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Animal African Trypanosomosis (AAT) and Economic Production of Cattle Among Smallholder Cattle Farmers in Edo State, Nigeria

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Abstract

This study was carried out to analyse the economics of cattle production under the effect of Trypanosomosis Disease among smallholder cattle farmers in Edo State, Nigeria. Trypanosomosis is a disease caused by trypanosomosis parasites and remains a major cattle health challenge in Nigeria. The study specifically sought to identify trypano-tolerant and tryperno-susceptible breeds of cattle and determine the costs and returns of cattle production in the study area with respect to tolerance and susceptibility of cattle breeds. A multi stage sampling technique was applied to select 270 pastoralists mostly from the Fulani extraction from 27 communities across nine Local Government Areas in the three agricultural zones of the State. Data were obtained from both primary and secondary sources and were analyzed using descriptive statistics and costs and returns analysis. The results revealed that the major trypano-tolerant breeds of cattle raised in the study area were Muturu (21.4%), Keteku (19.6%), and N'Dama (19.6%) while susceptible breeds were White Fulani (19.6%), Sokoto Gudali (17.9%) and Red Bororo (17.9%). The survival rate for trypano-tolerant breed was 91.31% while that of tryperno-susceptible breed was 88.00 %. The profitability analysis showed that the respondents realized more income breeding trypano resistant breeds than trypano-tolerant breeds of cattle. The result revealed a total revenue generated of ₦26,270,313 while the gross margin and net profit were ₦17,412,110.00 and ₦16,852.756.00 respectively. The study recommends that pastoralists should be encouraged to adopt ranching management systems to better cope with the trypanosomes (parasites) infection.

Keywords: Trypanosomosis, Smallholder, Trypano-tolerant, Tryperno-susceptible

1.0 Introduction

In the Nigerian agricultural sector livestock production has been identified as one of the good sources of employment and livelihood (World Bank, 2018). A good number of farmers in both rural and sub-urban areas of the country meet their livelihood needs in livestock production activities through rearing and marketing of livestock. Among the farm animals reared are cattle, sheep, goats, pigs, poultry and game animals.

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Cattle rearing is considered to improve farmers' total income and boost their living. Smallholder cattle farmers are those who rear between one and fifty cattle. There are two major groups of breeds of cattle and these are the indigenous and exotic breeds. The indigenous breeds comprise the Zebus and the Taurine. The Zebu cattle characteristically has long horns, large humps and usually tall. Typical examples of Zebu cattle are Bunanji (also known as White Fulani), Rahaji and Adamawa Gudali. Others are Wadara, Azawak and Sokoto Gudali. These breed of cattle are called trypano-susceptible breeds (Jill De Gier, 2020). The second indigenous breed called taurines are humpless, short-horned and short-legged. Typical members of this group are Muturu, Kuri, Keteku and N'dama (robust horns). In Southwestern part of the country the Keteku breed is most common while the Kuri breed is common to the north eastern part of the country.

The Animal African Trypanosomosis (AAT) is caused by tsetse flies which are vectors of blood parasite of the genus Trypanosoma. The AAT disease is unique to Nigeria particularly Edo State and it is a debilitating disease and often fatal. The disease affects both human [Human African Trypanosomiasis (HAT)] and livestock [African Animal Trypanosomosis (AAT)] or *ngana* (Vale *et al*, 2015; Wamwiri and Changasi, 2016). Daffa *et al* (2013) in their study put the annual tsetse infestation rate at 33% and also estimated that about 4 million people and 7 million cattle were at the risk of contracting Trypanosomosis.
In addition to mortality and morbidity in both livestock and humans, the activities of tsetse fly has led to the prohibited human occupation in some areas and has also hampered agricultural and livestock keeping activities in large parts of Africa (Matemba *et al*, 2010; Malele, 2011). It has also been estimated that *nagana* causes a loss in animals in terms of mortality and reduced milk yield of about US$ 7.98 million annually (Malele, 2011). This underscores the need for tsetse control in Nigeria in general and Edo State in particular. The attainment of full potential of the cattle sector is subject to availability and quality of animal health services (Matemba *et al.,* 2010; Malele, 2011).
Hence the rationale behind the analysis of trypanosomosis disease and economic production of cattle among smallholder farmers in Edo State, Nigeria. The study specifically sought to;

i. identify the breed of cattle mostly raised by farmers and their survival rate with respect of trypano-tolerance and trypano-susceptiblity;
ii. determine the costs and returns of cattle production.

2.0 Research Methodology

Area of the Study

The study was carried out in Edo State which is one of the 36 States in Nigeria. It has boundaries on the East by the River Niger, on the West by Ondo State, on the South by Delta state and in the North by Kogi State (Wikipedia, 2018). It ha a land area of 19,639.7km^2 with a population of 4, 777, 000 people made up of 2,470,908 males and 2,306,092 females (NPC, 2022 projected figure). It lies between latitude 6^0.44'N and 6^0.21'N of the equator and Longitude 5^0.35'E and 5^0.44'E of the Prime Meridian Hemisphere. It has two distinct seasons; rainy and dry with an annual rainfall of 2500mm in the Southern parts and 1500mm in the Northern areas (Iyalomhe and Cirella, 2018). It has three (3) ecological zones with the mangrove swamp forest in the extreme South, the rain forest in the middle and the derived savannah in the North. It has 18 Local Government Areas (LGAs) divided into three Agricultural zones of Edo North, Edo Central and Edo South zones. Farming is the predominant occupation of the people. Farmers in the State grow cash crops such as rubber, oil palm produce, cocoa, cashew, timbers, and food crops such as yam, cassava, cocoyam, rice, melon, maize, plantain, vegetables and ground nut. Artisanal fishing is carried out by the riverine communities while fish farming and livestock rearing are growing agricultural investments in the State. The map of the study area is shown in Figure 1.

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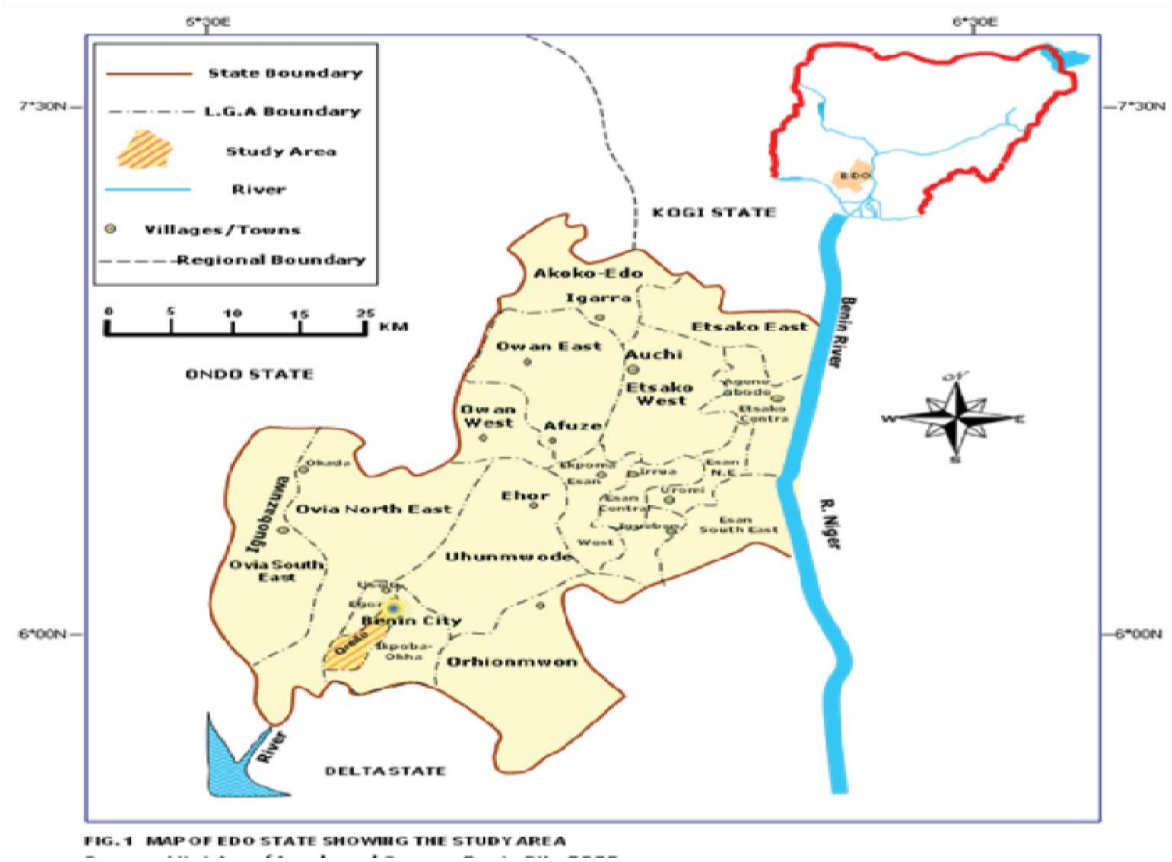

Figure 1: Map of Edo State showing Agricultural zones

Population and Sampling

The study was restrained to migratory Fulani Cattle farmers in Edo State who were engaged in the business venture in the 2021 and 2022 production season across the three agricultural zones. The population comprised of registered Cattle Breeders Association of Nigeria in the study area. Among these breeders associations are the Miyetti Allah Cattle Breeders Association (MACBAN), Nigerian Cattle Breeders Association (NCBA) and the National Cattle Breeders Association of Nigeria (NCBAN). The population of the registered cattle farmers in the study area for the season was103,023.

A multi stage sampling procedure was employed in the selection of respondents for the study. Stage one involved the selection of three local government areas (LGAs) from each of the three Agricultural Zones in the State while second stage was a random selection of three (3) communities from each of the sampled nine LGAs and this a total of 27 communities across the State. In the third stage, 10 respondents were sampled through snowball method from each of the communities to give a sample of 270 respondents. A total of 270 questionnaires were administered to the pastoralists but 263 were returned making the percentage return rate to be 97.41%. The distribution of population and sample of respondents is as presented in Table 1.

Collection and analysis Data

Primary data were collected from the Cattle Breeders through the Cattle Breeders Association of Nigeria. Structured questionnaire was used for data collection. Questionnaire was administered to the respondents by the researcher and trained enumerators. The questionnaire instrument sort responses from the respondents in areas socioeconomic characteristics, breed of cattle mostly raised and survival rate in the

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study area, in relation to prevalence of trypanosomosis. Others were the costs and returns of cattle production in the study area with respect to tolerance and susceptibility of cattle breed.

Descriptive statistics such as frequency counts, percentages and mean as well as standard deviation and budgeting techniques were applied in analyzing data generated.

Table 1: Distribution f Population and Sample of Respondents in the Study Area

LGAs	Communities	Population (Farmers)	Sample (ni)
Ovia North East	Ekehuan	66	10
	Gelegele	76	10
	Ughoton	74	10
	Total	**216**	**30**
Orhionmwon	Abudu	84	10
	Orhonigbe	66	10
	Ottah	58	9
	Total	**208**	**29**
Ikpoba-Okha	Idogbo	80	10
	Aghedo	76	10
	Ekosa	64	10
	Total	**220**	**30**
Esan Central	Irrua	72	10
	Ewu	60	10
	Ugbegun	40	10
	Total	**172**	**30**
Igueben	Ebelle	50	10
	Ekpon	40	10
	Igueben	50	10
	Total	**140**	**30**
Esan West	Ekpoma	72	10
	Ogwa	60	9
	Egoro-Noaka	60	10
	Total	**192**	**29**
Etsako West	Jattu	60	10
	Agbede	60	8
	Auchi	60	10
	Total	**180**	**28**
Etsako Central	Fugar	60	10
	Ogbonna	60	10
	Ugbekpe	76	9
	Total	**196**	**29**
Etsako East	Agerebode	60	10
	Amugbe	56	10
	Okpepke	60	8
	Total	**176**	**28**
	Grand total	**1700**	**263**

Source: Field Survey Data 2022

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3.0 Results and Discussion

Breed of cattle reared and their survival rate in the study area

The distribution of the various breed of cattle raised by Fulani Cattle Breeders under the extensive system of animal husbandry as elicited from 263 pastoralists sampled is highlighted in Table 2. Muturu (21.4%), Keteku (19.6%), N'Dama (19.6%), Kuri (16.1%) and West Africa Short Horn (19.6%). This distribution are trypano-tolerant breeds raised in the 2021/2022 farming season. This indicated that the rearing N'Dama, Muturu and Keteku breeds was common in the area. This could be because N'Dama, Muturu and Keteku exhibited more tolerance to tsetse fly trypanosomosis and thus yield optimally. This is in line with the findings of (Akpa, Alphonsus and Abdulkareem, 2012), who established that some breeds of cattle including N'Dama, Muturu and Keteku exhibited resistance to trypanosomosis disease.

Other breeds reared especially trypano-susceptible breeds includes, white Fulani (19.6%), Wadera (16.1%), Sokoto Gudali (17.9%), Azewak (14.3%), Adamawa Gudali (17.9%), Red Bororo (17.9%) and Yola (16.1%) respectively. These are all Zebu breeds of cattle, which are preferred by the respondents because they are larger, bigger, has large hump, large dewlap, weightier, more profitable highly prolific and has higher fecundity, though, they are less resistant to trypanosomosis. These exceptional qualities of the Zebu breeds makes the respondents have preference for raising them above the tolerant breeds of cattle. Furthermore, the characteristics exhibited by Zebu breeds of cattle far outweigh that of tolerant breeds of cattle (Muturu, N'Dama). This may be due to the fact that Zebu breeds exhibited better superior growth and yield and though less resistant to trypanosomosis in the study area.

In Nigeria tsetse infestation rate was 33% (Daffa *et al*, 2013).

Table 2: Breed of Cattle Reared and their Survival rate in the study Area

Breed	Herd size			Mortality		
	Min.	Mean	Max	Min	Mean	Max
A. Tolerant breeds:	6	23	**42**	**2**	2	2
Muturu bred	0	12	19			
Keteku bred	0	11	18			
N-dama bred	0	11	20			
Kuri bred	0	9	10			
West African short horn bred	0	11	15			
B. Susceptible breeds:	**6**	**25**	**56**	**1**	**3**	**5**
White Fulani bred	0	11	32			
Wadara bred	0	9	18			
Sokoto Gudali bred	0	10	32			
Azawak bred	0	8	12			
Adamawa Gudali bred	0	10	20			
Red Bororo bred	0	10	32			
Yola bred	0	9	22			

Source: Computed from Field Survey Data 2022

The mean prevalence rate of trypanosomosis in the study area was found to be 14.3%, and this figure agrees with both empirical and literature data of 14.3% as opined by Yusuf *et al* (2015) and cited by Jill de Gier *et al* (2020). What this means is that the survival rate of cattle in the study area is 85.7% as it is in Nigeria.

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The survival rate of trypano-tolerant breed in Edo Stare is 85.7% while that of trypano-susceptible breed of cattle in the 2021/2022 farming season was 11%.

Cost & Return Structure of Cattle Rearing

The cost and return structure associated with the breeds of cattle reared by the respondents identified the depreciated or fixed cost structure, the variable cost structure and the overall income sources associated with rearing of cattle and provide a summary of the profitability analysis. The result for an average farmer and based on breed is shown in Table 3.

Table 3: Fixed Cost Structure of Cattle Rearing per Farmer based on breed.

Items (₦)	Tolerant	Susceptible	Overall
Rearing hut/ house (₦)	39,234	46,617	85,851
Pan/ basin (₦)	6,740	8,009	14,749
Wheelbarrow (₦)	15,740	18,701	34,441
Cutlasses (₦)	10,289	12,225	22,514
Shovels (₦)	6,305	7,491	13,796
Bow and arrows (₦)	45,830	54,454	100,284
Dagger and knives (₦)	12,211	14,508	26,719
Land rent per annum	111,339	132,292	243,631
Others (₦)	7,938	9,431	17,369
TFC	**274,077**	**325,653**	**599,730**

Source: Computed fromField Survey, 2022

The pooled result revealed an overall fixed cost of ₦599,730.00. For the trypano-tolerant breed, the average depreciated cost was ₦274,077.00 while for the trypano-susceptible breed the total fixed cost was ₦325,653.00. The overall average depreciated cost expended for the trypano-susceptible breed is higher than that expended for the trypano-tolerant breed.

Variable Cost Structure for Cattle Rearing Based on Breed

The result in Table 4 shows that for the trypano-tolerant breed, the overall average variable cost was ₦4,137,694.10 while that of the trypano-susceptible overall variable cost was ₦4,721,508.90 comparing both breeds. It is clear that the respondent spent more variable costs in rearing the trypano-susceptible breed relative to the trypano-tolerant breed.

Table 4: Variable Cost Structure for Cattle Rearing Based on Breed

	Amount ((₦) (Mean)		
Items	**Tolerant**	**Susceptible**	**(Pooled)**
No. of cattle bought	23	25	
Unit cost	94,511	93,821	
Purchase cost	2,173,753	2,345,525	4,519,278
Feed	127,960	152,040	280,000
Water	76,097	90,418	166,515
Trypanocides	224,014	266,170	490,184
Acaricides	165,103	196,172	361,275
Taxes	163,338	194,076	357,414
Salt	151,180	179,630	330,810

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Insecticides	73,401	87,214	160,615
Transport cost/Live weight	386,870	513,308	900,178
Torch light/ battery	18,452	21,924	40,376
Marketing cost	98,563	107,125	205,688
Labour cost	446,852	530,943	977,795
Others	31,110	36,965	68,075
TVC	**4,137,694.10**	**4,721,508.90**	**8,858,203**

Source: Computed from Field Survey, 2022

Income Structure of Cattle Rearing Per Farmer based on breed.

The result in (Table 5) shows the income structure associated with the rearing of trypano-tolerant and trypano-susceptible breeds on a per farmer basis. Based on the healthy breed, the trypano-tolerant breed yielded a revenue of ₦10,160,262.00 while for the trypano-susceptible breed, the income derived from sales of healthy breed was ₦13,311,452.00.

Table 5: Income Structure of Cattle Rearing Per Farmer based on breed.

	Amount (₦) (mean)		
Revenue Items	**Tolerant**	**Susceptible**	**(Pooled)**
Herd size	23	25	
(i) Healthy breed			
Mortality rate	2	3	
Number sold (healthy)	21	22	
Unit price (healthy)	483,822	605,066	
Sub-income (healthy breed)	**10,160,262**	**13,311,452**	**23,471,714**
(ii) Diseased breed:	0		
Number diseased		3	3
Price for a diseased cattle (₦)	0	325,755	325,755
Sub- income (diseased breed)	-	977,265	977,265
(iii) By-products sold:			
Cow dung sold	101,220	120,267	221,487
Total amount of milk sold	121,669	144,566	266,235
Sales of calves at weaning	-	1,333,612	1,333,612
Sub-total	222,889	1,598,445	1,821,334/
Grand total	**10,383,151**	**15,887,162**	**26,270,313**

Source: Fixed Survey Data 2022

It is only from the trypano-susceptible breed that an income of ₦977,265.00 was realised by the respondent. The third component of sources of income was the sales of product. The result on the table shows that for the trypano-tolerant breed, the average farmer realised a total of ₦222, 889.00, while for the trypano-susceptible breed, the average farmer realised higher income from the trypano-susceptible inspite of the incidence of trypanosomosis. This means that the income would have been much higher, but for the infectious occurrence of *nagana* amongst the trypano-susceptible breed of cattle in the study area.

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Summary of Profitability Analysis of cattle rearing per farmer based on breed

The result of Table 6 shows that the average farmer realized a profit of ₦5,990,832.00 from rearing the trypano-tolerant breed, while from the trypano-susceptible breed the average farmer realized a total of ₦10,861,924.00. This suggest that the farmer realized more profit from the rearing of trypano-susceptible breed. This is because the trypano-susceptible breed, has higher conversion ratio, they are bigger, larger dew lap, huge hump, higher economic value, and highly prolific while the tolerant breed are a product of cross breeding between the susceptible (White Fulani) and the tolerant breed of cattle (N'dama, Kuri, West African Short horn). This findings is in line with that of Jill de Gier *et al*. (2020).

Table 7: Summary of Profitability Analysis of Cattle rearing per farmer basis Amount (₦) M

Items	Tolerant	Susceptible	Pooled
TR (TR - TVC)	10,383,151	15,887,162	26,270,313.00
TFC	274,077	325,653	599,730.00
TVC	4,118,242	4,699,585	8,817,827.00
TC	4,392,319	5,025,238	9,417,557.00
GM	6,246,457	11,165,653	17,412,110
Profit (GM-TFC)	**5,990,832**	**10,861,924**	**16,852,756**

Source: Survey Data 2022

Conclusion/Recommendations

The study looked at the effects of trypanosomosis disease on the profitability of cattle production in Edo State, Nigeria. The issue of trypanosomosis with regards to cattle production forms a significant part of livestock policy making in both developed and developing world. This is because trypanosomosis has hindered the profitability of livestock generally and cattle production in particular. On the basis of this, cattle farms should be insured against the incidence of trypanosomosis infestation. Again a reduction in the tax paid per herd of cattle is advocated as it is high and constitutes a significant percentage of the total variable cost.

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