crop Farmers in Iwajowa Local Government Area, Oyo State, Nigeria

Ogheneruemu Obi-Egbedi; PhD*[1], Abiodun E. Awoyemi; MSc[2] & Alphonsus O. Ehinlomo; BSc[1]

[1] Department of Agricultural Economics, University of Ibadan, Nigeria; [2] Department of Agricultural and Food Economics, University for Development Studies, Tamale, Ghana.

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Corresponding author
gheneobi@gmail.com
Department of Agricultural Economics, University of Ibadan, Nigeria.

Postal code: 200005
Tel: +234 803 475 1635

ABSTRACT

Background: The frequent conflict between nomads and farmers has been recently a major challenge in Nigeria, resulting in a huge economic setback which may have serious consequences on food security in Nigeria. There are limited studies linking to food security; hence, this study aims to examine the effect of the nomad–farmer conflict on food security among arable crop farmers in Iwajowa, Oyo State, Nigeria. **Methods:** Primary data was used for the study. A semi-structured questionnaire was employed to collect data from 150 arable crop farmers through a multistage sampling procedure from two wards and three villages, which were randomly selected. The food security index (FSI) and Logit regression model were used for data analysis. **Results:** The result revealed that the majority (74.67%) of the arable crop farmers were affected by the nomad-farmer conflict. Most of the arable crop farmers (54.00%) were food insecure. The factors that predisposed the arable crop farmers to being affected by the conflict were access to water point, land tenure system, bush burning, and years of education at different levels. Being affected by the nomad–farmer conflict caused food insecurity along with age, sex, and household size. **Conclusion:** It was therefore concluded that arable crop farmers in the study area were mostly affected by the nomad-conflicts that influence food insecurity. Policy measures by the government aimed at reducing the conflict between arable crop farmers and nomads should include water supply and increasing farmers' years of education.

Keywords: *Nomad-Farmer conflict; Food security; Access to water points; Arable crop farmers*

Introduction

Food security has been on the front burner of development issues in the last two and half decades. It is described as a state where all people irrespective of their status and locations have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for active and healthy life (Report of the ministers of agriculture, 2003). Food security is also a condition in which all members of households have both physical and economic access to adequate food without any doubt of losing further access to it (Food and

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Ariculture Organization, 2019). Household food security is the application of this concept to the family level with individuals within households as the focus of concern. The food security of a nation determines the people's access, availability, and affordability of food in addition to their nutritional well-being. Food security leads to an increase in micro nutrient intake which affects productivity positively. Good health and strength will lead to an increase in ability to perform other income generating activities, leading to economic growth and development.

About two billion people are food insecure worldwide; 1.04 billion (52%) in Asia, 676 million (34%) in Africa, and 188 million (9%) in Latin America (Food and Ariculture Organization, 2019). About 381 million undernourished people live in Asia, while Africa has the highest prevalence of undernourishment and the second highest number of undernourished people, accounting for 36.4 % of the global total (World Health Organisation, 2020). About 8.9% of the world's population (690 million) go to bed hungry each night (Food and Agriculture Organisation, 2020) and by 2030, the number of hungry people will reach 840 million (9.8%) of the global population (Moseley and Battersby, 2020). This paints a gloomy picture for achieving the sustainable development goal (SDG) of zero hunger, especially in food-deficit countries. The COVID-19 epidemic has further complicated the already daunting task of achieving the SDGs.

Sub-Saharan Africa, particularly, has experienced an increase in the number of malnourished people by 23.4 million since 2015, while about 239.1 million people were malnourished in 2018 (Food and Ariculture Organization, 2019). One in every four people in Sub-Saharan Africa are stunted and 23 million primary school-age children attend classes hungry across the sub-Saharan countries out of 66 million children in the developing countries (World Food Programme, 2018). In 2020, two-thirds of about 155 million people who faced acute food insecurity around the world were in African countries (Baquedano *et al.*, 2020). High levels of food insecurity on the continent were reported in 2020 for Central and Southern Africa with 43.0 million people, South Africa with over 9.3 million people, East Africa with 28.2 million people, and West Africa with 29.1 million people (Prügl and Joshi, 2021). The high levels of acute food insecurity are expected to persist in 2021 largely due to ongoing conflict and displacement, economic impacts of the ongoing COVID-19 pandemic, and rainfall deficits (Havnevik, 2021).

In Nigeria, food insecurity increased by 130% in 2020 compared to 2019 (Owoo, 2021). Nigeria also experienced the deepest recession in the region with a GDP contraction of 5.4% between 2019 and 2020. Food prices are among the highest in the region, with an increase of over 40% compared to normal levels. The general higher prevalence of food insecurity is mainly due to the adverse effects of the coronavirus disease (COVID-19) and related essential containment measures on the supply chain, the unfavorable macro-economic conditions, high food prices, and the escalation of armed and inter-community conflict including the nomad-farmer conflict. This has resulted in restricted food production and food security. Conflict, drought, terrorism, deforestation, famine, degradation, land tenure system, water stress, global climate change, extension gap, and low agricultural productivity are among several factors responsible for restricted food production and food security in Africa, specifically in Nigeria (Food and Agriculture Organization, 2017).

Nomad-farmer conflicts have been a critical yet tenacious issue which has threatened and disrupted the sustainability of agriculture and pastoral production in West Africa, especially in Nigeria (Shettima and Tar, 2008). Nomad-farmer conflicts are skirmishes that occur between nomad cattle herders and crop farmers, which have existed for decades but have become more frequent in recent times. According to the National Population Commission (NPC) (2006), nomads are cattle herders who migrate from place to place in search of pasture; staying in any area only for a short period of time. Arable crop farmers, on the other

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hand, spread across different regions of Nigeria and constitute the bulk of Nigeria's population engaged in agriculture in rural areas (Oti, 2020). Arable crop production is the use of land in growing crop plants in a way that ensures a sustainable supply of crops vis-à-vis pulses, grains, forage, oil, fibre and tuber crops (Adisa and Adekunle, 2010). The nomad-farmer conflict in Nigeria could be traceable to various factors including ambiguous land laws and a weak rule of law, especially in rural areas. Despite huge internal and food security government budgets, the crises have remained intractable. Most nomad-farmer conflicts are land-related between indigenes land owners and the nomad cattle herders who settle among them (Kuusaana and Bukari, 2015). Population growth due to improved health with consequent expansion of farm size and decreased grazing area for animals have also been important factors (Shettima and Tar, 2008). However, Madi noted a lack of agreement on the causes of the conflict (Madi *et al.*, 2021).

The effect of nomad-farmer conflict could be economic, physical, and socio-psychological loss (Adisa, 2011). About 26% of terror-related deaths in 2019 were caused by crises related to nomadic herders (GTI, 2020). Since 2011, about 60,000 people have died due to nomad-farmer conflicts in the country (GTI, 2020). Hence, both lives and livelihoods are affected causing displacement of people, loss of properties, destruction of farms, and other humanitarian consequences which will likely result in food insecurity (Martin-Shields and Stojetz, 2019, Okoli and Atelhe, 2014). Farmers may be deterred from carrying out their livelihood activities due to fear of being killed or destruction of their crops and farms (Adelaja and George, 2019, Adisa, 2011, Distefano, 2005). Thus, Nigeria will be at risk of falling into extreme food insecurity and poverty if the conflict between herders and farmers continues. Furthermore, the Oyo state government has put various policies in place to address the nomad-farmer conflict, including signing the anti-grazing policies in law since 2019. The law prohibits open grazing of cattle in Oyo State and imposes heavy fines on offenders. However, frequent occurrences of the conflict in the state still persist. In particular, the Oke Ogun area, which is a food basket of Oyo state, has been characterized by frequent incidences of nomad-farmer conflicts in all its 10 local governments areas (Igwe, 2020). This could have serious implications for food security in the area.

Several studies have been done on nomad-farmer conflict in the Northern Nigeria and food security (Adelaja and George, 2019, Adeoye, 2017, Adisa and Adekunle, 2010, Ajala, 2020, Aliyu, 2015, Aliyu *et al.*, 2018, Buba, 2021). Most of the studies on the conflict in Southern Nigeria have focussed on the causes of the conflict and extension delivery (Adelakun *et al.*, 2015). There are limited empirical studies that show the relationship between the farmers' conflict status and food security in the southern region of Nigeria. Furthermore, the government response to the nomad-farmer conflict has been the rehabilitation of affected farmers without considering salient factors that cause the nomad-farmer conflict. This will help government to adopt appropriate policies to prevent further conflict in the area. Moreover, the government's efforts will make more meaning if the factors that predispose the arable crop farmers to the conflict in Southwestern Nigeria are known and addressed. Therefore, the findings of this study will provide information on the salient factors that predispose arable crop farmers to being affected by the nomad-farmer conflict and how the farmers' conflict status influence their food security status in the Iwajowa local government of Oyo state, Southwestern Nigeria.

Materials and Methods

The study area: Iwajowa local government has its headquarters situated in the town of Iwere-Ile. Iwajowa local government was created by former Head of State Late Gen. Iwajowa local government was created by former Head of State Late Gen. Sanni Abacha in 1996. It has an area of 2,529 km^2 and a population of 102,980 at the 2006 census. Furthermore, farming is prevalent in the area, some practice it on a full-time basis while some on part-

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time. The edaphic feature of the soil shows that it is moderately weathered thus retain nutrient even at the upper ground level, hence supports and sustains the cultivation of surface feeder crops and deep-rooted crops such as maize, sorghum, cassava, yam, melon, cowpea, watermelon, etc.

Sources of data: Primary data was used for this study. Data was collected using a semi-structured and validated questionnaire. The process of validation included having a team of experts to confirm that the questionnaire content conformed to theory and addressed the issues under investigation. A pilot test was also carried out among the arable crop farmers to reduce sample errors. This also helped to check whether or not the respondents found the questionnaire meaningful to fill. Data on socio-economic characteristics were collected including age, sex, marital status, educational status, farming experience, farm size, primary occupation, secondary occupation, household size, annual farm income, size of farm destroyed, extension contact, and distance to farm from the homestead. Data on factors that predispose the arable crop farmers to nomad-farmer conflict, as well as the data on food security status were also collected.

S*ampling procedure and sampling size:* A three-stage sampling technique was used to obtain the data for the study. The first stage was the purposive selection of two wards (Idiko Ile/ Ilaji and Ijio/ Ayegun) out of the 10 wards in Iwajowa local government, due to the frequent occurrence of a nomad-farmer conflict in the wards. The second stage was the random selection, proportionate to size, of two villages from the Ijio/Ayegun ward and one village from the Idiko Ile/Ilaji ward. The lists containing the names and house numbers of all the arable crop farmers were obtained from the Chairmen of the farmers' associations in each of the three villages. In the third stage, arable crop farmers were randomly selected from each of the three villages in proportion to their population. A total of 150 arable crop farmers were sampled from the three villages.

Data analysis: The analytical tools used for this study were descriptive statistics, food security index (FSI), and logit regression model. Frequencies and percentages were used to describe the socioeconomic characteristics of arable crop farmers affected by the nomad-farmer conflict. The conflict status of the arable crop farmers was identified after asserting the negative effects of conflicts (Hussein and Al-Mamary, 2019, Kirchoff and Adams, 1982). Hence, questions were asked to the farmers about impediments to smooth working of their farming activities, diminishing output, obstructions to decision-making on production, and formation of competing affiliations in the community to mitigate challenges of the conflict. Farmers with positive responses were categorized as being affected by the conflict.

The FSI was used to estimate the food security status of the arable crop farmers. Identification and aggregation procedures were followed (Abur, 2014, Ahungwa *et al.*, 2013, Babatunde *et al.*, 2007, Ojeleye, 2019). Identification is the process of defining a minimum level of nutrition necessary to maintain healthy living. This involved two steps including defining a minimum level of nutrition necessary to maintain a healthy living, the food security line, below which households is classified as food insecure and aggregation, derived from food security statistics (Agboola *et al.*, 2004, Babatunde *et al.*, 2007). Caloric adequacy was estimated by dividing calorie supplied for the household by the family size adjusted for adult equivalent using the consumption factor for age-sex categories (Ojeleye, 2019). The quantity of crops produced, purchased, and received as gifts were converted to kilogram and more to calorie consumed per day for a household and then compared with the standard. the FSI is given as (Abur, 2014, Ahungwa *et al.*, 2013, Babatunde *et al.*, 2007):

$$Food\ Security\ Index\ (Z_i) = \frac{\text{Household's daily per capita calorie availability(Available)}}{\text{Household' daily per capita calorie requirement(Required)}} - 1$$

$Z_i \geq 1$ = Food secure i^{th} household

$Z_i < 1$ = Food insecure i^{th} household

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The recommended minimum daily energy intake per adult is 2500 Kcal; therefore, this value defines the food security line for the study (Food and Agriculture Organization and World Health Organization, 2010, Gazdar and Mysorewala, 2016). Households who were below the food security line were classified as food insecure households while those households who were equal or above the food security line were classified as food secured households. Daily per capita calorie consumption of each household and households' daily calorie intake were estimated by collecting the quantity of crops produced and purchased for consumption. This was converted to kilograms and further to calories and then divided by household size. The value for adult equivalence was adjusted using the equivalent male adult scale weight (Ojeleye, 2019).

The binary logit regression model was used to examine the factors that predispose the arable crop to conflict and to examine the effect of the nomad-farmer conflict on food security status among the arable crop farmers. It is appropriate because the dependent variable is dichotomous (dummy) both in the food security status and the conflict status. The food security status of a household was categorized into food secure (1) and otherwise (0). Likewise, conflict status was classified into conflict-affected (1) and otherwise (0). Logit and probit models are known to produce similar results. But the difference is in their distributions. Logit is based on the cumulative standard logistic distribution (*F*), while probit is based on the standard normal distribution (Φ). Logit is chosen in this case based on simplicity and the ease of interpretation of the coefficients.

The determinants of conflict among arable farmers in the study area were fitted with the binary logit model. The logistic regression model is presented in the Equations 1 and 2.

$$P_i = \frac{e^{Z_i}}{1+e^{Z_i}} = \frac{1}{1+e^{-Z_i}} \quad (1)$$

$$\text{Where, } Z_i = b_1 + b_2 x_i \quad (2)$$

Also, the logit model assumed Z to be directly related to the regressors when Z cannot be directly observed i.e.;

$$Z = b_0 + b_1 x_{i1} + b_2 x_{i2} + \cdots + b_k x_{ik} \quad (3)$$

Where, Z can be directly observed and linear regression is suitable.

$$P_i = \frac{1}{1+e^{-(b_0+b_1 x_{i1}+b_2 x_{i2}+\cdots+b_k x_{ik})}} \quad (4)$$

$$\text{i.e. } P_i = \frac{1}{1+e^{-(b_0+b_1 x_{i1}+b_2 x_{i2}+\cdots+b_k x_{ik})}} \quad (5)$$

Where, P_i is the probability, and Y changes giving the explanatory variables.

P_i = the probability that an arable crop farmer is food secure given the explanatory variables (X_i)

b_i = the parameters to be estimated

x_i = the explanatory variables

Since the result from the logit cannot be directly interpreted, the odds ratio (OR) or marginal effect is widely used. In this paper, the marginal effect of logit was used and econometrically expressed as;

$$\frac{\partial E(y_i/x_i)}{\partial x_i} = \wedge(X'\beta)[1 - \wedge(\wedge'\beta)]\beta \quad (6)$$

Following some studies (Aliyu, 2015, Musa *et al.*, 2016, Ogebe *et al.*, 2019, Oli *et al.*, 2018), the logit regression model was explicitly expressed:

$$Y = \beta_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i \quad (7)$$

The dependent variable is the conflict status of the arable crop farmers and coded 1 if food secure and 0 if otherwise.

Where:

Y = Conflict status (1= If a farmer is affected by the conflict = 1; 0 = otherwise), X_1 = Age (years), X_2 = Farm size (hectares), X_3 = Years of education (years), X_4 = Access to water points (1= Yes; 2= otherwise), X_5 = Bush burning (1= Yes; 2= otherwise), X_6 = Prevention of access to water point (1= Yes; 2= otherwise), X_7 = Land tenure system (1 = secured land tenure [inheritance, leasehold, purchase]; 2 = non secured land tenure (Gift), X_8 = Contamination of water (1= Yes; 2= otherwise), ε_i = Error term.

The second logit regression was applied to examine the effect of the arable crop farmers' conflict status on food security, with dependent variable as the food security status of the arable crop farmer. This model follows the studies (Arene and Anyaeji, 2010, Oti, 2020, Owolabi *et al.*, 2016,

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Oyebanjo *et al.*, 2013). It is explicitly stated in linearized form as:

$$A = \beta_1 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 C_4 + \beta_5 C_5 + \beta_6 C_6 + \beta_7 C_7 + \beta_8 C_8 + \varepsilon_i \quad (8)$$

Where, A is a binary response variable defined as:

A = food security status (1 = if a farmer is food secure; 0 = otherwise), C_1 = Age (years), C_2 = Sex (1= Male; 0 = Female), C_3 = Educational status (1= Formal education; 0 = no formal education), C_4 = Farm experience (years), C_5 = Farm size (hectares), C_6 = Household size (Number of individuals), C_7 = Land tenure system (1 = secured land tenure – inheritance, leasehold, purchase; 0 = non secured land tenure (Temporary gift and others), C_8 = Conflict status of the farmer (1 = If affected by the conflict; 0 = otherwise), ε_i = Error term

Results

Socio-economic characteristics of arable farmers by conflict status: The socio-economic characteristics of the arable crop farmers by their conflict status are shown in **Table 1**. It reveals that most (81.33%) of the arable crop farmers were 50 years of age or younger, hence, were still in their productive ages. The mean age of the arable crop farmers was 47 years and there was no significant difference between the ages of farmers who were affected and those who were not affected by the nomad–farmer conflict. With respect to sex of the arable crop farmers, 94.0% of the farmers were male, indicating that arable crop farming is a male-dominated activity in the study area. The pattern is the same among farmers who were affected by the conflict, with males being 94.6% are those not affected by the conflict were 92.1%. The marital status profile of the farmers revealed that the majority (82.7%) were married both farmers affected by the conflict (83.9%) and those who were not affected (79.0%) showing similar patterns. This shows that the arable crop farmers are responsibilities towards their spouses and children, who would also be indirectly affected by the conflict. In the same vein, the educational status of the arable crop farmers revealed that over three-quarters of the arable crop farmers in both groups had primary education or higher. This indicates that the farmers may have some knowledge of conflict management and avoidance strategies. The results further showed that most arable crop farmers (92.7%) were primarily engaged in farming as their major occupation, and most (72.7%) had no secondary occupation. Hence, they have no other source to augment income if affected by the conflict. This could have implications for food security.

The household size of the arable crop farmers was about 7 persons and no significant difference was found between the farmers affected by the conflict and unaffected farmers. A large household size could be difficult to feed and secure in a conflict situation. The farmers also had about 18 years of farming experience in arable crop productions indicating that they were versed in arable crop production. There was no significant difference in the farming experience of both groups of farmers affected by the conflict and those who were not affected. Conversely, the farm size of farmers affected by the conflict (14.2 ha) was significantly larger than unaffected farmers (10.8 ha). The mean farm size was 13.9 ha. This indicates that the farmers affected by the conflict have more asset at risk, in the event of conflict, than the farmers not affected. Consequently, the farm income of farmers affected by the conflict (₦4.0 million ($9,524)) was higher than that of the unaffected farmers (₦2.3 million ($5,476)). The mean annual income was ₦3.6 million ($8,571). This is well above the National Poverty line and indicates that the farmers are likely to have improved economic access to food which may (or may not) have implications for food security. Finally, the land tenure system, showed that 89.3% of the arable crop farmers owned their farmland, hence, had secured land tenure system, while both farmers who were affected by the conflict (92.8%) and those not affected by the conflict (79.0%) showed a similar pattern.

Conflict status of the arable crop farmers: The distribution of the conflict status among the arable crop farmers shows that 74.67% were affected by

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the conflict while 25.33% were not affected by the conflict. This reveals that majority of the arable crop farmers were affected by the conflict in the area under consideration.

Factors predisposing arable crop farmers' to being affected by the nomad-farmer conflict: Logistic regression estimates in **Table 2** show the results for the factors influencing the likelihood of arable crop farmers being affected by the nomad-farmer conflict. The diagnostics parameters of the model reveal a log-likelihood of -66.56 with a $P < 0.001$ which was significant. This indicates that the model was a good fit for the data. The pseudo R^2 of 0.21 implies that 21.59% probability of conflict status is explained by the logistic regression model. Four out of seven variables used in the logistic model were statistically significant at 0.1%, 0.05%, and 0.01%. Arable crop farmers that did not give nomads access to their water points increased the probability of being affected by the conflict which was statistically significant at 10%. Hence, not having access to water points has the propensity to increase the nomad-farmer conflict by 25%.

Table 2 also reveals that the land tenure system was negative and statistically significant at 10%. Thus, not having access to secured land tenure increased the likelihood of being affected by the nomad-farmer conflict by 18%. The results further revealed that practice of indiscriminate bush burning by the nomad on arable crop farmers' lands was negative and statistically significant at 1%. Hence, a farmer who has not experienced nomad bush burning will decrease the likelihood of being affected by the nomad-farmer conflict by 37%. Moreover, the result revealed that years of education of the arable crop farmers had a negative relationship with their conflict status and was statistically significant at 5%. This indicates that a unit increase in the arable crop farmers' years of education will decrease the likelihood of being affected by the conflict by 15%.

Food security status of the arable crop farmers: Based on the recommended daily calorie intake of 2500 kcal, the results show that 46% of the arable crop farmers were food secure, while 54% were found to be food insecure. Furthermore, based on the FSI, the food security incidence was 54%, food security depth was 7% which is the rate at which arable crop farmers are below the food security line and the severity of food insecurity was 1.2%. This indicates that most farmers in the area were food insecure.

Effect of conflict on the food security status of the arable crop farmers: **Table 3** presents the results for the effect of farmers' conflict status on food security status of the arable crop farmers. The diagnostic parameters of the binary logit regression model reveal a log-likelihood of -86.34, pseudo R^2 of 0.16, and a Chi-square statistic of 25.11. The pseudo R^2 shows that 16.57% of the likelihood of an arable farmer being food secure was explained by the regressors. The results show that four out of eight explanatory variables modelled have significant coefficients, including conflict status, age, gender, and household size. Conflict status of the arable crop farmers was negative and statistically significant at 10%. This indicates that a farmer who was not affected by the nomad–farmer conflict was more likely to be food secure by 15.9%. Similarly, the age of the arable crop farmers was negative and statistically significant at 10%. This indicates that a unit increase in the age of the arable crop farmers will decrease their likelihood of being food secure by 1.8%. Furthermore, the results showed that sex (female) was negative and statistically significant at 1%. Hence, being a male farmer increases the tendency to be food insecure by 40.5%. The household size was also negative and statistically significant at 1%. This indicates that an additional unit in household size of the arable crop farmers is likely to make the household food insecure by 8.4%.

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Table 1. Profiling of arable crop farmers by their conflict status.

Variables	Conflict status		
	Unaffected	Affected	P-value[a]
Age (y)			
< 30	9 (23.68)	11 (9.82)	0.01
31– 40	9 (23.68)	54 (48.21)	
41– 50	12(31.58)	27 (24.11)	
51– 60	2 (5.26)	13 (11.61)	
>60	6 (15.79)	7 (6.25)	
Mean ± SD	46.7 ± 10.7	46.5 ± 8.5	
Sex			
Male	35(24.82)	106 (75.18)	0.57
Female	3(33.33)	6 (66.67)	
Marital status			
Single	5 (13.16)	5 (4.46)	0.23
Married	30 (78.95)	94 (83.93)	
Separated/ divorced	0 (0.00)	3 (2.68)	
Widow/widower	3 (7.89)	10 (8.93)	
Educational status			
Informal	9 (23.68)	22 (19.64)	0.85
Primary	8 (21.05)	43 (38.39)	
Secondary	15 (39.47)	43 (38.39)	
Tertiary	6 (15.79)	4 (3.57)	
Primary occupation			
Farming	34(89.47)	105 (93.75)	0.38
Otherwise	4(10.53)	7 (6.25)	
Secondary occupation			
Yes	14(36.84)	27 (24.11)	0.13
No	24 (63.16)	85 (75.89)	
Household size			
< 5	13(34.21)	33 (29.46)	0.82
6–10	23(60.53)	74 (66.07)	
11<	2 (5.26)	5 (4.46)	
Mean ± SD	6.18 ± 1.90	6.50 ± 1.50	
Annual primary income (₦)			
< 1000000	2 (5.26)	0 (0.00)	<0.001
1000000-2000000	3 (7.89)	0 (0.00)	
2000001– 3000000	6 (15.79)	5 (4.46)	
3000001– 4000000	4 (10.53)	2 (1.79)	
>5000000	20 (52.63)	104 (92.86)	
Mean ± SD	2353684 ± 2147038	3967500 ± 3804519	
Farming experience			
< 10	14(36.84)	37 (33.04)	0.44
11 – 20	13(34.21)	42 (37.50)	
21 – 30	4 (10.53)	21 (18.75)	
31 -50	7 (18.42)	72 (10.71)	
Mean ± SD	18.0±5.7	18.1±3.4	
Farm size (Ha)			
< 5	20 (52.63)	13 (11.61)	0.001
6 – 10	10 (26.32)	30 (26.79)	
11 – 15	3 (7.89)	5 (22.32)	
16 – 20	2 (5.26)	26 (23.21)	
>20	3 (7.89)	8 (16.07)	
Mean ± SD	10.8 ± 8.7	14.2 ± 11.5	
Land tenure system			
Secured land tenure system	30 (78.95)	104 (92.8)	0.01
Non secure land tenure system	8 (21.05)	8 (7.14)	

[a]: Chi-square test.

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Table 2. Logit regression estimates for the determinant of conflict status.

Conflict status	Coefficients	Standard errors	Z-value	P-value
Access to water point	-1.45	0.80	-1.80	0.07
Land tenure system	-1.08	0.67	-1.60	0.11
Bush-burning	-2.08	0.49	-4.20	<0.001
Years of education	-0.15	0.07	-2.00	0.04
Contamination of water	0.29	1.08	0.27	0.78
Farm size	0.01	0.01	0.71	0.47
Age	0.00	0.01	0.35	0.72
Constant	3.15	1.33	2.35	0.01

Table 3. Logit regression model of the effect of conflict on food security status.

Variables	Coefficient	Standard Error	Z value	P-value
Conflict status	-0.47	0.28	-1.7	0.08
Age	-0.05	0.02	-1.89	0.05
Sex (female)	-1.62	0.48	-3.37	0.001
Farm experience	0.04	0.03	1.36	0.17
Household size	-0.25	0.07	-3.38	0.001
Farm size	-0.00	0.00	-0.53	0.59
Educational status (informal education)	0.15	0.30	0.52	0.60
Land tenure system (leasehold)	-0.09	0.27	-0.33	0.73
Constant	4.24	1.28	3.32	0.001

Discussion

Majority of the arable crop farmers were affected by the conflict in the area under consideration. This shows that the nomad-farmer conflict may be widespread among farmers and could result in negative implications for food production and security. Smallholder farmers produce the bulk of food in Nigeria; hence, if they hurt by the conflict, food production and consequently, food security may also be affected. Moreover, the link between access to water points and being affected by the conflict is plausible because water is essential to both arable farming and herding. The search for water is a major reason why nomads move their herds from place to place. The findings are supported by the others (Adeoye, 2017, Aliyu, 2015, Aliyu *et al.*, 2018) who found out that lack of access to water points causes conflict between herdsmen and farmers. Furthermore, the relationship between not having a secure land tenure and being affected by the nomad-farmer conflict refers to farmland that were either rented of temporarily gifted or contracted to the farmers under certain agreements. In the event of a conflict, such farmers could suffer from the loss of their crops, but still have to pay rents or fulfil the agreements on the land. However, this finding is not in line with Oli study (Oli *et al.*, 2018) who found the land tenure system to be positively related to a farmer being affected by the conflict.

Arable crop farmers that have not experienced nomad bush burning are less likely to be affected by the nomad-farmer conflict. The finding supports the study results of Musa study (Musa *et al.*, 2016) that reported nomad bush burning increases the chance of being affected by the conflict since bush burning clears the surrounding forest vegetation and provides easy access of cattle to the farmlands. Fresh grass for the cattle also grows after a short time; hence, this may explain why the nomads carry out such indiscriminate bush burning. However, it is a cost to the farmers who may lose crops due to the fires, and the environment also suffers from the air pollution caused by the smoke. The negative relationship between years of

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education of the arable crop farmers and their conflict status is unexpected, since an increased number of years spent in school should increase a farmer's knowledge of conflict management and avoidance, thereby reducing the likelihood of being affected by the conflict. This result may be due to the fact that in a conflict situation, survival skills matter more than formal education to mitigate the adverse effects of conflict.

Food producers were mostly food insecure. This portends a dire situation of Nigeria's food production and security. Being affected by the conflict contributes to the possibility of food insecurity. Expectedly, the conflict may result in food price fluctuations (Maccini and Yang, 2009) and interruption in the food supply chain which may explain the finding. Moreover, by aging the arable crop farmers, the likelihood of food insecurity increased. This is plausible, as aged farmers reduce their farm work which could lead to reduced farm productivity as well as reduced ability to cope with shocks. This finding is in agreement with a study (Abu and Soom, 2016) who found that an increase in age results in food insecurity. Moreover, a female arable crop farmer has the tendency to be food secure compared to a male farmer. This is reasonable considering the fact that women make the decisions of household food nutrition and allocation. The result is not in consistent with the findings of Oti study (Oti, 2020) who found that male-headed households had a higher probability of being food secure. Finally, increasing household size is likely to make the household food insecure, since it may lead to a decrease in the quality and quantity of food available to the household members. This finding is in agreement with the studies by the others (Aidoo *et al.*, 2013, Leza and Kuma, 2015) who reported a negative relationship between household size and food security.

The study results show that insecurity and conflict affect food security. Salient factors have been revealed as determinants of the likelihood that farmers will be affected by the nomad-farmer conflict. This will further the policy efforts of the government to arrest the conflict, especially in the study area. A limitation to the study is that only one food security line was used based on the total calorie intake method. Employing several food security measures to generate several food security lines may give more information on the nature of the food insecurity. Moreover, food security assessment can be extended to assess nutrition security, in which the minimum amount considered adequate to meet nutrient requirements of healthy individuals is measured. However, the study provided the best results within the limits of the data. It is required to conduct further studies on a variety of food security methods and incorporate nutrition security measures to expand the knowledge of food security among arable crop farmers in conflict situations.

Conclusion

The study found that three out of four arable crop farmers in the area were affected by the nomad-farmer conflict; nine out of ten farmers were primarily engaged in arable crop farming. The study established that the arable crop farmers' likelihood of being affected by the conflict was reduced by having access to water points, secure land tenure, no nomad bush burning incidence, and increased years of formal education. The study established that most of the arable crop farmers were food insecure. Being affected by the nomad-farmer conflict and age reduced the probability of food security among the farmers. On the other hand, being a female and reduced household size increased the probability of food security among the farmers. Therefore, the government should pursue policies that will eliminate the conflict between arable crop farmers and nomads to improve food security. In addition, food security improvement programmes and schemes by government and non-governmental agencies should target aging farmers and male-headed farming households, in addition to policies aimed at reducing household size. In order to end the nomad-farmer conflict, the government should ensure that arable crop farmers have access to water points, while policies that discourage bush burning and provide farmers with secure land

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tenure should be pursued. Moreover, policies that encourage increased formal education among the arable crop farmers should be favoured, since it can reduce the tendency of being affected by the conflict.

Conflict of interest

The authors declare no conflict of interest.

Author's contribution

All authors contributed equally to the conception, design, data gathering, data analysis and writing the manuscript.

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