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Adoption of Institute of Agricultural Research and Training (IAR&T) Small Ruminant Technologies by Farmers in South Western Nigeria

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ABSTRACT: *Institute of Agricultural Research and Training (IAR&T) is a multi-commodity research Institute that has generated adoptable technologies on small ruminant. The study investigated the adoption of IAR&T small ruminant technologies among farmers in South-Western Nigeria. A multi-stage sampling procedure was used to select 160 respondents for the study. Data were collected with interview schedule and analysed using descriptive (percentages and mean scores) and inferential (Chi-square and PPMC) statistics. Results revealed that majority of the respondents reared goats (86.9%), under semi-intensive management system (67.5%), for income generation (95.0%), and with 5.5±7.4 years of experience. Major modes of receiving small ruminant technologies/information were through Agbe asejere/IAR&T radio programme ($\bar{x}$=0.82) and farmers' guide ($\bar{x}$=0.54). Use of pawpaw seeds for deworming ($\bar{x}$=0.94), incorporation of crop residue in ration ($\bar{x}$=0.94) and use of tobacco extract for treating parasites ($\bar{x}$=0.87) were the most accessible small ruminant technologies to the respondents. Though constrained by high capital investment ($\bar{x}$=1.50) and poor access to small ruminant technologies ($\bar{x}$=1.21), the respondents' rate of adopting small ruminant technologies was high (68.7%). Access to small ruminants technologies (r=0.518, p=0.000) and constraints (r=-0.305, p=0.01) were significantly related to adoption of IAR&T small ruminant technologies. The study concluded that readily accessible technologies were equally the most adopted ones. Therefore, it is recommended that IAR&T should endeavour to concentrate its efforts on making its technologies more accessible to end users.*

KEYWORDS: adoption, small ruminant technologies, livestock farmers and crop residue

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INTRODUCTION

Agriculture is an important sector of the economies of developing countries including Nigeria. Agriculture constitutes about 21.5% of Nigeria's GDP and 36.5% to employment (FAO, 2019). The agricultural sector is heterogeneous, comprising small, medium and large scale farmers. However, small scale farmers dominate crop and livestock production, cultivating crops and rearing animals otherwise known as livestock farming. Livestock farming is an essential aspect of agricultural production. It plays a major role in household incomes and a key role in the economies of West African countries, providing up to 44 percent of agricultural GDP (Mensah *et al*., 2017). In Nigeria, the livestock sector contributes about 1.7% to the national GDP and up to 9% to the agriculture value added (FAO, 2019).

Under livestock farming, farmers can rear farm animals such as ruminants, non-ruminants and poultry. Goats and sheep (small ruminants) form the bulk of ruminants reared by smallholders in developing countries. Statistics revealed that the national ruminant population in Nigeria consists of 18.4 million cattle, 43.4 million sheep and 76 million goats (FMARD, 2017). Raised mainly in low input and low yielding management or production systems, small ruminants support to the livelihoods of the country through the supply of food and nutrition, and generation of income for families. As a result, small ruminant production by smallholders has been rising, yet there is need for improved productivity (Adams *et al*., 2021; Lalljee *et al*., 2019). This is against increase demand for livestock products that will ensue from population increase, urbanisation, income rises and hence increase in purchasing power of populations. Attainment of nationwide productivity increase and achieving sustainable livelihood from animal production consequently hinge on the adoption of improved technologies among other things by small ruminant farmers.

By definition, technology refers to information necessary to attain a specific production output through the combination or processing of selected inputs including production processes, management techniques and marketing methods (Mascus, 2003). By changing the risk or payoff profiles of agriculture (Bridle *et al*., 2019), the incorporation of technologies in agriculture has made farm work easier and resulted in productivity increase. Relating to small ruminant production, Morgan-Davies *et al*. (2015) noted that technology could provide the ideal opportunity to improve or simplify their management on farms particularly in extensive conditions where there is less frequent handling of animals.

Through research, agricultural technologies are being developed and implemented by private, public and non-governmental organisations in the African continent. In an attempt to improve smallholders' livelihood resilience, profits and nutrition in Africa, groups such as AGRA and CGIAR centers continue to develop improved technologies. Similarly, in Nigeria, the Institute of Agricultural Research and Training (IAR&T) Livestock Improvement Programme has developed and disseminated improved technologies on different types of livestock especially small ruminant (goats and sheep). The technology focuses on improving breeds of goat and sheep that are adaptable to the Southwest ecological zone of the country. The IAR&T is pursuing this based on the given mandate by Federal Government and the fact that the country is naturally endowed with a conducive climate for the development of different livestock categories.

According to Obinna and Onu (2021), technology and improved management options are the only alternatives to accelerate growth in the productivity of goat and sheep which is low under traditional system of production. In the last five decades, IAR&T has developed and disseminated several adoptable technologies on livestock, unfortunately there is little or no information on how these technologies have been adopted. The adoption and implementation of these innovations yet do not appear to have significantly resulted in productivity increases at the macro-level. An adducible reason for this is that the adoption of new technology on farms is often slow, especially in extensive livestock farms . It is also reported that many smallholders face constraints to adopting agricultural technologies, ranging from economic factors (e.g. availability/accessibility, prices/cost) to behavioral (e.g. timing or ambiguity aversion) (Bridle *et al*., 2020). Hence, the study was designed to investigate the adoption of IAR&T small ruminant technologies among farmers in South-Western Nigeria. The specific objectives were to:

1. describe small ruminant farmers' production characteristics;
2. highlight small ruminant farmers' modes of receipt of IAR&T technologies;
3. ascertain small ruminant farmers' access to IAR&T technologies;
4. evaluate small ruminant farmers' adoption of IAR&T technologies;
5. identify constraints to small ruminant farmers' adoption of IAR&T technologies.

METHODOLOGY

The study was conducted in Southwestern Nigeria. A multi-stage sampling procedure was adopted for the study. The IAR&T and Agricultural Development Programmes (ADPs) extension service in the six states (that is, Ekiti, Lagos, Ogun, Ondo, Osun and Oyo) that constitute the Southwestern

agro-ecology have disseminated IAR&T small ruminant technologies to the States, out of which two States (Osun and Oyo) were randomly selected. Two Local Government Areas (LGAs) were purposively selected from each of the two states (Odo otin and Ilesa west LGs from Osun state; Iseyin and Akinyele LGs from Oyo state) and subsequently purposive selection of two communities from each of the Local Government Areas were carried out based on their intensity of goat and sheep rearing. The last stage involved purposive selection of 20 farmers that owned the highest number of small ruminants (goat and sheep) from the selected communities, totalling 160 respondents. Structured interview schedule was used to collect relevant data. Collected data were on: production characteristics (such as livestock reared, livestock experience, management system, etc.); modes of receiving IAR&T small ruminant technologies; access to IAR&T small ruminant technologies; adoption of IAR&T small ruminant technologies (categorized into high and low based the number of technologies adopted); and constraints to adoption of IAR&T technologies. Collected data were analysed using descriptive (mean scores and percentages) and inferential statistics (Chi-square and PPMC)**.**

RESULTS AND DISCUSSION

Production characteristics of farmers

Presentation of the small ruminant farmers' production characteristics is given in Table 1. The greater proportion of them kept goats (86.9%) while 13.1% kept sheep, indicating the dominance of goat rearing over sheep. This observation is not limited to the Study Area alone, given that recent estimates in Nigeria show that the number of goats (76 million) significantly dwarfs that of sheep which is put at 43.4 million (FMARD, 2017). The respondents had little livestock farming experience (5.5±7.4 years). However, this finding might positively influence the adoption of small ruminant technologies, as research has found a negative relationship between ample years of experience of farmers and level of technology adoption (Mulaudzi and Oyekale, 2015). The farmers reared small ruminants for different purposes, but the primal reasons for doing so were for income generation (95.0%) and household consumption (43.8%). The economic motive of keeping small ruminants for income generation is achieved by selling live animals or butchering them for onward sale as meat (Adams *et al*., 2021). Occasional, particularly during festive seasons, small ruminants can serve as source of food for households. Rearing small ruminants with the motives of income generation and source of food for household consumption will promote the adoption of technologies. This hinges on the reality that farmers' choice of technologies and their adoption is geared towards increasing production, productivity and income (OECD, 2001). Semi-intensive

management system, which gives attention to managing animals relating to housing, feeding and veterinary care better than the extensive system but lower than the intensive system, was adopted by over two-thirds (67.5%) of them. Generally, in Africa, the management systems for ruminant production vary with the socio-economic characteristics of individual farmers as well as the agricultural situations (Otaru and Iyiola-Tunji, 2014).

Table 1: Personal characteristics of small ruminant farmers

Variable	Percentage	Mean
Livestock reared		
Goat	86.9	
Sheep	13.1	
Livestock experience		
1 – 5	34.4	5.5±7.4
6 – 10	34.4	
11 – 15	8.8	
16 – 20	8.8	
> 20	13.8	
Reasons for rearing livestock		
Hobby	1.3	
Household consumption	43.8	
Income generation	95.0	
Cultural rights	1.3	
Management system		
Extensive	31.3	
Semi-intensive	67.5	
Intensive	1.3	
Extension contact		
Yes	100.0	

No	0.0	

***Multiple responses**

Modes of receiving IAR&T small ruminant technologies

Livestock information is a precondition for recognising opportunities for improvements and the possible effect of these improvements on the overall availability of animal food products (Otte and Chilonda, 2003). As indicated in Table 2, Agbe asejere radio programme ($\bar{x}$=0.82) and farmers' guide ($\bar{x}$=0.54) were observed to be key modes of receiving IAR&T goat and sheep technologies by the respondents. Agbe asejere is a radio programme broadcast at stipulated days of the week under the auspices of IAR&T. The salience of radio as a mode of disseminating livestock technologies according to Amusat and Omirin (2023) is underscored by the fact that while performing their tasks on the farm, farmers can simultaneously and conveniently listen to farm broadcasts on radio anywhere. This largely gives credence as to why radio is considered the most influential and inexpensive means of obtaining useful agricultural information (Braimok, 2017). As regards farmers' guide, it can be described as a leaflet or booklet with information detailing how farm practices are carried out. It is meant to guide or train farmers on sustainable production and management practices, and it is usually written in respondents' native dialect and English language.

Table 2: Modes of receiving IAR&T small ruminant technologies

Modes	Mean	Rank
Farmers guide	0.54	2nd
Agbe asejere (IAR&T radio programme)	0.82	1st
Television	0.49	3rd
Internet	0.31	4th
IAR&T personnel	0.19	7th
Refils workshop	0.29	5th
IAR&T training programme	0.28	6th

Access to IAR&T small ruminant technologies

Goat and sheep technologies disseminated by IAR&T often come in form of information. Easy access to such information by small ruminant farmers would put them in a vantage position of making informed choices about their livestock enterprise. As seen in Table 3, use of pawpaw seeds for de-worming together with the incorporation of crop residues in ration ($\bar{x}$=0.94), use of tobacco

leaf extract for treating ecto-parasites ($\bar{x}$=0.87), and incorporation of agro-industrial by-products to feed ($\bar{x}$=0.82) were the most accessible IAR&T technologies to the respondents. Internal parasites constitute a major problem to the health of sheep and goats (University of Delaware, 2020). Grinding pawpaw/papaya seeds and daily feeding of same to goats and sheep can significantly reduce the number of parasites eggs and adult worms in their stomach. Crop residues which are readily available and accessible after the harvesting of crops can be fed to small ruminants as a source of nutrition. Incorporation of crop residues in the feed of small ruminants is similar to adding agro-industrial by-products to their feed. Apart from reducing the cost of feeding ruminants just like crop residues, Vastolo *et al*. (2022) reported that the combining agro-industrial by-products to livestock feed can give several advantages including addition of value to livestock products and enhancing the health of livestock. Use of tobacco leaf extract has significance in the treatment of ecto-parasites e.g. lice. Parasites, both endo-parasites and ecto-parasites, can constitute a significant problem to the performance (that is, health and product performance) of animals. Considering the control of lice in small ruminants using chemical acaricides has proven to be controversial due to problems of lice/tick resistance, chemical residues in animal products and the environment (Sharma *et al*., 2020), biological control method such as the use of tobacco leaf extract is advocated. Apart from it being cheap and easy to use, tobacco leaf extract does not pollute animal products and the environment (that is, it is ecofriendly).

Table 3: Access to IAR&T small ruminant based technologies

Technologies	Mean	Rank
Raised platform housing system with stair case	0.73	6th
Use of slatted floor in housing facility	0.82	4th
Production of salt lick/mineral lick	0.37	7th
Incorporation of crop residues in ration	0.94	1st
Incorporation of agro-industrial by-products e.g. in ration	0.82	4th
Use of tobacco leaf extract for treating ecto-parasite	0.87	3rd
Use of pawpaw seeds for de-worming small ruminants	0.94	1st

Adoption of IAR&T small ruminant technologies

Results in Table 4 and 5 reveal that 68.7% of the respondents possessed high adoption rate of IAR&T small ruminant technologies. Of the seven technologies, respondents who adopted at least four technologies were characterised as having high adoption rate, while those who adopted less than four technologies were characterised as having low adoption rate. The most adopted technologies were use of pawpaw seeds for de-worming small ruminants ($\bar{x}$=0.93), incorporation of agro-industrial by-products in feed ($\bar{x}$=0.90), incorporation of crop residues in ration ($\bar{x}$=0.86),

and use of tobacco leaf extract for treating ecto-parasite ($\bar{x}$=0.71). Going by these findings, it is apparent that livestock technologies that were more accessible to the respondents were equally the ones that were mostly adopted. It suffices to say that farmers would display a higher propensity to adopt technologies that are readily accessible to them. Same would be the case when such technologies align with their needs and can easily be applied in their context (Omirin, 2021). Generally, farmers will first consider the degree to which a technology can satisfy their needs before deciding to adopt such a technology.

Table 4: Levels of adoption of IAR&T small ruminant technologies

Levels	Percentage
High	68.7
Low	31.3

Table 5: Adoption of IAR&T small ruminant technologies

Technologies	Mean	Rank
Raised platform housing system with stair case	0.58	5th
Use of slatted floor in housing facility	0.39	6th
Production of salt lick/mineral lick	0.31	7th
Incorporation of crop residues in ration	0.86	3rd
Incorporation of agro-industrial by-products e.g. in ration	0.90	2nd
Use of tobacco leaf extract for treating ecto-parasite	0.71	4th
Use of pawpaw seeds for de-worming small ruminants	0.93	1st

Constraints to adoption of IAR&T small ruminant technologies

Livestock production constraints are usually a reflection of the management or production system under which animals are kept. In this study, the management system practised by majority of the respondents is semi-intensive management system. Results in Table 6 indicate that high capital investments ($\bar{x}$=1.50), poor access to small ruminant production technologies ($\bar{x}$=1.21), and poorly organised market for sheep and goat ($\bar{x}$=1.19) were the main constraints associated with the adoption of IAR&T small ruminant technologies. The capital demand or cost associated with technology adoption is identified among other things to be responsible for little uptake of

technologies by most smallholder farmers (Dlamini and Ocholla, 2018). As rightly noted earlier in the discussion of this study, access to a technology is a precondition for its adoption. Notwithstanding, Chentouf *et al*. (2014) reported that access to technology is the main factor limiting livestock productivity. Going by these findings, it is apparent that livestock technologies that were more accessible to the respondents were equally the ones that were mostly adopted. It suffices to say that farmers would display a higher propensity to adopt technologies that are readily accessible to them.

Table 6: Constraints to adoption of IAR&T small ruminant technologies

Constraints	Mean	Rank
Poor access to small ruminant production technologies	1.21	2nd
Illiteracy/low level of education	1.10	5th
Poorly organised market for sheep and goat	1.19	3rd
High capital investments	1.50	1st
Inadequate understanding of the usefulness of the technology	1.07	8th
Poor access to extension agents	0.74	10th
Poor access to required inputs needed to use technologies	1.13	4th
Reliance on indigenous ways of rearing animals	0.86	9th
Technicality of the technology	1.10	5th
Use of technical jargons by research and extension personnel	1.08	7th

Relationships between livestock management system, experience, access to ruminant technologies, constraints and adoption of IAR&T small ruminant technologies

Results in Table 7 reveal that significant relationships exist between access to small ruminant technologies (r=0.518, p=0.001), constraints (r=-0.272, p=0.001) and adoption of IAR&T small

ruminant technologies. It was earlier revealed in this study that livestock technologies that were more accessible to the respondents were equally the ones that were mostly adopted. This is consequent on the fact that the adoption of accessible technologies provides tangible benefits including cost reduction and increase in productivity (Forrester, 2016). The negative correlation sign between constraints and adoption indicates that the greater the constraints confronting farmers, the less their propensity to adopt IAR&T small ruminant technologies. This aligns with Bridle *et al*. (2020) submission that many smallholders face constraints to adopting agricultural technologies, ranging from economic factors (e.g. availability/accessibility, prices/cost) to behavioral (e.g. timing or ambiguity aversion).

Table 7: Chi-Square and correlation analyses between livestock management system, experience, access to ruminant technologies, constraints and adoption of IAR&T small ruminant technologies

Variable	χ^2	Df	r–value	p–value
Management system	1.482	2	-	0.686
Livestock experience	-	-	-0.085	0.284
Access to ruminant technologies	-	-	0.518*	0.000
Constraints	-	-	-0.305*	0.001

*$P \leq 0.05$

CONCLUSION AND RECOMMENDATIONS

Adoption of IAR&T small ruminant technologies by livestock farmers was generally high, with use of pawpaw seeds for de-worming small ruminants, incorporation of agro-industrial by-products in feed, incorporation of crop residues in ration, and use of tobacco leaf extract for treating being the most adopted technologies. Agbe asejere radio broadcast and farmers' guide, being key modes of receiving technologies, enhanced technology adoption, yet constraints such as high capital investments, poor access to small ruminant production technologies, and poorly organised market for sheep and goat limited the adoption of IAR&T small ruminant technologies. Given that the most readily accessible small ruminant technologies were equally the ones that were mostly

adopted, it is advocated that IAR&T should consolidate its efforts on developing and disseminating technologies that are easily accessible to intending beneficiaries. This is underscored by the fact that the adoption of accessible technologies offers benefits such as reduced cost and increased productivity.

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