

**PRODUCTION DYNAMICS AND GROWTH RATES OF
LIVESTOCK IN THE DERIVED SAVANNAH OF
OYO STATE, NIGERIA**

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Target Audience: Dairy farmers, livestock nutritionists.

ABSTRACT

Several works have been done on the settlement of Fulanis in the derived savannah of Oyo State, but none has really considered the dearth of information on the livestock dynamics in this zone which this study focuses on. Attempts were made to determine the growth potential of the cattle herds and stability of herds growth in the study area. Primary data were collected from 63 agropastoralists; 29 in Oyo, 16 in Ogbomosho and 18 in Saki, on the necessary information needed for this study. The data collected were analysed using simulation model.

Results showed that the herd structure and composition are clearly representative of dairy herds. The potential herd growth rate (R^*) of the study area observed to be 2.4% is an indication of a steady growth of 6 animals per year. Suggestion for further improvement of herds includes the provision of sufficient grazing land for communal and/or commercial grazing, and the education of farmers on benefits associated with the production of crop residues favoured by cattle.

Key words: Herd structure, simulation, potential growth rate

DESCRIPTION OF PROBLEM

Pastoralism is an age old system of livestock husbandry which entails global grazing of ruminant livestock as practiced in the ecological stratification of West Africa (1). Despite its dominance in the region, the system has long begun to break down in recent decades as a result of population explosion, draught, low rainfall and reduction in fertile land, especially in the Sahel (2,3).

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One response to this crisis has been the movement of many pastoralists southwards to the moist savannah zone in search of pastures and crop residues regarded to be abundant in this zone and the decline in the risk of trypanosomiasis due to tsetse fly control measures (4,5). Consequently, crop-livestock interaction and integration are now evolving mostly in the sub-humid zone of southern Nigeria (6). Market access, access to improved technology packages, presence of cash crops, dominance of cereals in the cropping pattern and relative prices have been mentioned as additional factors fostering intensification and interaction of crop-livestock in specific situation (7,8). The long-term survival of the evolving systems within the national economy thus depends on their capacity to provide products both in quality and quantity and at prices which satisfy the subsistence and income need of the producers.

The impact of the evolving crop-livestock systems on land resources also determines their survival as existing surplus capacity can quickly be eliminated by poor management. Despite the variance that might exist among the production systems (e.g. degree of crop-livestock integration), essentially the factor of most concern is the conversion of pasture and other animal feed resources, to products useful to man (9). The management regimes as well as the availability of feed resources regulate the scheduling of some biological processes such as the breeding season, age of offspring and weaning of animals as well as the timing and rates of off-take from the herd. The variability in this supply and quality of forage more often than not cause changes in the biological process of animals. Therefore the day-to-day or season to season performance of the livestock herd is to a large extent determined by the management practices adopted.

With the gradual relocation of national herd to the sub-humid/derived savannah zones which have abundant grazing facilities, there is a need to analyse the inevitable implication of such relocation. Though the area is thought to have a higher carrying capacity, however the question of sufficiency with respect to the available grazing land and crop residue to sustain the size of herds needs to be addressed. Sustainable ways of maintaining large herd size must then be developed with available resources in order to achieve this. A good knowledge of the herd structure composition and growth potential is needed in planning for the future. The main task of this study therefore is to assess the dynamics of livestock production in the derived savannah of southwest Nigeria. Specific objectives included the assessment of structure and composition of cattle herds, and the determination of growth potential of the herds in the zone.

MATERIALS AND METHODS

This study was conducted in the derived savannah of Oyo State, in the South Western Nigeria, where pastoralists practise mixed farming. Data were collected in 1996 by multiple visit survey from 63 agropastoralists previously surveyed (6) in the area. Okoruwa (6) conducted an extensive survey of cattle

agropastoralists using the stratified random sampling approach which utilized the village type/location as stratification factor. Agropastoralists selected included 29, 18 and 16 from Oyo, Saki and Ogbomoso respectively. Relevant secondary biological data (production parameters) were sourced from ILCA/ILRI reports and bulletin and previous studies (10,11,12) on cattle production in both the humid and sub-humid zones of Nigeria.

Descriptive Statistics was used to assess the structure and composition of herds kept by the agropastoralists. A herd model (13) was used to determine the growth potential of cattle herds in the study area. The features of the model include facility for reproduction, mortality processes, stocks integer and time dynamic components applicable to a range of production situations and used as a tool to complement traditional research, particularly by allowing the integration of research results into a more holistic view of the target system.

Certain assumptions that form the theoretical underpinning of the model are:

- i. All cows calve simultaneously and all heifers reach adulthood at the same time. This is to avoid the problems of mixed age group, seasonality and other variations.
- ii. Calving rate, culling rate and adult female mortality rate apply to all females defined as adult (above the age at first calving already established).
- iii. Heifers leave total herd only as a result of mortality and are not sold for slaughter which is usually the case with the cattle Fulani.

The general simulation model is presented as follows:

Model format	Parameter	Formula
Adult cow-of herd	A	*
Number of adult cow	B	$Pop \times A / 100$
Calving rate %	C	$360 / CID \times 100$
Female calves born annually	D	$B \times C / 200$
Age at first calving (Year)	E	*
Mortality females 0-1 %	F	*
Number of heifers reaching age 1	G	$D \times (1 - F / 100)$
Heifer and cow Mortality % 1-2 years	H	*
Heifer and cow Mortality % 2-3 years	I	*
Mortality at first calving age	J	*
Mortality of adult females	K	*
Culling rate of cow %	L	*
Number of heifers attaining first calving age	M	$G \times (1 - H / 100) \times (1 - I / 100) \times (1 - J / 100) \times (E - 3)$
Heifer survival rate from birth to age at first calving %	N	$(100 \times M) / D$
Implications with zero growth rate;		
Surplus heifers produced per year (num)	P	
As a % of cows	Q	$M - [B \times (K + L)] / 100$
Potential herd growth rate	R	$(100 \times P) / B$
		$(C / 200 \times N)$
		$\frac{[K + L]}{[(1 + R / 100) \times (E - 1)]}$

Figures estimated from sample.

R*, is obtained by an interactive search process using the computer to examine the relationship over E years between a group of heifers born at the point in time, O, and the cows that they replace, when they enter breeding herd exactly E years later, at their moment of first calving (Y). The model avoids the issue of whether cattle numbers refer to mid-year, end-year or start of the year figures and to which the rate was applied.

To validate the result from model, certain production parameters such as the calving rate, mortality rate, culling rate, calving intervals and age at first calving were altered by considering management practices and location as they affected the herd performance in the different locations of the study areas.

RESULTS AND DISCUSSION

Head Structure and Composition

The composition of cattle herds managed by Fulani agro pastoralist in the derived savannah differs considerably from that of their transhuman kinsman in the drier areas of the north, as the structure of cattle typifies those of dairy herds, (Table 1). This confirms the average trend earlier observed (11) in the zone. Herd composition for all the farmers showed that about 6% were bulls, 45% were cows, 11% were steers, 18% heifers and 20% were calves. The proportion of mature males (bulls) were extremely low suggesting higher off take rates of males at relatively young age. The proportion of male to female were about 1:10 for adult cattle and 1:1 for calves further suggesting a diary based herd.

Table 1: Average size and composition of Cattle Herds of Agropastoralists in the Derived Savannah

	Oyo Agro-past	Ogbomoshu Agro-past	Saki Agro-past	All Farmers
*Total	27 (1.1)	20.6 (1.3)	28.7 (1.7)	25.6 (1.9)
Adult Male (bull)	2.0	1.4	1.3	1.6
% of Cattle	7.0	6.8	4.5	6.3
Young male (steer)	3.2	2.5	2.1	2.8
% of Cattle	11.9	12.1	7.3	10.9
Male calves	2.4	3.2	2.2	2.3
% of cattle	8.9	15.5	7.7	9.0
Adult female (cow)	1.0	8.2	13.8	11.6
% of cattle	44.4	39.8	48.1	45.3
Young female (Heifer)	4.4	3.2	6.3	4.6
% of cattle	16.3	15.5	22.0	18.0
Female calves	3.0	2.1	3.0	2.7
% of cattle	11.5	10.3	10.4	10.5

() Figure in parenthesis represent standard deviations (S.D.)
 1 Represent figures for Tropical Livestock Unit (TLU)
 * Agropastoralist.

The average size of cattle kept by all the farmers is about 26 animals in ¹TLU. However, a careful study of cattle sizes between areas (towns) shows that there are differences in the number of cattle kept by farmers in each area. Agro pastoralists settled around Saki town, had the largest number of cattle (29 cattle). This was followed by agropastoralists residing around Oyo (27 cattle) and Ogbomoshò towns (21 cattle) respectively (Table 1).

Herd Simulation Analysis

Herd simulation model was used to determine the potential growth rate of the cattle herds which is defined as the steady state, or equilibrium rate of growth of the herd. The parameters used were based only on the females (cows) of the herd, since this determines growth rate and is the limiting factor in producing breeding stock. Table 2 shows the result of the simulation analysis.

Table 2: Herd Simulation and Sensitivity Analysis Results

Parameter	Derived zone	Locations in the Derived zone		
		Oyo	Ogbomòshò	Saki
Adult Cow % of herd	45	45	45	45
Number of Adult Cows	243	243	243	243
Calving rate %	46	36	48	63
Female Calve born usually	56	44	58	77
Age at first Calving (year)	3.7	3.9	33.9	4
Mortality at age % 0-1 year	11	12	12	9
No. of heifers ranching age 1	41	32	42	57
Heifer & Cow mortality % 1-2 years	5	7	6	5
Heifer & Cow Mortality % 2-3 years	5	6	5	4
Mortality at First Calving age %	6	7	6	5
Mortality of Adult females %	5	6	5	4
Culling rate Cows %	8	7	15	3
Number of heifers attain first Calving age	35	26	35	50
Hefer survival rate from birth to first calving age %	76	72	74	79
Implications with zero growth rate: (Surplus heifers producer year) Number	9	-6	-4	35
Implication as a % of Cows	4.5	2.8	2.2	17.8
Potential Herd Growth rate: (R*)	2.4	-	-	5.5

The number of adult breeding cows was observed to be 243 representing 45% of herd size. The analysis shows that the calving rate of about 46%, though low, is typical of tropical cattle breeds raised under traditional management conditions. This falls within the range 34.2 - 54.8% and is a little above 45.5% calving rates reported for white Fulani and N'dama cattle in the savannah (1) and humid tropics of Nigeria (14). Moreso, the analysis shows the age at first calving to be about 3 years, while mortality at age zero to one year, which is 11% decreased to about 6% at first calving age (3 years). Mortality of adult females was about 5%. This is considered to be high probably due to poor

management and lack of good health services. The analysis further showed that the culling rate is 8% in the derived savannah zone. Thirty-five heifers attained the first calving age out of fifty-six female calves born annually, representing 76% survival rate from birth to age at first calving. Surplus heifers produced per year were observed to be nine. If added to the number of adult breeding cow, the cow number would increase every year by nine cows. On the other hand if these were sold, then the herd's growth rate will be nil. However the analysis revealed the potential herd growth rate in the area of study to be 2.4% thus suggesting that the herd would have a steady growth of about six animals every year in the area

Sensitivity Analysis

A sensitivity analysis was carried out to test the viability of the variation in the production parameters used in estimating potential herd growth rate and potential for producing surplus heifers at the different locations of the study area where cattle farmers were sampled. Biophysical variables such as calving rate, first calving age, culling rate, and mortality rate variations across the three location were analysed. The result of the sensitivity analysis is presented in Table 2 using a fixed number of 243 adult breeding cows.

The result of the analysis showed that calving rate varied between 36% and 63%. This large variability observed could be attributed to one or more of the following environmental and management factors: the chronic nutritional stress and deficiencies; the relatively long postpartum anestrus due to extended milking period and/or suckling; dam and old age; and the high ratio of cows to breeding bulls.

The female calves born annually varied according to the increase in calving rate, between 44 and 77 calves per annum. The analysis showed the number of heifers attaining first calving age to be 26, 35 and 50 for Oyo, Ogbomoso and Saki areas respectively. This showed an increase with decrease in the rate of mortality between age zero to age at first calving (3 years). Furthermore, the heifers and cow mortality rate ranged from age zero to age at first calving (3 years) and decreased from about 12% to about 5%. While adult female mortality ranged between 4% and 6%, it was observed that most of the mortality usually occurred during the dry season (11). This could be attributed to insufficient feeding and/or scarcity of water during the period and lack of good health care services and drugs coupled with poor management practices of the farmers in the areas of study. The age at first calving was about 4 years which was fairly uniform across the three locations and typical of tropical environment. This estimate is not significantly different from the widely accepted 3.7 years for Zebu raised under traditional management in Nigeria.

Heifer survival rates from birth to age at first calving were observed to vary between 72% and 79% in the locations. Moreso, the analysis showed the surplus heifers produced per year for the three areas to be -6, -4 and 35 heifers.

The negative surplus (-6, -4) of heifers produced in the case of Oyo and Ogbomosho areas is an indication of breeding stock depletion. Hence to maintain the present size of herds, new breeding stock would have to be purchased. For these two areas the potential growth rate is nil and the implications as of the percentage of cows is such that for the two areas, the population of cows are likely to decrease by 2.8% and 2.2% for Oyo and Ogbomosho respectively. Certain factors might be advanced as reasons for the negative surplus of heifers in Oyo and Ogbomosho areas. These include the fact that both areas are link routes for cattle trafficking between the north and southwest. Hence there is the likelihood of continuous sale of stock as farmers might be predisposed to selling off their surplus heifers to cattle merchants travelling along these routes. Additionally, the two locations though highly populated are also close to one of the largest and highly populated city centres in the country (Ibadan); thus suggesting a high demand for cattle from both locations to Ibadan.

Saki which is relatively a rural area with low population density recorded a positive surplus of about 35 heifers and if added to number of cows would thus increase the breeding stock by 35 animals. This show that the area is quite conducive for the growth of animals hence herds in this area are likely to grow with the number of cows increasing yearly. The potential growth rate for herds in this area was 5.5%. This is indicative of a steady growth of about thirteen animals per year.

CONCLUSION AND APPLICATIONS

The structure of herds in the derived savannah typifies those of diary herds. The study shows that over half (65%) of the herds in the zone were female animals. The proportion of males was extremely low thus showing a higher off take of males relative to females.

Simulation of the various biological parameters of females yielded a positive surplus of females (heifers) per year. The growth potential for herds in the derived zone was therefore 2.4% an indication of a steady growth of about six animals every year. By testing the viability of variations in production parameters of female animals in three locations of the derived zone, the simulation result indicated that two of the locations - Oyo and Ogbomosho had zero growth potential as a result of excessive offtake of female animals in these areas. However, Saki had a positive surplus of heifers and hence a potential growth of about 13 animals per year for the location. Based on the findings the following conclusions were reached.

1. To enhance productivity and increase in the size of herds in the zone, there is an urgent need for a reserved land to be set aside for

communal and/or commercial grazing. It is envisaged that this will forestall any decreases in herd size that will occur as a result of pressure on land by the population.

2. The importance of crop residue in augmenting feed requirement cannot be over emphasised. Hence it is of utmost importance that crop and livestock be fully integrated in this zone in order to derive the benefits thereof. To accomplish this task, extension institutions should educate farmers on benefits associated with mixed farming, while emphasis should be on intensive means of raising the productivity of crop forage legumes, and crop-byproducts favoured by livestock.
3. Since farmers in this zone are disposed to keeping more of female cattle to male thus suggesting a dairy setting, research should be geared towards ways of improving, packaging and marketing milk and milk-products produced by farmers.
4. To stem the negative growth rate noticed in Oyo and Ogbomosho areas, farmers are encouraged to in addition to their herds invest on animals that can be fattened for sale. It is envisaged that this will allow for a buildup of the depleted herd.

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