EVALUATION OF HAYBARN ADOPTION BY RUMINANT ANIMALS FARMERS IN NASARAWA LOCAL GOVERNMENT, NASARAWA STATE, NIGERIA

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ABSTRACT

The adoption of innovative agricultural technologies plays a pivotal role in addressing the challenges faced by smallholder farmers, particularly in improving productivity and sustainability in livestock farming. This study focused on evaluating the level of awareness and adoption of haybarn storage facilities among ruminant animal farmers in Nasarawa Local Government Area, Nasarawa State, Nigeria. Haybarns are essential for conserving forage, mitigating seasonal feed shortages, and enhancing livestock nutrition. A total of 50 farmers were randomly selected, and data were gathered through structured questionnaires and interviews, which were analyzed using descriptive statistics. The findings revealed that only 34% of respondents were aware of haybarn technique, and a mere 2% had adopted it for forage storage. Despite its potential benefits, adoption remains abysmally low due to several constraints. The most significant barriers included inadequate dissemination of information (96%), high costs of constructing haybarns (66%), lack of access to credit facilities (72%), and farmers' strong preference for traditional extensive and nomadic farming systems (62%). Additionally, limited entrepreneurial skills and inadequate

capital were identified as hindrances. The study highlights the weak research-extension-farmer linkage in the area, which has impeded the effective transfer of agricultural innovations. To address these challenges, the study recommends amongst others the introduction of participatory extension methods such as farmer field schools and agricultural exhibitions to raise awareness. There is also a need for improved access to credit facilities, entrepreneurial development programs for farmers, and government investment in rural infrastructure to support modernized livestock farming systems. Enhancing the adoption of haybarn storage facilities could significantly mitigate seasonal feed shortages, reduce livestock mortality, and improve the socio-economic wellbeing of ruminant farmers. These measures are crucial for promoting sustainable agricultural practices and ensuring food security in the region.

Keywords: Haybarn, Adoption, Innovation, Ruminant Animals Farmers, Nasarawa Local Government Area

INTRODUCTION

Agriculture remains a fundamental pillar of economic growth, food security, poverty alleviation, and rural development, particularly in developing countries. It is a vital source of income and sustenance for approximately 2.5 billion people globally, with the majority residing in rural areas of the developing world (FAO, 2023). In Nigeria, agriculture contributes significantly to the economy and provides livelihoods for millions, particularly in rural communities.

However, agricultural productivity in the country is hindered by the widespread reliance on traditional, inefficient production techniques. These outdated methods often fail to meet the growing demands for food and livestock products, exacerbating poverty and food insecurity. Smallholder farming systems are at the heart of rural agriculture and are considered a critical tool for achieving sustainable development. These systems play a pivotal role in addressing global challenges such as reducing hunger and extreme poverty, as highlighted in the Sustainable Development Goals (United Nations, 2015). However, their potential remains largely untapped due to limited access to modern agricultural technologies and innovations that are essential for improving productivity and efficiency. Agricultural technologies encompass a wide range of improved methods, practices, and tools that enhance the quality and quantity of agricultural outputs (Mausch, Harris, Heather & Jones 2021). Despite their transformative potential, the adoption and diffusion of these technologies are often slow and uneven across sub-Saharan Africa. Adoption, defined as the decision to fully utilize an innovation, and diffusion, which refers to the gradual spread of a technology within a population, are influenced by a multitude of socio-economic, cultural, and institutional factors (Becerra-Encinales, Bernal-Hernandez, Beltrán-Giraldo, Cooman, Reyes & Cruz. 2024).

One of the critical challenges facing livestock farmers in Nigeria is the seasonal fluctuation in the availability and quality of forage. Ruminant livestock, such as cattle, sheep, and goats, are particularly affected by the scarcity of good-quality feed during the dry season, leading to

reduced productivity, economic losses, and, in some cases, forced sale of animals to offset feeding costs. Traditional practices, such as transhumance nomadism, which involves moving animals in search of grazing land, are no longer sufficient to address the challenges posed by seasonal feed shortages. This practice often results in animal stress, reduced productivity, and conflicts over grazing land (Arinzen, Hilton, Hodgson, King, & Krauss, 2018).

Innovative solutions, such as haybarn storage facilities, have been developed to address these challenges. A haybarn is a specialized structure designed for storing hay in a manner that preserves its nutrient content and protects it from adverse weather conditions. This facility ensures the availability of high-quality fodder throughout the year, mitigating the effects of seasonal feed shortages. By conserving forage and crop residues, haybarns play a crucial role in reducing production losses and improving the overall productivity of livestock farming systems (Archibald, Bennett & Kuzmeski, 2019).

However, despite its benefits, the adoption of haybarn storage technique in many rural areas, including Nasarawa Local Government Area of Nasarawa State, Nigeria, remains low. This can be attributed to factors such as limited awareness, lack of access to credit, high costs of construction, and socio-cultural preferences for traditional farming systems. Understanding these barriers and addressing them through targeted interventions is essential for promoting the adoption of haybarns and other agricultural technologies.

This study seeks to evaluate the level of awareness and adoption of haybarn storage facilities among ruminant animal farmers in Nasarawa Local Government Area. It also aims to identify the key constraints to adoption and provide recommendations for improving the dissemination and utilization of this innovation. By doing so, the study contributes to the broader goal of enhancing livestock productivity, improving rural livelihoods, and promoting sustainable agricultural practices in the region.

The objective of this study is to determine the level of awareness and adoption of haybarn storage technique among ruminant animals' farmers in Nasarawa Local Government Area. The study will also involve identifying, analyzing and determining causes of low and/or lack of adoption and diffusion (if any) of haybarn storage technique among ruminant animals' farmers in Nasarawa Local Government Area of Nasarawa state, Nigeria.

Methodology

This study employed a descriptive research design to evaluate the awareness, adoption, and constraints associated with the use of haybarn storage facilities among ruminant animal farmers in Nasarawa Local Government Area (LGA) of Nasarawa State, Nigeria. The approach was designed to systematically investigate the extent of haybarn utilization, identify barriers to its adoption, and recommend strategies for improving its dissemination and use. The methodology consisted of clearly defined research questions, a focus on a specific study area, a robust sampling process, and structured data collection and analysis techniques.

Study Area

The research was conducted in Nasarawa LGA of Nasarawa State, Nigeria. Geographically, the area is located between latitude 8°32'N and longitude 7°42'E, covering a landmass of approximately 5,704 square kilometers. As of the 2006 census, the LGA had an estimated

population of 189,835. Nasarawa LGA shares boundaries with Kogi State to the south, Doma and Kokona LGAs to the east, Karu LGA to the north, and Toto LGA and the Federal Capital Territory (FCT) to the west.

The area experiences a tropical climate characterized by an annual rainfall of about 1,500mm and temperature variations ranging from a maximum of 44°C to an average of 34°C and a minimum of 25°C (Binbol & Marcus, 2008). The local economy is predominantly agrarian, with the residents primarily engaged in arable crop farming, livestock rearing, and trading. Livestock farming in the area largely involves cattle, sheep, and goats, making it an ideal setting for studying haybarn adoption.

Sampling Technique and Data Collection

The study adopted a simple random sampling technique to ensure an unbiased representation of the target population. A sample size of 50 ruminant animal farmers was selected from various communities within Nasarawa LGA. This sampling approach provided a diverse pool of respondents, capturing a wide range of experiences, practices, and challenges related to haybarn utilization.

Data were collected using a structured questionnaire supplemented by scheduled interviews. The questionnaire was carefully designed to elicit detailed responses on key aspects of the study, including demographic characteristics of the farmers, awareness of haybarn storage technique, adoption levels, and constraints hindering its use. The questionnaire consisted of both closed-ended and open-ended questions to allow for quantitative and qualitative data collection.

Since many of the respondents were illiterate, interviews were incorporated to ensure inclusivity and enhance the reliability of the data. The interviews allowed respondents to provide additional context to their responses and enabled the researcher to capture nuanced perspectives that might not be easily expressed in written form.

Data Analysis

The data collected were analyzed using descriptive statistical tools, including frequencies, percentages, and tabulations, to summarize and present the findings. Awareness and adoption levels were calculated to provide an overview of the penetration of haybarn storage technique among the farmers

To identify constraints, respondents were asked to select or indicate challenges from a predefined list. The constraints were categorized based on their impact:

Significant Constraints: These were challenges that affected at least 25% of the respondents.

Insignificant Constraints: These were challenges that affected less than 25% of the respondents.

Major Constraints: These were defined as challenges impacting at least 50% of the farmers, highlighting their critical importance.

This analytical framework allowed the study to isolate the most pressing barriers to haybarn adoption and identify areas where intervention is urgently needed.

Ethical Considerations

The study adhered to ethical research standards. Respondents were informed of the purpose of the study and assured of the confidentiality of their responses. Participation was voluntary, and farmers had the right to withdraw at any stage of the research process without repercussions.

Results and Discussion

3.2 Demographics of respondents

Table 3.2.1

CLASS	GROUP	F	%
Gender	Male	50	100
	Female	0	0
Age (years)	<25	2	4
	25-45	23	46
	>45	25	50
Marital status	Married	46	92
	Unmarried	3	6
	Divorced	0	0
	Widowed	1	2
Level of education	None	19	38
	Primary	21	42
	Secondary	7	14
	Tertiary	3	6
Household size	<3	5	10
	3-6	27	54
	>6	18	36

F = Frequency, % = Percentage Source: field survey 2024

The study revealed that all the respondents (100%) were male. This finding suggests that ruminant animal farming in the study area is predominantly male-dominated, aligning with cultural norms in many Northern Nigerian rural communities where livestock farming is traditionally considered a male activity. The absence of female respondents highlights potential gender disparities in agricultural participation, which could be influenced by socio-cultural barriers, land ownership issues, and financial constraints that limit women's involvement in livestock farming as noted by Mausch et al., 2021.

The respondents' age distributions revealed: below 25 years (4%), 25-45 years (46%), and above 45 years (50%). The dominance of farmers aged above 45 years suggests that livestock farming is more prevalent among middle-aged and older individuals. This pattern may be due to the financial requirements and experience needed to sustain livestock production, which younger farmers might lack. The finding is in tandem with Mausch et al., 2021, who reported a low participation and a declining interest in livestock farming among younger generations. This could be attributed to rural-urban migration, limited access to capital, and the preference for white-collar jobs.

The majority of respondents (92%) were

married, while 6% were unmarried, and 2% were widowed. This high percentage of married individuals suggests that livestock farming is a major livelihood activity for family heads who bear financial responsibilities. Previous studies, such as Akudugu, Guo & Dadzie, (2012), have suggested that married individuals are more likely to adopt agricultural innovations due to their need to improve household income and food security. However, the study also highlights that being married does not necessarily translate into increased adoption of haybarn technology.

The level of education among respondents varied, with 38% having no formal education, 42% attaining primary education, 14% completing secondary education, and only 6% reaching tertiary education. The significant percentage of respondents with low educational attainment suggests that literacy may be a limiting factor in the adoption of modern agricultural practices, including haybarn storage facilities. As noted by Mausch et al. (2021) farmers with higher education levels are more likely to understand the benefits of new technologies, access relevant agricultural information, and implement improved management practices.

Household size was classified into three groups and the respondents' data showed: fewer than three members (10%), between three and six members (54%), and more than six members (36%). The predominance of medium to large households suggests a reliance on family labour in livestock farming. Larger household sizes can be advantageous for farm operations, particularly in labour-intensive tasks such as feeding and managing livestock Issa, Abdulazeez, Kezi, Dare & Umar (2014).

3.3 Socio-economic characteristics

Table 3.3.1

CLASS	GROUP	F	%
Farming experience (years)	<10 years	15	30
	10-20 years	23	46
	>20 years	12	24
Member of cooperative group	Yes	33	66
	No	17	34
Number of visit by extension agent per month	None	47	94
	Once	3	6
	Twice	0	0
	More than twice	0	0
Access to Credit facilities	Yes	5	10
	No	45	90
Livestock reared	Cattle only	10	20
	Sheep only	1	2
	Goats only	2	4
	Cattle & Sheep	12	24
	Cattle & Goats	1	2
	Sheep and Goats	11	22
	Cattle, Sheep & Goats	13	26

Farm size (No. of animals in the farm)	<15	8	16
	15-30	19	38
	31-50	18	36
	>50	5	10
System of Production	Intensive	0	0
	Semi-intensive	1	2
System of Production	Intensive	0	0
	Semi-intensive	1	2
	Extensive	7	14
	Nomadism	42	84
Purpose of production	Subsistence	6	12
	Commercial	44	88

F = Frequency, % = Percentage Source: field survey 2024

Socio-economic characteristics showed that 66% of farmers belonged to cooperative groups, while 90% had no access to credit facilities. Similarly, Akudugu, et al. (2012) noted that membership in social groups enhances access to information and resources, but lack of credit remains a persistent challenge for technology adoption. Moreover, only 6% of respondents interacted with extension agents monthly, indicating weak extension services. Agwu, Uche-Mba & Akinnagbe (2008) also highlighted poor extension-farmer linkages as a barrier to innovation dissemination.

3.4 Awareness of haybarn storage facility

Table 3.4.1

Variable	Frequency	Percentage(%)
Yes	17	34
No	33	66
No Response	0	0

Source: field survey 2024

3.5 Adoption of haybarn

Table 3.5.1

Variable	Frequency	Percentage(%)
Yes	1	2
No	49	98
No Response	0	0

Source: field survey 2024

The study found that only 34% of respondents were aware of the haybarn storage facility, and adoption level was a mere 2%. This is consistent with the theory by Rogers (1995), which states that awareness is the first stage in the innovation-decision process but does not always lead to adoption. The findings align with Odediran and Ojebiyi (2017), who observed that high awareness does not guarantee high adoption rates. Low adoption rates in this study could be attributed to constraints such as inadequate resources and systemic inefficiencies in agricultural extension services. The innovations can be adopted at a very slow pace because farmers had to make their choices on which innovations they wanted to practice in relation to their farming situations, given the limited resources they have and constraints faced (Mawusi, 2004).

3.6 Constraints to farmers' adoption of haybarn storage facility

Table 3.6.1

Factors as perceived by farmers	Percentage affected	Category	Remark
Lack of information dissemination	96	Major	Significant
High costs of facility	66	Major	Significant
Inaccessibility to credit facility	72	Major	Significant
Inadequate capital	52	Major	Significant
Inadequate entrepreneurial skill	26	Minor	Significant
Preference for extensive/nomadic system	62	Major	Significant
Low demand for products	18	Minor	Insignificant
Insecurity	10	Minor	Insignificant
High cost of land	20	Minor	Insignificant
Risk of fire outbreak	24	Minor	Insignificant
Problems of wild animals	18	Minor	Insignificant

Source: field survey 2024

The results in Table 3.6.1 showed the constraints to ruminant animal's farmers' adoption of haybarn storage facility in the study area. Those considered significant constraints were those that affects at least 25% of the farmers in adoption of the facility while those that affects less than 25% of the farmers were considered insignificant. The major constraints however were those that affects at least 50% of the farmers in adoption of the facility while those that affects less than 50% were considered minor. The data show that lack of information dissemination, high cost of facility, inadequate capital, inaccessibility to credit facility and preference for extensive/nomadic system, are major and significant constraints in the adoption

of haybarn storage facility in the study area. This is in line with the research of Adefalu, Aderinoye-Abdulwahab, Bello, Olorunfemi & Oba (2013) and Issa et al. (2014) which revealed that inadequate capital was the major constraint to adoption of improved technologies by farmers. Inadequate entrepreneurial skill among the farmers was a significant but minor constraint to adoption of haybarn storage facility in the study area.

Major constraints identified included lack of information dissemination (96%), high costs of the facility (66%), and inaccessibility to credit (72%). These findings corroborate studies by Adefalu et al. (2013) and Issa et al. (2014), who reported that financial barriers and poor information dissemination are primary obstacles to the adoption of agricultural technologies. Furthermore, the preference for extensive/nomadic systems by 62% of respondents reflects cultural practices and economic limitations, as also noted by Arinze et al (2018). Minor but significant constraints included inadequate entrepreneurial skills (26%). This observation aligns with Doss (2003), who emphasized the need for capacity-building initiatives to empower farmers with the knowledge and skills required for technology adoption. Lack of information dissemination was the highest or most common constraint (96%) experienced by the farmers. This could be attributed to poor extension linkage system which decrease the rate of technology adoption among farmers. Agwu *et al* (2008) posited that high extension agents' farmer ratio would obviously affect effectiveness and efficiency of extension delivery in the rural areas.

The results suggest that increasing haybarn adoption will require addressing both structural and behavioural barriers. Policy interventions focusing on financial support, such as subsidized credit and cost-sharing programs, are critical. Additionally, strengthening extension services and employing participatory approaches, as recommended by Bandiera and Rasul (2002), could enhance awareness and adoption rates.

Summary, Conclusion, and Recommendations

Summary

This study evaluateded the adoption of haybarn storage facilities among ruminant animal farmers in Nasarawa Local Government Area, Nasarawa State, Nigeria. It aimed to evaluate the levels of awareness and adoption, identify constraints to adoption, and propose strategies to enhance the dissemination and utilization of haybarn storage technique. The findings revealed that the level of awareness of haybarns among farmers was low, with only 34% of respondents aware of the technology. Furthermore, the adoption rate was alarmingly low, with just 2% of the farmers utilizing haybarns for forage storage. The study identified several significant constraints hindering adoption, including inadequate information dissemination (96%), high costs of constructing haybarns (66%), lack of access to credit facilities (72%), and farmers' preference for traditional extensive or nomadic systems (62%). Other barriers included limited entrepreneurial skills (26%) and inadequate capital (52%). These findings suggest a weak research-extension-farmer linkage in the region, which has limited the effectiveness of technology transfer and adoption. The results underscore the need for targeted interventions to address these barriers and promote the adoption of haybarns, which have the potential to mitigate seasonal feed shortages, enhance livestock productivity, and improve the socio-economic wellbeing of farmers.

Conclusion

The study concluded that the adoption of haybarn storage technique in Nasarawa Local Government Area is exceedingly low, reflecting broader systemic issues in agricultural extension and technology dissemination. Despite the significant benefits of haybarns in conserving

forage and reducing seasonal feed shortages, adoption remains constrained by socio-economic, cultural, and institutional barriers. This low adoption rate underscores the urgent need for deliberate and sustained efforts by stakeholders, including policymakers, extension agents, financial institutions, and farmer cooperatives, to bridge the gap between research and practical implementations, and this can be achieved through a robust implementation of the under listed recommendations of the study.

Recommendations

To address the constraints identified and enhance the adoption of haybarn storage technique, the following recommendations are proposed:

1. Strengthen Information Dissemination and Awareness Creation: Agricultural extension services must prioritize awareness campaigns to educate farmers on the benefits of haybarns. Participatory extension approaches, such as farmer field schools, agricultural exhibitions, and demonstration farms, should be employed to showcase the practicality and advantages of haybarn storage technique.
2. Provide Financial Support and Subsidies: The government, financial institutions, and development organizations should establish accessible and affordable credit facilities to help farmers finance the construction of haybarns. Subsidies or grants should be provided to reduce the high upfront costs associated with building haybarns.
3. Enhance Entrepreneurial and Business Development Skills: Farmers should receive training on entrepreneurship, business management, and financial literacy to enable them to optimize their livestock production systems. Farmer cooperatives should be strengthened to facilitate collective action, improve market access, and enhance bargaining power in accessing inputs and credit.
4. Transition to Improved Livestock Production Systems: Efforts should be made to transition farmers from traditional nomadic systems to semi-intensive and intensive livestock production systems. Investment in rural infrastructure, such as grazing reserves, water points, and veterinary services, should be prioritized to support more sustainable livestock management practices. Awareness campaigns should be conducted to educate farmers on the long-term benefits of adopting modern livestock farming systems over nomadism.
5. Strengthen Research-Extension-Farmer Linkages: Research institutions and extension agents must collaborate to ensure that innovations, such as haybarns, are effectively communicated to farmers. Regular capacity-building programs should be organized for extension agents to enhance their technical knowledge and communication skills.

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