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Constraints to Herding and Pastoralists' Awareness of Hydroponics as Alternative for Fodder Production Among Fulani Herders in Ogun State, Nigeria

***Michael O. Olayemi¹, Olatunbosun J. Soetan¹, Wahab G. Ojebiyi¹,
Victoria O. A. Ojo¹, Tolulope O. Olayemi², Olubunmi R. Ashimolowo¹,
Petra B. Abdulsallam-Saghir¹ and Esther O. Olayemi²**

¹Federal University of Agriculture Abeokuta, Ogun State, Nigeria

²University of Ilorin, Ilorin, Nigeria

*Corresponding author's email: mike_olayemi@yahoo.com

Abstract

The persistent conflict between farmers and Fulani herders resulting from land use competition has affected the crop production and livestock industries which are crucial to economic development in Nigeria. This study examined the constraints to herding and pastoralists' awareness of hydroponics as alternative for fodder production among Fulani herders in Ogun State, Nigeria. Multistage sampling procedure was adopted in selecting 86 Fulani pastoralists from Odeda and Abeokuta North Local Government Areas, Ogun State. Data were obtained using interview guide and analyzed descriptively using frequency counts, percentages, mean and standard deviations. Results revealed that the mean herding experience, farm size, and herd size of the respondents were 41 years, 2 hectares, and 81 cattle respectively. Also, all (100.0%) of the sampled pastoralists reared cattle and cultivated arable crops. Crops cultivated included maize (100.0%), millet (100.0%), pepper (95.3%), sorghum (90.7%), cassava (65.1%), and yam (70.9%). Almost all (95.0%) of the Fulani pastoralists operated on leased farms. Results further indicated that scarcity of pasture ($\bar{x} = 2.64$) and attacks from host crop farmers ($\bar{x} = 2.55$) were the major constraints faced in herding. Finally, findings revealed that none (0.0%) of the Fulani pastoralists were aware of the use of hydroponics as alternatives for fodder production. The study concluded that the constraints of pasture scarcity would have been minimized (if not completely eradicated) provided that Fulani pastoralists were aware and adopted the use of hydroponics for fodder production. It is therefore recommended that extension agents should raise awareness, and train the Fulani pastoralists on the benefits of using hydroponics for fodder production in Ogun State.

Keywords: Fodder production, Fulani pastoralists, Hydroponics, Herding constraints,

1.0 Introduction

The crop and livestock are the two most important subsectors of the agriculture sector contributing about 95% of the sector's share of the Gross Domestic Product (GDP) (Oyaniran, 2020). Despite the significance of the two subsectors, there is competition for natural resource (land) used for grazing of livestock and crop cultivation. There are numerous reports of bloody clashes between the primary producers of crops and livestock rearers especially in Southwest Nigeria. According to Okoro (2020), Herdsmen-farmers conflict has resulted to massive loss of human and animal life with diverse impacts. According to a report by Folorunsho-Francis (2023), over 4,000 Nigerians had lost their lives as a result of the perennial conflict between herders and farmers since 2016. Ogunbode *et al.* (2023) added that about 60,000 deaths and 400,000 displaced people were documented from different reports on multiple clashes between farmers and Fulani herders across the country.

Though the clashes are concentrated in the northern regions (North West, North Central and North East), the southern part is not spared as there are increasing incidences of the conflict in southern Nigeria including southwest geopolitical zone. There are reports of clashes between Fulani herders and farmers in farming communities in Ogun State. The clashes by cattle grazing on farmlands in agrarian communities of Ogun State have resulted in the death of several farmers and herders. According to Oluwole (2022), though farmers-herders conflicts occur across the State, Yewa North and Imeko-Afon Local Government Areas are the hot spots with most cases and casualties. It is also important to document that, there are increasing cases of clashes between Fulani herders and farmers in host communities like Alabata, and Opeji within the Odeda LGA of the State.

Olaniyan *et al.* (2015) attributed the leading cause of several conflicts between the Fulani herdsmen and crop farmers to the southward migration of Fulani herdsmen across the nation in search of greener pastures for their herds. For example, Nweze (2005) and Ajuwon (2004) independently reported cases of loss of lives and thousands displaced in the hostility between Fulani pastoralist and crop farmers in the host community. The loss of lives, maiming, sexual harassment of female farmers, desecration of rural values and sacred places, incarceration of farmers, cattle rustling, loss of arable crops and farmlands, entire massacre of villages and abandonment of farms has been attributed with herdsmen and crop farmer's conflict (Ogunbode *et al.*, 2023).

Across the nation, reports show that destruction of crops by cattle, farmers' encroachment of grazing reserves and indiscriminate bush burning by nomads accounted for loss of crops and clashes between herders with farmers and their host communities (Adeoye, 2018; Ofem and Inyang, 2014). This heated competition received international recognition when in 2014, the Global Terrorism Index (GTI) placed Nigeria's Fulani herdsmen as the fourth deadliest militant group in the World, accounting for 1,229 deaths. The current situation is expected to worsen considering the increasing global population which is expected to reach 9 billion by 2050 with the bulk of the increment coming from developing countries like Nigeria (FAO, 2013). Nigeria is expected to be the third most populous country by 2050. Excluding Brazil and China, per capita meat consumption in developing countries is expected to increase to 26 kilograms in 2030 and 32 kg in 2050 (FAO, 2013). Therefore, increased demand for meat fueled by increased population will lead to increased production which will further culminate into increased frequencies of clashes between herdsmen and crop farmers under a business as usual status quo.

To tackle the ongoing calamitous fracas, the onus is placed on all stakeholders from the National, State, Local to the Individual level to begin to search inward for sustainable innovations which can increase the availability of pasture all year round for herdsmen thereby boosting livestock production and enhancing peaceful coexistence between herdsmen and crop farmers. In the light of the sustainable development goals targeting the reduction of poverty, hunger and malnutrition through increased production of food under environmental friendly conditions, hydroponics has been promoted.

According to Indira *et al.* (2020), the hydroponic technique, which involves utilising a mineral solution in water to grow plants without soil, is an effective way to relieve land strain and produce green manure for cattle. This is because, environmental variables like pH, water availability, and nutrient levels can be precisely controlled, resulting in effective and optimal plant growth. Hydroponics fodder enhances digestibility of nutrients, and helps in improving milk production (Ghorbel and Kosum, 2022; Hassen and Dawid, 2022). Fodder produced from hydroponics technology is rich in protein, vitamins, fiber, and minerals and are suitable for a range of animals - cattle, sheep, goats, pigs, rabbits, fish and poultry (Petkova, 2017; Girma and Gebremariam, 2018). It is an efficient method of producing vegetables and ornamental crops (Bekuma, 2019).

According to Seaman (2017), the use of hydroponically produced fodder to feed swine led to reduced death rates, reduced feeding expenses, and improved health of pigs. Generally, effective use of hydroponics technology has the potential of ensuring an all-year round supply of natural livestock feed from fodder production by using minimal land and minimal man-hour per day (Bekuma, 2019). Despite the discussed benefits and importance in reducing conflicts between farmers and herders, the technology is yet to be adopted in Ogun State, and other southwestern Nigeria due to low awareness and lack of technical know-how of the technology in the region.

There are numerous review works on the economic and nutritional benefits of hydroponically produced fodder to the livestock industry in the face of climate change and fodder scarcity. Also, fodder produced using hydroponics technologies have been fed to different animals in experimental studies. However, there is dearth of cross-sectional research studies on the awareness of hydroponics and adoption of the technology as alternative for fodder production in Ogun State, Nigeria. Hence, this study assessed the constraints facing herding and their awareness of hydroponics for fodder production among Fulani agropastoralists in Ogun State, Nigeria. Specifically, this study described the herding characteristics of the Fulani Agropastoralists in Ogun State; identified the constraints faced by Fulani agropastoralists in herding; and assessed Fulani agropastoralists' awareness of hydroponics as alternative for fodder production. The outcome of this research has therefore contributed to the body of knowledge on the herders' awareness of the technology as alternative for fodder production in the study area. The recommendations emanating from this research also suggested ways of raising Fulani pastoralists' awareness of hydroponics as a way of ending the age long conflicts with host farming communities.

2.0 Materials and Methods

2.1 Study Area

This research was conducted in Ogun State, Nigeria. The vegetation of Ogun state varies from derived Savannah to rain forests. The land area consists of natural resources such as rivers, mineral resources, forest reserve, an ocean front as well as an extensive fertile soil for cultivating equatorial, tropical and savannah crops. The study area is largely characterized by natural pasture, herbaceous plants and shrubs. The predominant activities in Ogun State include farming such as cassava, maize and spices, food processing, artisanal work, trading and casual work (Fabusoro, 2005). Cattle production is mostly done by settled Fulani Pastoralists in some parts of Ogun State.

2.2 Study population, sampling procedure and sample size

The population of the study comprised settled Fulani agropastoralists in conflict prone areas of Ogun State. Since, there is no comprehensive list of herdsmen in the Fulani communities of Ogun state; non-probability sampling technique was used to select representatives for the study. Multi-stage sampling procedure was used in selecting respondents for the research. Stage 1 involves the purposive selection of Odeda and Abeokuta North Local government areas (LGAs) of the State due to high population of Fulani agropastoralists, and the availability of research on herdsmen-farmer conflicts and in the two LGAs. At stage 2, three (3) settled Fulani agropastoralist communities were purposively selected from each of the LGAs based on the reasons mentioned in stage one. This led to the selection of Alabata, Malaka and Opeji communities from Odeda LGA, Imala, Olorunda and Ayetoro communities from Abeokuta North LGA. At stage 3, Fulani pastoralists were conveniently sampled due to availability and readiness to participate in the study. This resulted in the selection of eighty-six (86) Fulani pastoralist from the six (6) communities.

2.3 Measurement of Key Variables

2.3.1 Constraints to herding: This was measured at ordinal level using an 8-item scale with three response options - Major Constraint, Minor Constraint, and Not a Constraint. The options were assigned ordinal scores of 3, 2 and 1 respectively. Mean values were computed to rank the constraint items in order of severity. Also, items with mean values above the cut-off point (2.00) were considered as severe constraints to herding while those lower than 2.00 were considered otherwise.

2.3.2 Awareness of hydroponics fodder: This was measured at nominal level as farmers were asked whether they are aware of hydroponics technology for fodder production. The response options were Aware and Not Aware with nominal values of 1 and 2 respectively.

2.4 Methods of Data Collection

Primary data were collected from Fulani pastoralists using interview schedule to generate data on the herding characteristics of the respondents, constraints faced by Fulani pastoralists in herding, and herders' awareness of hydroponics technology for fodder production. The interview schedule was prepared in English Language and administered to the respondents in their language with the aid of a research assistant. The research assistant asked questions based on the content of the interview schedule and immediately recorded the responses provided by the respondents.

2.5 Methods of Data Analysis

Collected data were cleaned, coded and entered into Statistical Package for Social Sciences version 20.0 before being subjected to descriptive statistics. The descriptive statistics used were frequency counts, percentage, mean and standard deviation. Results were presented in suitable distribution tables and chart.

3.0 Results and Discussion

3.1 Herding Characteristics of the Herdsmen

Results on the herding characteristics of the Fulani pastoralists are presented in Table 3.1. Findings show that all (100.0%) the Fulani pastoralists also engaged in arable crop farming as additional means of livelihood. This implies that the sampled herdsmen were also crop farmers. It was also reported by earlier works (Olusanya *et al.*, 2014; Sodiya *et al.*, 2009) that apart from livestock rearing, Fulani pastoralists in Ogun State were also engaged in crop production. Babagana *et al.* (2019) also reported that herdsmen in Yobe State engaged in other occupation. Sodiya *et al.* (2009) attributed the pastoralists' engagement in other economic activities to their sedentised lifestyle. It could also mean that the Fulani pastoralists are likely to understand the plights of the crop farmers in their host communities. Hence, are likely to adopt alternative measures in providing feeds for their livestock.

Results on herding experience of the Fulani herdsmen reveal that more than half (51.2%) of the respondents had been in herding for 21-40 years while 38.5% were in the practice for 41-60 years with mean herding experience being 41 years. This suggests that the Fulani herdsmen had substantial experience of herding and hence, have better understanding of the difficulties involved in grazing the livestock. As such they are expected to adopt any means that will make grazing easier. Table 3.1 further reveals that all (100.0%) of the Fulani herdsmen cultivated maize and millet. Other crops cultivated by the herdsmen were yam (70.9), cassava (65.1%), pepper (95.3%), and sorghum (90.7%). These findings are similar to those of Sodiya *et al.* (2009) which indicated that commonly grown crops among Fulani pastoralists were sorghum, cassava, maize and yam which were mostly grown as inter-crops. This implies that the herdsmen primarily grow arable food crops instead of cash crops. This could be attributed to their nomadic lifestyle and landless status.

As found in Table 3.1, 60.5 percent of the Fulani herdsmen cultivated 1.1-2.0 hectares of farmland while 19.8 percent cultivated 2.1-3.0 hectares of farmland. The mean farm size cultivated by the Fulani herdsmen was approximately 2.0 hectares. It was also revealed that almost all (95.3%) of the Fulani herdsmen leased the farmlands while only 11.6 percent purchased their farmlands. This implies that majority of the Fulani herdsmen are landless. Hence, their reliance on leased farmlands. This finding is in tandem with the position of Sodiya *et al.* (2009) who opined that Fulani Agro pastoralist are landless because of the difficulty in acquiring land from the State or Local government area where they reside due to social, institutional, and legal litigation impeding them as non-indigenes. As shown in Table 3.1, all (100.0%) of the Fulani pastoralists were rearing cattle while few were into sheep (14.0%) and goat rearing (17.4%) implying that cattle was the most commonly reared livestock among Fulani pastoralists. This supports the report of Olusanya *et al.* (2014) that cattle was the primary livestock reared by pastoralists in Yewa area of Ogun State.

On herd size of the Fulani pastoralists, results in Table 3.1 show that the highest proportion (62.9%) of the Fulani pastoralists had 51 – 100 herds of cattle while about one-quarter

(24.6%) had more than 100 herds. The mean herd size was 81. Lawal-Adebowale *et al.* (2018) also found that the most common herd size among settled pastoralists was 61-80 herds. This implies that the Fulani pastoralists must always find means to provide fodder for their cattle. Findings further indicated that all (100.0%) of the respondents were rearing the White Fulani breed subspecies of Zebu breeds of cattle. This is similar to the findings of Lawal-Adebowale *et al.* (2018) which reported that White Fulani was the most commonly reared breeds of cattle among settled pastoralist in Ogun State. This could be attributed to its good resistance to drought and trypanosomiasis.

Table 3.1: Distribution of the Fulani pastoralists by their herding characteristics (n=86)

Herding characteristics	Frequency	Percentage	Mean	Standard deviation
Other Occupations				
Crop farming	86	100.0		
Trading	0	0.0		
Herding experience (years)				
≤20	6	7.0		
21 – 40	44	51.2	41	11.4190
41 – 60	33	38.5		
≥60	3	3.5		
Farm size (Hectare)				
≤1.0	16	18.6		
1.1 – 2.0	52	60.5	2	0.6407
2.1 – 3.0	17	19.8		
>3.0	1	1.2		
Crop cultivated*				
Maize	86	100.0		
Cassava	56	65.1		
Pepper	82	95.3		
Yam	61	70.9		
Millet	86	100.0		
Sorghum	78	90.7		
Ownership of farmland*				
Leased	82	95.3		
Purchased	10	11.6		
Type of livestock reared*				
Cattle	86	100.0		
Sheep	12	14.0		
Goat	15	17.4		
Size of Herd				
≤ 50	11	12.8		
51 – 100	54	62.9	81	7.8712
≥100	21	24.6		
Breeds of Cattle				
White Fulani	86	100.0		

*Multiple responses

3.2 Constraints to herding among Fulani pastoralists

Results on the constraints facing herding are presented in Table 3.2 which reveals that 73.3% and 59.3% of the Fulani pastoralists considered scarcity of pasture and attack from crop farmers, respectively as the major constraints facing herding in Ogun State, Nigeria. Also, about half of the herders indicated that cattle rustling (50.0%), loss of herds/missing herds (48.8%), and exposure to disease outbreak (47.7%) as minor constraints to herding. The mean values ranked scarcity of pasture as the most severe constraint faced by Fulani pastoralists ($\bar{x}$ = 2.64). This was followed by attack from crop farmers ($\bar{x}$ = 2.55), cattle rustling ($\bar{x}$ = 1.55), while long distance journey ($\bar{x}$ = 1.12) and exposure to disease outbreak ($\bar{x}$ = 1.12) were the least severe constraints.

Using the mean value of 2.00 as the mid-point, the findings indicated that scarcity of pasture and attack from crop farmers were considered as primary constraints to herding in the study area while other items were not considered as important constraints among Fulani pastoralists. This could mean that pasture scarcity could lead to Fulani pastoralists herding their cattle on farmlands around them which can lead to destruction of crop farms of economic values. This corroborates the position of Lamidi and Ogunkunle (2015) who stated that conflicts between pastoralists and farmers had negative consequences including loss of income, yields, household resources and stored farm products, as well as destruction of farmlands. The findings also agree with those of Idris (2018) and Abdullahi (2016) who identified conflict with farmers and competition for land use respectively as challenges associated with herding in Nigeria.

In the same vein, grazing cattle and other livestock on crop farms could lead to reprisal attacks from crop farmers thereby deepening the conflict between crop farmers and Fulani herders. This implies that lack of green pastures due to extra-long drought periods is threatening agro-pastoral production and peaceful co-existence among pastoralists and host communities. This is in tandem with Blench (2006) who opined that the herdsman-farmers conflict is attributed to competition for natural resources. Nweze (2005) also posited that agricultural activities of herdsman and farmers is been affected by the conflicts which has claimed numerous lives, properties, herds and farms. Conflicts often have negative implication on both crop and cattle production. Hence, an alternative means of providing cattle with fodder through hydroponic could resolve existing conflicts.

Table 3.2: Constraints faced by the respondents in Herding (n = 86)

Constraints	Major constraints	Minor constraints	Not a Constraint	Mean	Rank
Scarcity of pasture	63 (73.3)	15 (17.4)	8 (9.3)	2.64	1 st
Attack from crop farmers	51 (59.3)	31 (36.0)	4 (4.7)	2.55	2 nd
Cattle rustling	2 (2.3)	43 (50.0)	41 (47.7)	1.55	3 rd
Loss of herds/Missing herds	2 (2.3)	42 (48.8)	42 (48.8)	1.53	4 th
Fatigue	2 (2.3)	26 (30.2)	58 (67.4)	1.35	5 th
Attack by wild animals to the herds	1 (1.2)	26 (30.2)	59 (68.6)	1.33	6 th
Long distance journey	0 (0.0)	10 (11.6)	76 (88.4)	1.12	7 th
Exposure to disease outbreak	27 (31.4)	41 (47.7)	18 (20.9)	1.12	7 th

Figures in parentheses () are expressed as percentages; Cut-off point =2.00

3.3 Awareness of Hydroponics Fodder

Results on the awareness of Fulani pastoralists about the use of hydroponics for fodder production are presented in Figure 1. Findings reveal that all (100.0%) of the Fulani pastoralists were not aware of the use of hydroponics for fodder production. This means that despite the herdiness experience of the Fulani herders, they had never heard about the use of hydroponics for fodder production. Their lack of awareness could be associated with low literacy level among the herders which militate against the adoption of any technology. This could negatively influence potential adoption as awareness is usually the very first stage in the adoption process of any technology. This is in tandem with Kudi *et al.* (2011) who opined that the rate of adoption of agricultural innovation is largely dependent on the farmer's awareness of that innovation. Lack of awareness about hydroponics is a probable reason for the conflicts between crop farmers and pastoralists as Fulani pastoralists continue to rely on naturally grown pastures including arable crops cultivated by farmers for human consumption. Apart from low literacy level, old age, small farm size, lack of access to training on hydroponics, and lack of contact with extension workers could be responsible for the Fulani herders' low awareness of hydroponics technology. This assumption is supported by the findings of Uddin and Dhar (2018) who identified farm size, farming experience, training and extension contact as rendering significant explanations to farmers' adoption of hydroponic fodder production technology in Bangladesh.

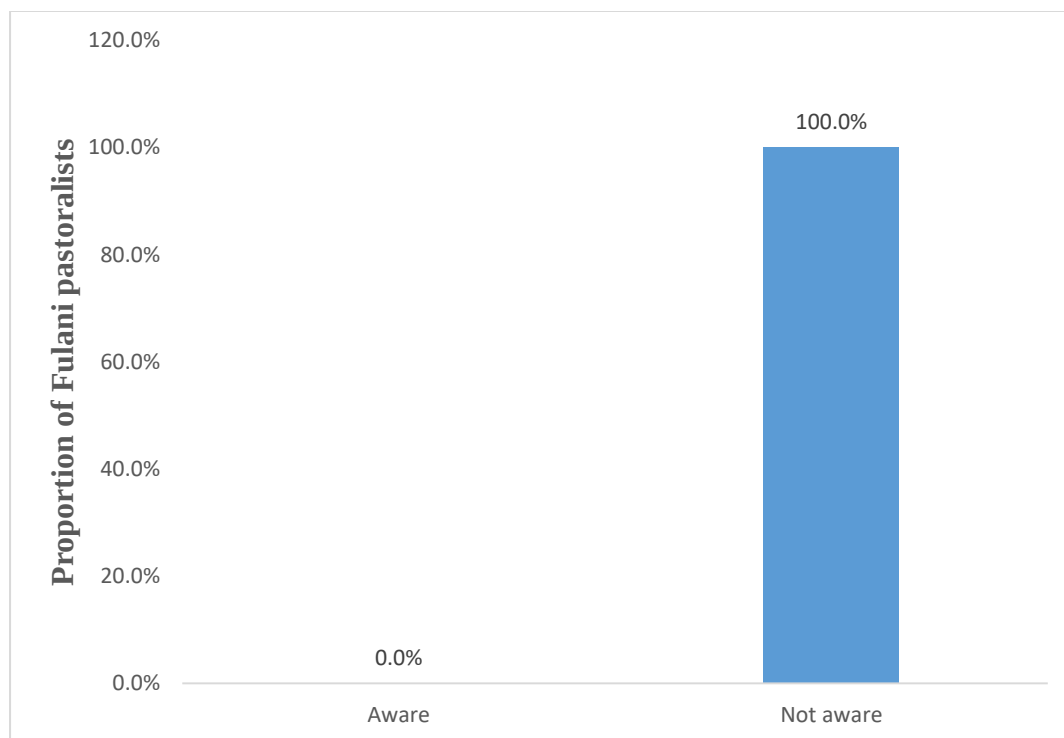


Figure 3.1: Distribution of Fulani pastoralists by awareness of hydroponics for fodder production

4.0 Conclusion and Recommendations

Based on the findings, the study concludes that Fulani pastoralists were constrained primarily by scarcity and pasture, and attacks from crop farmers among other constraints when herding.

The Fulani pastoralists were also not aware of the use of hydroponics for fodder production. It is therefore concluded that the constraints of pasture scarcity would have been minimized (if not completely eradicated) provided that Fulani pastoralists were aware and adopted the use of hydroponics for fodder production. It is therefore recommended that extension agents should raise awareness, and train the Fulani pastoralists on the benefits of using hydroponics for fodder production in Ogun State. Also, farmers and Fulani pastoralists should devise viable strategies for resolving conflicts between the two parties. Fulani pastoralists are also encouraged to consider adopting hydroponics for fodder production.

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