EVALUATING THE POTENTIAL ADOPTION OF FULANI PASTORALISTS TO HYDROPONICS FODDER PRODUCTION IN OGUN STATE, NIGERIA

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ABSTRACT
This study assessed the potential adoption of Hydroponic Fodder Production Technology (HFPT) among Fulani pastoralists (FPs) in Ogun State, Nigeria. FPs were sensitised, instructed, and involved in an On-farm Adaptive Research (OFAR) on HFPT due to their low awareness of HFPT. 86 respondents were sampled from Abeokuta North and Odeda Local Government Areas using multistage sampling procedure. The majority of the FPs were married (96.5%), men (97.7%), and had no formal education (90.7%) with a mean age of 51 year? s and an average household size of 6 people. Majority of FPs who participated in the training on HFPT considered that adopting HFPT was compatible with current practice (96.5%), had relative advantages (98.8%), could be tried (80.2%), was not complex (94.2%), and was observable (100.0%). After the OFAR, the majority of the FPs (93.0%) adopted HFPT. Chi-square analysis indicated that the availability of natural pasture (?2 = 14.674) and the high cost of grains (?2 = 31.990) were significantly related to the potential adoption of HFPT. The study concluded that HFPT has great potential for adoption among FPs. To address the envisaged constraints and turn potential adoption into actual adoption, extension workers should provide FPs with follow-up training on HFPT.
Keywords: Conflict, Envisaged constraint, Fodder production, Hydroponics, Potential adoption.

INTRODUCTION
One cannot overstate the role of agriculture in boosting national economies. This is significant because, according to the International Food Policy Research Institute (2019), 70% of the development target group in Africa for the Sustainable Development Agenda resides in rural regions and depends on agriculture for a living. Invariably, increasing productivity, reducing poverty, improving nutrition and general well-being of the population would imply improving the livelihood of the majority and this hinges critically on the performance of the agricultural sector (Uzonwanne *et al.,* 2023). For instance, using World Development Indicator (WDI) (2020) data from Nigeria for selected periods, it was found that, there was a strong positive correlation between food production and primary school enrollment ratio and gender equality while there was a strong negative correlation between food production and child mortality rates.

The livestock subsector, which contributed an average of 9.2% between 1960 and 2020, is the second largest (Uzonwanne et al., 2023). The highest supply of animal protein, including dairy and poultry products is also found in this industry. Thus, the subsector's economic significance is demonstrated by the availability of food, the creation of jobs and revenue, and the supply of hide as a raw material. Even though agriculture plays a significant role as a major economic determinant in determining Nigeria's GDP (Sasu, 2023a), the over reliance of farming on soil exposes it to problems related to soil-based farming, such as weed evasion, soil erosion, desertification, urbanisation, industrialization, and climate change (Ajibade et al., 2018). Additionally, by exposing the land's surface to erosion and creating intense competition between livestock and crop farmers for pastures, the grazing of livestock, particularly cattle on green pastures, contributed to the degradation of the land. This has been a major cause of conflict between livestock herders and crop farmers.

Soilless farming is simply the art of growing crops without using soil as a growth medium through which inorganic nutrient is provided to the root of plant through irrigation (Savvas *et al*., 2013). Tajudeen and Taiwo (2018) define Soilless farming as any method of cultivating crops without the use of soil as a rooting medium, in which the nutrients absorbed by the roots are supplied via irrigation water. Tajudeen and Taiwo (2018) also observed that Soilless farming is a sustainable farming technique which do not rely on soil, thereby devoid of the challenges facing conventional soil-based farming, and capable of helping Nigeria achieve Zero hunger goal of the Sustainable Development Goal by 2030. Hydroponic fodder which is a type of Soilless farming that involves the cultivation of crops without soil by utilizing water or nutrient rich solution within a greenhouse within a week (Naik, 2014). Sustainable dairy production is majorly challenged by provision of green fodder to cow economically (Naik *et al.,* 2012) which can be addressed by the adoption of Hydroponic fodder.

It is estimated that Nigeria has 21 million cow which consumes 500 million kilogram of grass and drinks 1 billion gallons of water per day (Sasu, 2023b), yet, in

the past five years, majority of Nomadic Fulani herdsmen has fled their pasture fields in the North East due to intense Boko Haram crisis (World Health Organization - WHO, 2020). Climate change is also causing desertification in the Northern areas, thereby resulting into an estimated 20% reduction in crop yield and prolonged drought period (WHO, 2020).

Furthermore, several reports (Bello, 2013; Aliyu *et al*., 2018; Oyeinfie, 2021) had linked the causes of conflict between herdsmen and crop farmers to an array of multidimensional factors including effect of climate change leading to unavailability of water and pasture, reprisal attacks, increasing cattle production, and inaccessibility to pasture fields in the North Eastern part of Nigeria due to insurgency. Although, the Federal Government of Nigeria has tried relentlessly to address this conflict without meaningful solution through the implementation of policies and programmes such as Rural Grazing Area (RUGA) and the recent National Livestock Transformation Plan (NLTP), yet the occurrence of bloody clashes between these stakeholders is still a recurrent topic in National discourse. This is because the projects suffered a still-birth owing to resistant campaign of "Fulanization", "Colonization", "Islamization" and ethno-religious antagonism which led to the suspension of those laudable projects.

Hence, so as to increase livestock productivity despite the foregoing, there will be need to introduce low cost technology that would improve the current systems of management, which is cost effective and which can be carried out with ease. Acceptable and successful feed systems are described as those that are simple, practical, and consistently reproducible which are within the limits of the farmer's resources (Ande, 2011). This underscores the importance of adopting hydroponics fodder which is the practice of growing plants in liquid nutrient rather than in soil so as to provide continuous feeds for animals throughout the year. The growing of water hyacinth and other aquatic plants upon water channels such as the Ogun River is typical of hydroponics.

Therefore, this study assessed the potential adoption of hydroponics fodder production technology (HFPT) among Fulani pastoralists in Ogun State, Nigeria. The specific objectives described the socioeconomic characteristics of the Fulani pastoralists, identify the envisaged constraints to the adoption of HFPT, assessed the potential adoption of HFPT, and determine the perceived benefits of adopting HFPT . At 0.05 levels of significance, this study tested the hypothesis that there is no significant relationship between the potential adoption of HFPT and the envisaged constraints

MATERIALS AND METHODS

Study area

This research was conducted in Ogun State, Nigeria with a varied vegetation from from derived Savannah to rain forests. The land area boast of natural resources such as rivers, forest reserve, mineral resources, an ocean front as well as a vast fertile soil for cultivating equatorial, tropical and savannah crops. The proposed study areas are largely characterized by natural pasture, herbaceous plants and shrubs. The major activities in Ogun State include farming such as cassava, maize and spices, food processing, artisanal work, trading and casual work (Fabusoro, 2007). Cattle production is mostly done by settled Fulani Pastoralists in some parts of Ogun State.

Study population, sampling procedure and sample size

The study population consist of settled Fulani pastoralists 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 involved the purposive selection of Odeda and Abeokuta North Local Government Areas (LGAs) of the State due to high population of Fulani pastoralists, and the availability of research on herdsmen-farmer conflicts in the two LGAs. At stage 2, three (3) Settled Fulani pastoralist 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 while Imala, Olorunda and Ayetoro communities were selected from Abeokuta North LGA. At stage 3, the proportionate random sampling technique was used in selecting a total of eighty-six (86) Fulani pastoralists who were willing to participate in the research from the six (6) communities.

Methods of data collection

This research is a follow-up to a previous research on Fulani pastoralists' awareness of HF which found that none of the sampled pastoralist were aware of HF. The research in two phases. The first phase involved a capacity development training programme during which the respondents were trained on the use of hydroponics for fodder production. After this, the participants were asked to indicate their interest to participate in an On-Farm Adaptive Research (OFAR) in a fodder collection centre within their communities. During the second phase, the respondents were exposed to the practical process of producing fodder using the hydroponic techniques. This was done for ten days.

Interview guide and Focus Group Discussions were used to collect primary data from Fulani pastoralists to generate data on the socio-economic characteristics of Fulani pastoralists, perceived benefits of adopting hydroponics, envisaged constraints to adopting HF by Fulani pastoralists, and potential adoption of HF by Fulani pastoralists. The interview guide was prepared in English Language and administered to the respondents in their language with the aid of a research assistant.

Measurement of key variables

Envisaged constraints to Adoption of HF: Using a three-point rating system with Not a constraint = 0, Minor constraint = 1, and Major constraint = 2, this was assessed at the Ordinal level. To order the constraint items according to severity, the mean severity of the constraint was calculated. Items are categorised as severe constraints if their mean values are at least 1.00; items with lower values are not categorised as severe constraints.

Perceived benefit of adopting Hydroponics fodder (HF): A five-point Likert scale with the options of Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), and Strongly Agree (SA) was used to test this on a 20-item researcher-developed scale. The five components of the scale were created by Rogers (2003) and include observability (3 items), trialability (3 items), complexity (3 items), compatibility (4 items), and relative benefit (7 items). Positively worded items were scored as 5,4,3,2, and 1 for response options of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SA) respectively while the scoring was reversed for negatively worded statements. Additionally, mean values were calculated for every component. The details of the individual components and categorization are contained in Table 1.

Potential adoption of the innovation: This was measured as the number of Fulani pastoralists who adopted HFPT upon the completion of the OFAR. The potential adoption index was determined through a formula at the end of the capacity development as:

$$\frac{\text{Number of Potential Adopters}}{\text{Total number of respondent}} \times 100\%$$

Table I: Categorization and individual components of perceived benefit of adopting Hydroponics fodder (HF)

Innovation characteristics	Number of Items	Minimum score	Maximum score	Cut-off points	Decision
Relative advantage	7	7	35	21	<21- No relative advantage ≥21 - HF has relative advantage
Compatibility	4	4	20	12	<12: Not compatible ≥12: compatible
Complexity	3	3	15	9	>9: Complex ≤9: Not complex
Trialabilty	3	3	15	9	<9 - cannot be tried ≥9 - can be tried
Observability	3	3	15	9	<9 - Not observable ≥9 - Observable
Overall Perceived Benefits	20	20	100	60	<60 - Not beneficial ≥60 - Beneficial

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 (frequency counts, percentage, mean and standard deviation) and inferential (Chi-square) statistics. Results were presented in suitable distribution tables and charts.

RESULTS AND DISCUSSION

Socio-economic characteristics of Fulani pastoralists

Results on the socio-economic characteristics of Fulani pastoralists are presented in Table II. It shows that the mean age of the Fulani pastoralists was 51 years with 73.6% within the ages of 31 – 60 years. This suggests that herding was dominated by people within the active workforce of the population, though most of them are ageing. This finding agrees with Sodiya et al. (2009) who submitted that majority of the pastoralists are still energetic with strength to undertake both social and economic and activities that could improve the livelihood status of their households. It also suggests that the elderly are the gatekeepers of innovation adoption occupying key decision-making position in the hierarchical structure among settled Fulani pastoralist. Adoption of innovations such as the HF depends on approval or otherwise from the aged hierarchical office holders.

Majority (97.7%) of the Fulani pastoralists were male suggesting that herding of livestock such as cattle in Ogun State was dominated by men who took herding as their responsibility. Reasons for this could be attributed to the tedious nature of herding as it involves traveling long distances and coordinating many cattle in thick bushes for several hours. This is in line with the findings of Sodiya (2005) who reported that animal rearing is culturally regarded as a male dominated affair. This does not underscore the significant roles played by women in Fulani households as the women are often in charge of household chores such as food preparation, milking, processing and marketing of dairy products. It was also found that the sampled pastoralists were mostly married (96.5%). This could be attributed to the fact

that culturally, the Fulanis don't delay marriage. Hence, the married pastoralists could rely on family labour for their pastoral production as well as household chores. This is supported by Olusanya et al. (2014) who reported that majority of pastoralists was married. This can also be attributed to the fact that majority of the respondent are within marriageable age of at least 18 years. Findings further indicated that 90.7% of the sampled Fulani pastoralists had no formal education, suggesting that Fulani herdsmen are not literate. Not having formal education is expected to negatively influence the potential adoption of innovation by the Fulani pastoralists as education in directly associated with adoption of innovation (Agbamu, 2006). This finding is in tandem with the report of Lawal-Adebowale *et al.* (2018) who posits that sizeable proportion of herdsmen in Ogun State lacks formal education. More than half (55.8%) of the sampled pastoralists had household size of 1-5 persons while 38.4% had 6-10 persons in their household and the mean household size was approximately six persons suggesting that the Fulani pastoralists had relatively moderate household size. This differs from the general belief that Fulanis generally keep large household size. Also, the finding did not neglect the possibility that the pastoralists might still have other family members (wives and children) in their home States. As shown in Table 2, at least 90 percent of the Fulani pastoralists earned 150,000 - 500,000 per as annual income. This implying that the earnings of the pastoralists varied based on a number of factors such as herd size and engagement in other means of livelihood.

Table II: Distribution of the Fulani pastoralist according to their Socioeconomic characteristics (n=86)

Socioeconomic characteristics	Frequency	Percentage	Mean	S.D
Age (years)				
≤ 30	4	4.8		
31 – 60	63	73.6	51	11.0620
> 60	19	22.1		
Sex				
Male	84	97.7		
Female	2	2.3		
Marital Status				
Married	83	96.5		
Widowed	3	3.5		
Annual Income (₦)				
150,000 – 250,000	23	26.8		
251,000 – 350,000	26	30.2		
351,000 – 500,000	31	36.0		
501,000 – 700,000	6	7.0		
Household Head				
Male	86	100.0		
Female	0	0.0		
Educational attainment				
No formal education	78	90.7		
Formal education	6	7.0		
Quranic education	2	2.3		
Household Size (persons)				
1 - 5	48	55.8		
6 – 10	33	38.4	6	2.394
11 – 15	5	5.8		

SD = Standard deviation

Perceived benefit of adopting hydroponics fodder production technology

Table III reveals that the majority of Fulani pastoralists who participated in the training programme on HFPT considers that the use of HF can be tried (80.2%), is compatible with existing practice (96.5%), has relative advantage (98.8%), Observable (100.0%) and not complex (94.2%). Overall, all (100.0%) of the Fulani pastoralists perceived that the use of HF for fodder production is highly beneficial. This is consistent with the reports of Naik *et al.* (2013), FAO (2015) and Rachel *et al.* (2015) who opined that the cost of feed/kg of milk produced is lesser with higher net profitability when fodder was produced in low cost hydroponics system. Thalkar (2019) also emphasised that hydroponics fodder production is cost effective which simply needs water and seed as production inputs and little manpower. Because hydroponics requires no fuel for the operations of harvesting and post-harvesting, it

minimises post-harvest losses. Furthermore, with hydroponic systems, the development process from seed to fodder takes only 7-8 days, whereas in traditional systems, it takes 45-60 days (Thalkar, 2019). Al-Karaki and Al-Momani, 2011; Naik, 2014; Rachel *et al*., 2015; Yvonne, 2016) and other earlier research have also suggested that HF uses less water than traditional pasture agriculture. According to Naik *et al.* (2015), feeding hydroponically grown fodder also improves the ration's nutrient digestibility, which may boost milk output. While discussing the relative advantage of HF over the conventional pasture cultivation and management system, Sneath and McIntosh (2003) and Shipard (2005) reported that HF production has the capacity to eliminate anti-nutritional factors such as phytic acid and it is rich in chlorophyll and grass juice factor which improve livestock performance. On compatibility with existing practice, the findings of this study align with the culture and social norm of the Fulani pastoralists, known as the *Pulaaku* social capital**.** The *Pulaaku* is a code of social values such as trust, norms, and social networks (Green and Haines, 2011). The perceived benefit of simplicity of HF production can be attributed to the step-wise practical capacity development received. This is also in tandem with Loevinsohn *et al.* (2012) who posit that the dynamic interaction between the technological features and the array of conditions and circumstances surrounding such technology greatly determine how the farmer will utilize and the decision of the farmer to either adopt or reject an innovation. Rogers (2003) posits that trialability is inversely correlated with uncertainty, hence, decreasing resistance and facilitating adoption of innovation. This was evident by the introduction of mat container made from palm fronds by the *Seriki Opeji*. The mat container was used to efficiently replace the bamboo container of the hydroponics system. Naik *et al.* (2013) also reported that farmers using low-cost hydroponics system or green house for hydroponics maize prodcution indicated that the innovation had observable growths. The overall assessment of hydroponics fodder production as advantageous presented in this study is in line with the conclusions of Yvonne (2016), who asserts that a mere one square metre of space is required to generate hydroponic fodder for two cows each day, leading to a 13% increase in milk yield.

Table III: Respondents' distribution of the different innovation characteristics of HF

Innovation characteristics	Frequency	Percentage	mean±SD
Relative advantage			
Has Relative advantage	85	98.8	4.62±0.05
Has no relative advantage	1	1.2	
Compatibility			
Compatible	83	96.5	4.57±0.44
Not compatible	3	3.5	
Complexity			
Complex	5	5.8	4.50±0.06
Not complex/Simple	81	94.2	
Trialability			
Can be tried	69	80.2	3.98±0.05
Cannot be tried	17	19.8	
Observability			
Observable	86	100.0	4.66±0.04
Not observable	0	0.0	
Overall perceived benefit			
Beneficial	86	100.0	4.47±0.08
Not beneficial	0	0.0	

Potential adoption of the innovation

As shown in Figure 1, the study's findings indicate that, while 3.5% of respondents were unsure and another 3.5% rejected the idea, the majority of respondents (93.0%) were willing to use hydroponic fodder to feed their herds. This implies that the use of hydroponics for the production of fodder has a high potential, and this may be ascribed to the success of the capacity building programme, which involved the respondents in the methodology and results demonstration. The finding contradicts the finding of Kiobia *et al.* (2020) which reported that only 5.6% of smallholder farmers in Tanzania adopted hydroponics production technology. The discrepancy could be attributed to the fact that while the Tanzanian study was on actual adoption, the current study is on potential adoption which intentionally introduced and trained the Fulani pastoralists on the technology. Determining the actual adoption would take some time.

The decision to strategically construct, install the hydroponic fodder centre and carryout capacity development at the residence of the Seriki Fulani (influencial Fulani Chief) of each study area and the presence of dignitaries such as the Ogun State Secretary of Miyetti Allah Cattle Breeders Association of Nigeria (MACBAN) is deduced to be responsible for the higher proportion of potential

adoption of hydroponic fodder among the Fulani pastoralists. Since adoption is the conscious decision to utilize a new technology or implement a new practice (Ochuko, 2013), majority of the respondents were enthusiastic to adopt the use of hydroponics fodder. This was demonstrated when the Seriki Opeji (Traditional head of a Fulani community) suggested the use of locally weaved mats as a substitute to the bamboo trays which was a component of the Hydroponics fodder system. This reinvention by the adopter is a reflection of the flexible nature of the innovation.

The respondents belonging to different categories on adoption of the innovation after its introduction gives credence to Rogers and Shoemaker (1971)'s categorization of adopters into various groups as the laggards, the late majority, the early majority, the early adopters, and the innovators. Considering the Innovation-decision process, it is also possible for some adopters to later discontinue the adoption of the innovation with likely possibility of other Fulani pastoralists who rejected the innovation to later decide to adopt the innovation.

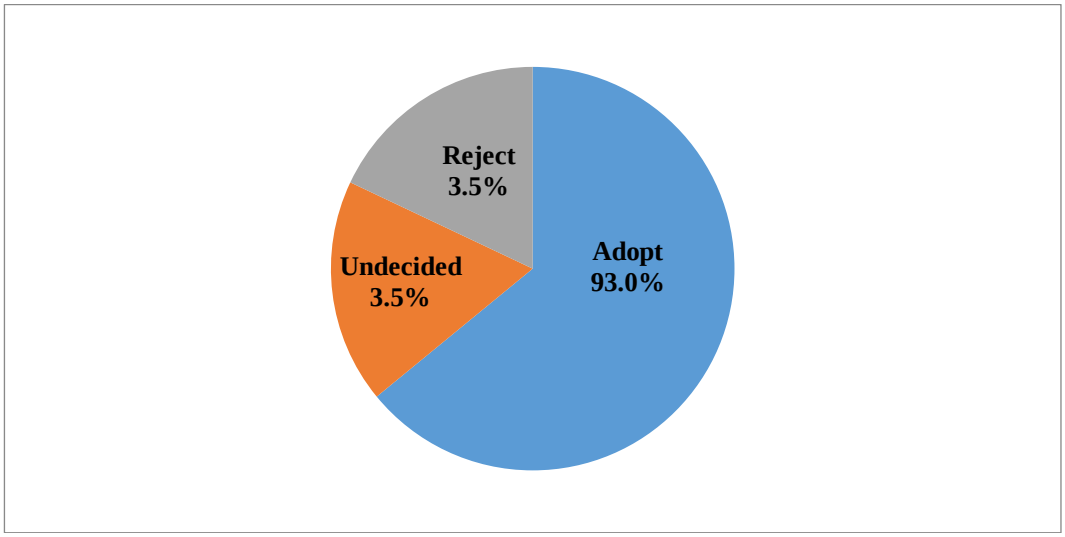

Figure 1: Potential adoption of the Hydroponic fodder
Source: Field Survey, 2020

Envisaged constraints to Adoption of innovation

Results on the envisaged constraints to adoption of hydroponics for fodder production are presented in Table IV. Findings reveal that the highest proportions of the sampled Fulani pastoralists envisaged that high cost of grains (46.5%), lack of effective extension service (46.5%), inadequate finance (40.7%) and inadequate water (44.2%) would be major constraints to their adoption of hydroponics for fodder production. This is because maize grains which were mainly consumed among the pastoralists was used during the on-farm demonstration of the technology despite the high cost of maiza grain. This is in tandem with the findings of Naik *et al. (*2014) and Rachel *et al*. (2015) who found that the cost of seeds accounted for 85-90% of the total cost of producing hydroponics fodder. The need for grains for the production of hydroponics fodder implies extra financial implications on the herders even though they can produce high quality fodder for their herds by adopting hydroponics fodder production non-seasonally and without the need to travel long distance thereby encroaching into farms.

On the other hand, the highest proportion do not envisage availability of natural pasture (72.1%), lack of fodder centre (86.0%), cultural incompatibility (94.2%) and complexity of hydroponics fodder production process (95.3%) as constraints to their adoption of hydroponics for fodder production. This is consistent with the perceived qualities of the technology which the pastoralists considered to be compatible with existing practice and simple.

The mean values of severity of constraints indicated that the adoption of HF by Fulani pastoralists was envisaged to be significantly impacted by high grain costs ($\bar{x}$ = 1.24), a lack of effective extension services ($\bar{x}$ = 1.22), inadequate money ($\bar{x}$ = 1.19), insufficient water ($\bar{x}$ = 1.17), and insufficient resources ($\bar{x}$ = 1.19). Also, agronomic issues were shown to be a major obstacle to Tanzanian smallholder dairy farmers implementing hydroponic production technology by Kiobia *et al.* (2020).

Table IV: Envisaged constraints to Adoption of innovation

Possible constraints	Major constraint	Minor constraint	Not a constraint	Mean
High cost of grains	40 (46.5)	27 (31.4)	18 (20.9)	1.24
Lack of effective Extension service	40 (46.5)	35 (40.7)	11 (12.8)	1.22
Inadequate finance	35 (40.7)	32 (37.2)	19 (22.1)	1.19
Inadequate water	38 (44.2)	25 (29.1)	23 (26.7)	1.17
Availability of natural pasture	2 (2.3)	22 (25.6)	62 (72.1)	0.30
Lack of fodder centre	1 (1.2)	11 (12.8)	74 (86.0)	0.15
Cultural incompatibility of the technology	0 (0.0)	5 (5.8)	81 (94.2)	0.06
Complexity of hydroponics fodder production process	0 (0.0)	4 (4.7)	82 (95.3)	0.05

Figures in parentheses () are expressed as percentages
Source: Field Survey (2020)

The participants at one of the Focus Group Discussions at Alabata community also revealed that water scarcity is a major problem in the community especially during the dry season.

"We are faced with water scarcity and the situation is worse during dry season when we have to trek for long distances to fetch water for household uses. Even our herds had to graze over long distance in search of water during which we experience conflicts from other tribes as we try to provide water for our herds from the same water source of the villagers" (FGD, Alabata)**.**

The finding also indicate the shortage of water for household use and livestock rearing currently being faced by the Fulani rural communities could deter the adoption of hydroponic fodder production. The scarcity of water is further exacerbated by climate change leading to increase in security challenges especially in the semi-arid region of sub-Saharan Africa (Audu *et al*., 2013). Also, it was observed that cattle herds drinking from the same streams that is used by human for domestic consumption such as cooking and drinking could contaminate the water source been used by the community, thereby causing herdsmen-farmers conflict. This is corroborated by Ofem and Inyang (2014) who submitted that the contamination of communal streams by herds is responsible for the herdsmen-farmers conflict in Yakurr, Cross River State, Nigeria.

Lawal and Oluloye (2008) posit that the sensitization, mentoring and demonstration by extension agents largely determines the rate of adoption of innovation. The consideration of ineffective extension service delivery as a severe envisaged constraints probably implies that the Fulani herders are already afraid of the continuity of the innovation based on their previous experiences with Government interventions with white elephant-projects that lacks sustainability. The Secretary of the Ogun State branch of Miyetti Allah Association stated during the Focus Group Discussion held at Opeji that:

" *This capacity development on hydroponics fodder production is the first time our herdsmen community has ever benefited from any extension services from the Federal University of Agriculture, Abeokuta despite been neighbors to the host institution and we look forward to more benefit from the Government institution".*

Association between envisaged constraints to adoption of HF and potential adoption of hydroponic fodder production

Results of the Chi square analysis are presented in Table V. It reveals that high cost of grains (χ^2 = 31.990, df=6) and the availability of natural pasture as alternative feed source (χ^2 = 14.674, df =4) were significantly ($p \leq 0.01$) related with the potential adoption of HF. This implies that availability of grains will influence the decision of Fulani herdsmen to either adopt or reject HF while they will still prefer to graze their herds during rainy season when natural pasture is abundant. This is expected considering the high demand for grains for human consumption and other uses. This support previous findings of (Naik *et al*., 2014; Rachel *et al*., 2015) which disclosed that the cost of seed is responsible for 85-90% of the total cost of producing hydroponics fodder.

Table V: Chi-square analysis of envisaged constraints to adoption of HF and the potential adoption

Variable	χ^2	df	Decision
Financial capital	8.493	4	0.75
High cost of grains	31.990	6	0.001*
Complexity of hydroponic fodder	0.315	2	0.854
Lack of effective Extension service	3.267	4	0.514
Cultural incompatibility of the technology	0.484	4	0.975
Availability of natural pasture	14.674	4	0.005*
Lack of fodder centre	1.653	4	0.799
Inadequate water	8.798	4	0.66

***means significant association exist**
Source: Field Survey (2020)

CONCLUSION AND RECOMMENDATIONS

Findings from this study indicated that most of the Fulani pastoralists were willing to adopt the use of hydroponics fodder production irrespective of their culture background, religion, and existing agropastoral practices. The study concludes that there was a high potential for adoption of hydroponics fodder production among Fulani herders, and that their decision to adopt the technology was influenced by the high cost of grains and availability of pasture. The study suggested that extension workers follow up with Fulani pastoralists on hydroponics fodder technology in order to address the anticipated barriers and turn the potential adoption into actual adoption, thereby reducing the Herdsmen-farmers conflict. .

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