


A PRODUCTIVE LIVESTOCK SECTOR FOR THE SURVIVAL OF AN AILING ECONOMY

The Savanna Brown goats' reproductive phenomenon as a focal point.

BY

OMOTUNDE OLUSEYI ADEMUYIWA FASANYA
DVM., M.Sc., PhD
VETERINARIAN, AND PROFESSOR OF ANIMAL PRODUCTION
Department of Animal Production
School of Agriculture and Agricultural Technology
Federal University of Technology, Minna
Niger State, Nigeria, West Africa

THE FOURTH INAUGURAL LECTURE SERIES OF THE FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

24TH JUNE 2004


AISHA JUMMAI JUMOKE FASANYA

THANK YOU ALL AND GOD BLESS YOU

LIST OF REFERENCES


DEDICATION

This lecture is dedicated most warmly to my children Opeoluwa Olusola Babayemi and Oluyinka Omolabake Ayoola and my wife Baby Jummai Aisha Fasanya.
PREAMBLE

We receive knowledge but don't know hence where it is coming from.

We perceive understanding and conceptualize it as our capacity.

We come to terms much later when reactivation and re-application become difficult then we say Oh God.

I acknowledge most graciously the Almighty God for the gift of knowledge and wisdom.

CONCLUSION

For the time allotted, it is impossible to adequately cover the related areas, which will clearly give understanding to the subject. However, it is clear that under the Nigerian environment, a continued confused policy formulation on livestock will not yield any result. Rather, a dynamic, practical policy, which has a characteristic focus, will help in resolving livestock production issues. Any policy, which does not take into cognizance the agroclimatological variation within the geo-political zones of the country, cannot adequately help animal husbandry practices.

If grazing lands are not available under the Nigerian context it will be impossible to efficiently plan for a good Animal Husbandry Management. This estimation of available grazing land will assist in delineating sufficient area for animal production and the determination of the optimum carrying capacity of each of these areas will ensure all-year production planning strategy.

The Savanna Brown goats among all others have proven itself to be worthy of exploitation. Only this has to be done in the right way to enhance its efficiency. Many taboos or myth as the case may be which usually form the basis of decisions for consuming or not the goat meat and milk need to be worked upon. This will course the affected population begin to appreciate the capacity of the goat. Also, in Nigeria production capabilities, which the animals portends, must be exploited for the benefit of the nation. Not only in terms of protein intake but the rebirth of the Moroccan leather associated with the Brown goats. Economic indices acclaim that this has a capacity for revenue generation.

In conclusion answers to the posers raised at the beginning can only be providing by Nigerians, but we have all it takes not to go hungry in the country.

ACKNOWLEDGMENTS

I WARMLY ACKNOWLEDGE THE PRESENCE OF ALL OF YOU HERE PRESENT.

I PARTICULARLY ACKNOWLEDGE PROFESSORS HERE IN THE FEDERAL UNIVERSITY OF TECHNOLOGY MINNA AND ELSEWHERE IN NIGERIA

I WISH TO ACKNOWLEDGE MY CHILDREN; OPEOLUWA OLUSOLA BABAYEMI FASANYA AND OLUYINKA OMOLABARE AYOOLA FASANYA

MAY I CRAVE THE INDULGENCE OF THIS GATHERING TO PUBLICLY ACKNOWLEDGE THE ROLE PLAYED BY MY LATE WIFE MARIE OLUREMI ADEOTI FASANYA

I WISH TO ACKNOWLEDGE A WONDERFUL BEAUTY THAT CAME MY WAY WHEN WE WERE ALMOST SAYING IT WAS DONE IN OUR QUEST FOR WORK MY WIFE
quality of protein nutrient made available in the diet. It should be emphasized that the quality and quantity of protein diet provided must be well monitored otherwise there will be a loss in capital investment of such projects. Cost effective management analysis indicate that the less the amount of protein supplement to ruminant animal the more productive they will be. That however takes into cognizance that other productive parameters have been met.

Since we have chosen to make a case for the economic viability of the goat, it is necessary that the entire entity of the animal be put into proper perspective. In the effort on work done on the Savanna Brown goats over the years, the observation on the milk production parameter is quite impressive. Obvious changes in the circumference of the udder in lactating animals were observed. Either during the intensive management or extensive or semi intensive management, the circumference of the udder show appreciable genetic adaptation in relation to others in different parts of the world.

Table XI

<table>
<thead>
<tr>
<th>Age of lactation (week)</th>
<th>N</th>
<th>Circumference of udder (cm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Before milking</td>
</tr>
<tr>
<td>1-2</td>
<td>2</td>
<td>23.25</td>
</tr>
<tr>
<td>3-5</td>
<td>17</td>
<td>22.53</td>
</tr>
<tr>
<td>6-10</td>
<td>20</td>
<td>18.026</td>
</tr>
<tr>
<td>11-15</td>
<td>18</td>
<td>19.49</td>
</tr>
<tr>
<td>16-18</td>
<td>4</td>
<td>19.49</td>
</tr>
</tbody>
</table>

Usually the circumference of the udder is largest during the first 5 weeks of lactation in most domestic animals. This is quite represented in the goat. The changes in the circumference of the udder are related to the volume of milk yield and the level of lactation experienced in the animal. This is further influence by the dietary plane they are placed upon. During the course of these various studies it was noted that animals placed on the semi-intensive management system produced fairly large quantities of milk. Those on intensive production pattern and supplemented with concentrate suffered from deficiencies, which affected their production levels. Pregnancy toxemia is the first indices one would observe on the farm when these conditions are present. Affected animals will usually abort.

Volume of milk yield was highest during the first 5 weeks of lactation and subsequently decreased. It should be noted that the period kidding could also affect lactation in these species. Animals that kid during the raining season produce more milk than those in the dry season. Consequently, production must be targeted towards the period of maximum yield (raining season) or animals be well supplemented with diet with high moisture contents.

INTRODUCTION

A productive livestock sector implies that the entire production phenomenon must be on hand to ensure that the production line is not interrupted. In the Nigerian situation, can this happen? Over the years, several effort both in research and production strategies have been adopted but none has yet given the country respite on animal protein production and consumption.

This has made it difficult to provide reasonable figures on livestock population of the country. Ariyo (2002) presents some figures from the 2001 livestock preliminary survey (Fig. 1) which indicates that goats (24.3million), sheep (20.5million), cattle (19.8million), pigs (4.9million), donkeys (1million), horses (0.2million), camel (0.18million) and poultry (126million) were available. May be with the impending National population census, the livestock producers may go side by side with the human enumerators with the hope of finding out some kind of figures. Consequently, it is invariably impossible to evaluate the animal protein intake per caput per day in the Nigerian system. Many of our figures try to quote those of FAO and other countries whose parameters far outweigh that of our country. The figure on the protein intake per caput per day gives an indication of a nations awareness to livestock production and the utilization of the predominant animal species which can help it meet the needs of the human population.

Therefore, the questions we must ask under the current low level of livestock production in Nigeria include:

i. Are we doomed to fail in livestock production?

ii. Does it mean the Nigerian livestock does not have the capacity to help the Nation?

iii. Do the Nigerian livestock producers know what it takes to ensure a production line?

iv. Are there the required experts in Nigeria that can ensure a reversal of our predicament?
Livestock 2001

![Livestock Graph](source)

Fig. 1 Estimated Livestock figures in Nigeria (Source: Ariyo 2002).

Some of these questions aided the focus on Nigerian Livestock using the Savanna Brown goat as a reference point in our various studies. Aspects, which could provide a short or long term solutions, were focused on.

To many, goats represent animal species that engage in destructive tendencies of their environment. Others see them as animals, which could be used as gifts or killed to meet the immediate meat requirement of the home since its size permits it, and it is readily available and easily affordable during festivals.

The goat population in Nigeria in the last 16 years (since engaging in research activity on the species) has been on the decline. This is because many homes now result in using them for their need since the price of cattle and fish and other forms of animal protein has skyrocketed. This gives an indication that the goat after all is not useless. The level of off-take far outweighs the production level.

This lecture will try to make a case for the goat with particular emphasis on the reproductive capacity using the Savanna Brown goats as the index of capacity utilization.

LIVESTOCK PRODUCTION IN NIGERIA

Livestock production in Nigeria has been a practice made for the Fulani herdsmen. It is known to involve its movement from the Northern part of the country to the Southern part. This movement is governed by the pattern of rainfall, which influences the pattern of vegetation cover. The vegetation cover of the Nigerian mass (Fig II) indicates that in the last 500 years there has been a great modification. This modification is more obvious in the last 50 years due to human activities and climatological changes. The human activity

Similarly, forage provided for production can be simulated independently, based on monthly time series data. The beauty of this model is the time-dependent nature, which allows for projections and adequate policy determinations.

MILK PRODUCTION CHARACTERISTICS IN THE SAVERNA BROWN GOATS

It had earlier been indicated that the reproductive system represents the end of the factory line in animal production (Fasanya, 2003). The type of raw materials that might have been provided during the production stage characterizes this factory line. The process of lactation takes into maximum consideration these raw materials. Akinsoyinu et al. (1978) notes that the diet and lifetime nutritional status of an animal are considered the most important factors, which influence reproductive activities in the goats. This is confirmed by the earlier observation by Lamond et al. (1972) who noted that these exert significant effect on the ovarian function. Others also reported that this has effect on embryonic and early foetal development, size, vigor, viability as well as growth of the new born (Sanchez et al. 1985, Robinson and McDonald, 1989).

The quality of milk in some species of animals particularly cattle is dependent on the
(a) Section of the uterus of a goat 4 dpp showing maternal crypts, x 200.
(b) Section of the uterus of a goat 4 dpp showing distinct intercaruncular epithelium, x 400.

Fig XVI. Histological section of the endometrium showing the epithelial lining

has continued unabated to the extent (Fig. III) that the little vegetation cover available for grazing is now no longer tenable. Consequently, the livestock production activity remains on the decline and the Fulani herdsman must find another friendly environment for its cattle, sheep and goats. The result is low productive and high cost of cattle and other livestock particularly small ruminants.

Vegetation

Fig II. Vegetation cover of Nigeria

In its present state, heavy investment in production yields little result because those who chose to engage in production try to adopt the short cut method, which leads to failure. This is in addition to the fact that, the natural ingredients such as land, pasture and the likes are being diminished.
Goats and sheep (1996)

Fig III. Map of Nigeria showing the relative distribution of small ruminants. (Source, Ariyo, 2002)

PRODUCTION METHODS
Our livestock production engineering has not moved away from the traditional husbandry practices of our forefathers. These include the semi-intensive and largely free range. The intensive management system is being adopted at very slow rate and cutting corners, which in most instances has lead to poor performance and abandonment of the project midstream. These traditional approaches represented the level of awareness of the people at that time and it had its advantages particularly with regards small ruminants like the Savanna Brown goats.

There has been a tremendous improvement in livestock production engineering in the world that it is time for us to move a step further. These methods mainly intensive take cognizance of the agroclimatological indices of the production environment. Such methods allow for the provision of special housing, which recognizes production parameters. With the semi-intensive method, the adapted housing pattern and feed production is related to the production environment.

Some of the livestock houses may not be necessary in Nigeria since our climatic changes

cattle, management of the postpartum period have been shown to guarantee one and half calf from a cow in three years.

Fig XV Uterus of a doe showing the normal caruncles arranged in rows.

A typical model is a line dynamic, stochastic, non-optimizing and treats simulated animals as individual entities. The model also provides the use with an array of policy options to enable herd performance to be studied under identified management regimes. In addition, this model allows for input and output policy to be specified with adequate details relating to management of the herd as an economic unit. Example of output in the model is milk and meat off-take, which can be regulated as the rate of surplus female, over and above a planned herd size.
With a calving rate of 60% and maturity up to weaning of 13% annual output/cow was 88 kg live weight/100 kg of cow maintained. The effectiveness of this model is presented in Scheme 2. Production parameter for individual animals can be carefully engaged which will ensure that the economics of production is achieved.

**EARLY MATURING ANIMALS**
5 - 7 MONTHS OF AGE
Live weight 10.5 kg - 13.5 kg.

**BREED AS SOON AS FIRST OESTRUS IS OBSERVED**
*Natural or A.I.

**DOES WILL KID AT**
12 - 13 Months of age
**WEAN KIDS AT 4 WEEKS**

* Natural mating
** The presence of microbial agents such as Staph, aureus Mycoplasma agalactiae, E.coli Ureaplasma sp.

Natural mating outweighs that could and interfere with uterine involution. Nutrition could do the same, but this has not been tested.

Note: With this programme, it is possible to obtain 10 viable kids from a doe in a 5 year active lifespan.

FIG XIV Breeding plan for early maturing Savanna Brown doe kids under the semi-intensive Management system.

Postpartum:

Since most animals must maximize breeding efficiency, the duration of the postpartum interval must be such that does not allow for waste of reproductive characteristics. The shorter the postpartum interval, the more efficient the reproductive performance.

In the Brown Goats of the Northern Savanna, the postpartum uterus is capable of receiving a new fetus 24 days after, which it translates to an average of two kidding per year per doe (Fasanya et al. 1987).

If nutrition, health care practices and other production indices are maintained, optimum reproductive performance can be obtained (Fasanya et al. 1992 a & b). Similarly, in the

Livestock management involves the provision of factors, which will ensure that animals are maintained at optimum level of comfort to ensure maximum production capability and healthy status. These factors relate to the physiological state of the animals, which has a link to production.

In livestock production anywhere in the world, the fascinating experience is the way affected societies manipulate any constraints observed to their advantage. Some of these factors are not estranged from the Nigerian agro ecological terrain. They include Nutrition, (energy, protein agro-industrial by products, minerals and vitamins), genetic, environment (climate change, housing) animal behavior and other related factors.

Generally, animals must be able to adapt favorably to their environment in order to meet their daily challenges.

ANATOMICAL CONFORMATION AND ANIMAL MANAGEMENT PATTERNS.

There are several species of domestic animals whose anatomical conformation has enabled them to adapt to their environment.

**SHEEP:**

Because of the various breeds of sheep and their anatomical conformation, their productive characteristics have been well documented.

For example, Wool sheep, Merino breed.

Type: Strong woollen Merino
Location: South Australia, North-Western and Western Plains of New South Wales and Queensland.

**Fine Woolled Merinos:** Tableland, Western Districts of Victoria, Tasmania.

Either the ewe or ram, the production capabilities of these animals, will be guided by the management practices involved. Other breeds of animals have similar factors related to them. Their geographical location help to ensure that this characteristic is well manifested.

24
Lincoln Breed (British): Cotswold, English Leicester, Romney Marsh etc.

Local breeds of sheep: Yankassa, Uda, Balami and West African Dwarf sheep.

Goats: West African Dwarf goats, Savanna Brown goats, Kano Brown, Bengal etc.

Cattle: Muturu, Ndama, Sokoto gudali, Adamawa gudali, Friesian dairy cattle, Beef or Dual purpose), white Fulani.

The shape of the body allows for adequate and efficient management pattern to be developed (Fig. IV). A classical anatomical conformation which helps to guarantee survival in animal species can be identified in the camel which employ the capabilities of long limbs and availability of the pouch to conserve water and easy grazing access to tall trees when necessary.

Furthermore, in goats (Savanna Brown goats), when the translation of the above observation is made, the conclusion that dietary supplementation have impact on the onset of puberty and postpartum is quite essential for efficient production capabilities (Fasanya, et al., 1992a & b).

Hormonal interaction, which usually is a function of the endocrine performance, is an important factor, which has been employed to improve on performances of most domestic animals. The use of these hormones has consistently been applied in the area of attainment of puberty, early resumption of ovarian activity in postpartum species (Fasanya, 1997). It was noted that PMSG alone was capable of stimulating follicular activity and ovarian development, which can lead to ovulation, and hence it has an advantage in the early induction of ovarian activity in nulliparous Savanna Brown goats. (Fig XII) This aspect of production becomes relevant on large livestock farm basis where large quantities of these agents may be required. A limiting factor in the Nigerian perspective to the success of this agent can be found in the areas of inadequate data collection and storage. Such areas require regular history of the animal species under use.

The phenotypic parameters of the Savanna Brown goats show that they have the propensity for maximal utilization when compared with other types of goats anywhere in the world. Growth rate during the 2nd, 4th, and 6th weeks was 8.4, 6.7 and 8.1 % (p<0.05) respectively in the male kids (Fasanya, et al., 1993). [Tables I & II].

Table I

<table>
<thead>
<tr>
<th>Wet Season</th>
<th>Dry Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Weeks)</td>
<td>N</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

Table II

<table>
<thead>
<tr>
<th>Wet Season</th>
<th>Dry Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Weeks)</td>
<td>N</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Mean serum progesterone profile before and after puberty. Bar lines indicate the standard deviation; x, does were also mounted at this point.

LIVESTOCK PRODUCTION MODELS

In order to accommodate stress parameters models, which cause interactive effects, are sometimes employed for efficiency. Livestock production models are now effective techniques, which practitioners of livestock production employ.

Such models incorporate rangeland production data, weight changes or milk production as the case may be. Abassa et al. (1987) used the model developed at Texas A&M to simulate the performance of Gobra Zebu cow which had access to natural rangelands on the Dahra range in Northern Senegal in terms of weaned calf weight. (Gobra Zebus were cows with mature cow size of 425kg and potential milk production of 6.7 litres per day).

Also, average male weight at weaning of 6 months was simulated at 116kg or equivalent to an average daily gain of 0.5 kg.
**PHYSIOLOGICAL STATUS OF THE N TH ANIMAL AT THE END OF THE MONTH**

<table>
<thead>
<tr>
<th>Data resources - Base and breed characteristics</th>
<th>Management policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic components of the biological model</td>
<td></td>
</tr>
<tr>
<td>Basic model components</td>
<td></td>
</tr>
<tr>
<td>Determine equality/quantity of forage - an offer to the whole herds</td>
<td></td>
</tr>
<tr>
<td>Physiological status of the animal at the beginning of the month</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probability Distribution of Forage on offer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage intake based on forage quality/quantity and animal physiological status</td>
<td>Energy requirements based on animal physiological status</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected growth and Milk yield based on policy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth and milk production component</td>
<td>Supplementary milking &amp; reed weaning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected mortality rates under a normal nutritional region</th>
<th>Breeding policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected reproduction rates</td>
<td></td>
</tr>
</tbody>
</table>

**NUTRITION**

Species requirement must be carefully identified in order to ensure that nutritional requirements, which will sustain production, are made available. Good animal husbandry practice will involve the provision of adequate, balanced and highly nutritive feed materials for the species of animals. It should be noted that inadequate and poor nutrition leads to infertility, fetal death or embryo resorption, stunted growth in most animals, poor reproductive efficiency and susceptibility to disease conditions.

The manifestation of nutritional deficiencies in most animal species vary. This can be noticeable in the various breeds, age and sex of related species. Some of these deficiencies could manifest themselves in clear disease while others may be as a result of metabolic disorders (Fig. V). In order to overcome or reduce some of these deficiencies, essential nutrients involving energy, protein, vitamins, minerals and portable water must be provided as strategic means for animal husbandry.

There are essential nutritional materials whose deficiencies will cause severe crisis in management of livestock. Phosphorus deficiencies in cattle are known to predispose to poor fertility, anestrus, decreased milk production and deprived appetite. Also, deficiency in minerals will lead to subnormal growth in young animals and reduced weight gain in mature ones. Other minerals, which would play prominent role in livestock production, are potassium, sodium, magnesium, calcium and sulfur. The clinical manifestation of deficiencies of these minerals varies with the conditions under which the...
livestock are kept. In a recent study on the Savanna Brown goats, where intensive management was employed, these clinical manifestation were clearly demonstrated (Fig. V). A close study of the Savanna Brown goats indicates that they maximize feed materials provided to them. This is observable from the feed conversion ratio in the corresponding tables (Tables III, IV, and V).

**Table III**
Summary of performance characteristic of Savanna Brown does fed concentrate (T) and maize bran (C) during a 12-week period. *

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>T</th>
<th>C</th>
<th>± SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of animals</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Initial body weight (kg)</td>
<td>8.67±1.11*</td>
<td>8.67±1.14*</td>
<td>±1.13NS</td>
</tr>
<tr>
<td>Final body weight (kg)</td>
<td>9.83±0.86</td>
<td>12.17±0.56*</td>
<td>±0.71**</td>
</tr>
<tr>
<td>Feed intake (kg)</td>
<td>4.71±0.17*</td>
<td>5.98±0.12*</td>
<td>±0.15**</td>
</tr>
<tr>
<td>Weekly body weight gain (kg)</td>
<td>0.17±0.11*</td>
<td>0.29±0.11*</td>
<td>±0.11NS</td>
</tr>
<tr>
<td>Feed conversion ratio</td>
<td>0.27±0.35*</td>
<td>0.73±0.62*</td>
<td>±0.49NS</td>
</tr>
</tbody>
</table>

* Data on the same row with the same superscript do not differ significantly from each other (p>0.05)
** Significant, NS- Not significant, SEM-Standard error of mean, T- Treatment, C- Control

The manner of presentation and the type of feed could have tremendous influence on the performance of the animal, which will ultimately affect production. These are practical experiences, which must be made known to producers such that they do not just take matters for granted. The Brown goats have clearly proven that in spite of these problems they can adjust favorably and make conversion to improve themselves. It should be stated that diarrhea represent the first signs to look out for, when providing these animals with various feed materials.

animal perform maximally.

The observation contained in table X, is based on the characteristic of hormonal changes and physical exhibition of signs of oestrus by these animals. With a pattern of management and adequate record keeping, the appropriate calving, lambing or kidding rates will be obtained.

Adu, Bricksman and Kutigi (1979) had equally indicated that for small ruminants information such as age at first oestrus, live weight at first oestrus, duration of oestrus cycle, gestation period, age at first lambing or kidding, weaning percentage, mortality, birth weight and growth rate are essentially necessary for successful production programmes. This is further confirmed by Fasanya (1986) as enumerated in the breeding plan (Fig. XIV & XVII).

With the analysis of all available data and literature, Ademosun (1985) on goats, remarked that sensitivity analysis done demonstrated a higher risk involved in goat production, reflecting higher mortalities and emphasized that without improvement, few benefits can be derived from improved marketing in the survival of the animals without a prior improvement in survival following nutrition and management.
animal to reach sexual maturity and not attain puberty. Both situations must be checked that the animal, meets up the expected production level.

Table IX
CONSUMPTION OF DIETARY SUPPLEMENT AND BODY WEIGHT CHANGES AT PUBERTY OF SAVANNA BROWN DOES

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Av. Daily feed supplied (kg)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Total feed supplement consumed (kg)</td>
<td>294.6</td>
<td>187.0</td>
<td>338.0</td>
<td>-</td>
</tr>
<tr>
<td>Av. Daily supplement intake (kg)</td>
<td>2.34</td>
<td>1.67</td>
<td>2.7</td>
<td>-</td>
</tr>
<tr>
<td>Total feed supplement refused</td>
<td>305.4</td>
<td>413.0</td>
<td>261.8</td>
<td>-</td>
</tr>
<tr>
<td>Av. Daily supplement refusal (kg)</td>
<td>2.55</td>
<td>3.44</td>
<td>2.2</td>
<td>-</td>
</tr>
<tr>
<td>Mean initial body weight (kg)</td>
<td>6.76±1.35</td>
<td>6.3±0.9</td>
<td>6.34±0.11</td>
<td>6.5±0.75</td>
</tr>
<tr>
<td>Av. Daily weight gain(kg)</td>
<td>0.02</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>98.7</td>
<td>39.4</td>
<td>44.5</td>
<td>ND</td>
</tr>
</tbody>
</table>

Table X: Age at onset of puberty in some Nigerian livestock.

<table>
<thead>
<tr>
<th>Species</th>
<th>Age at onset of Puberty</th>
<th>Weight (Light weight)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savanna Brown does</td>
<td>3-4 months</td>
<td>9-10kg</td>
<td>Fasanya, et al. (1987)</td>
</tr>
<tr>
<td>Yankassa Ewe</td>
<td>4-5 months</td>
<td>10 kg</td>
<td>Adu, et al. (1979)</td>
</tr>
<tr>
<td>White Fulani</td>
<td>9 months</td>
<td>200 kg</td>
<td>Oyedipe et al. (1982)</td>
</tr>
</tbody>
</table>

Reproductive efficiency of most of the Nigerian livestock has been dependent on the availability of adequate nutritional materials. In as much as this becomes desirable the supporting management practices such as reproductive health care management, housing, genetic consideration, and others cannot be isolated from ensuring that the
Table IV: Performance Characteristic of SB Goat Bucks Fed Experimental Diet [DM, Basis].

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mean Initial Body Weight [kg]</td>
<td>7.25 ±0.13</td>
<td>6.90±0.17</td>
<td>6.77±0.08</td>
<td>0.046</td>
</tr>
<tr>
<td>Mean Final Body weight [kg]</td>
<td>14.50±0.18</td>
<td>15.75±0.08</td>
<td>14.75±0.11</td>
<td>0.110</td>
</tr>
<tr>
<td>Mean Daily Body Weight Gain [kg/d]</td>
<td>0.040±0.001</td>
<td>0.049±0.001*</td>
<td>0.044±0.001b</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean Daily Body Weight gain [kg/d/w **]</td>
<td>0.09±0.001</td>
<td>0.10±0.001*</td>
<td>0.097±0.001b</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean Dry Matter Intake [kg/d]</td>
<td>0.45±0.11</td>
<td>0.46±0.22</td>
<td>0.43±0.11</td>
<td>0.029</td>
</tr>
<tr>
<td>Feed Conversion Efficiency.</td>
<td>11.25±2.8</td>
<td>9.39±4.39</td>
<td>9.77±2.57</td>
<td>0.643</td>
</tr>
<tr>
<td>DM/body weight</td>
<td>3.12±0.17</td>
<td>2.93±0.04</td>
<td>-1.90±0.57</td>
<td>1.045</td>
</tr>
</tbody>
</table>

* Means in the same row with different superscripts are significantly (P< 0.05) different, otherwise they are the same.

It has been noted that chopping of green forages or hay has the ability to reduce intake in the goats while it is also true that animals provided with whole forage or pelleted food of low quality roughage have their intake increased (Dehority and Grub, 1977). In the Nigerian livestock with the goat as study animals, the performance characteristics give indication that the availability of nutritional materials on dry matter basis is significant to the efficiency of growth and reproductive performance. This is because the intake will vary at any given time.

HEALTH MANAGEMENT STRATEGIES

Agroclimatological consideration usually predispose to an efficient healthcare management practice. This normally would be the first index placed under consideration. In some conditions, such as helminthiasis, microbial infections (Pneumonia, bronchitis, etc) the understanding of the agroclimatological delineation of the zones will enhance adequate management practices.

There are broad-based healthcare practices, which need be highlighted that would reduce stressful conditions in animal and ensure maximum productivity. These include the provision of adequate disinfection processes, deworming and zonal classification of grazing areas. This classification will enhance the control of developmental stages of developing protozoa and helminthes. General sequence adopted to ensure proper health management and reduce stress in livestock production is presented in Table VIII.

TABLE VIII: SEQUENCE OF PRACTICING DISINFECTION IN LIVESTOCK PRODUCTION

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Empty the pen and preferably the house of all livestock.</td>
</tr>
<tr>
<td>2.</td>
<td>Clean out all “organic matter” – dung, bedding, old feed, any other material, which could contain pathogenic microorganisms. Remove totally from building area.</td>
</tr>
<tr>
<td>3.</td>
<td>Remove all portable equipment from cleaning and disinfecting outside the building.</td>
</tr>
<tr>
<td>5.</td>
<td>Apply a disinfectant appropriate to the type of infections being dealt with. Usually required is a mixture active against viruses, bacteria, parasites and insects.</td>
</tr>
<tr>
<td>6.</td>
<td>Wherever possible, fumigate with a formaldehyde-active material after the equipment and litter have been reassembled.</td>
</tr>
<tr>
<td>7.</td>
<td>Dry out and rest for a day or two before restoring.</td>
</tr>
</tbody>
</table>

REPRODUCTION

The reproductive capabilities of the domestic livestock are quite enormous; hence a clear understanding of the physiological status of the animals must be understood. In most female animals, oestrus characteristics will greatly influence the success of this activity. There are numerous factors, which would influence the efficiency of these phenomena. These include nutrition, disease environment, species or breed of animal. Also, it is desirable that information on the reproductive performance of farm animals be provided to assist the farmer in the management of its stock.

Major indices of efficient reproductive performance in the domestic animal are the onset of oestrus, which is related to age and live weight in domestic animals, onset of puberty, age, and lactation parameters.

Puberty: To ensure that final benefit is obtained, weight changes from the time of onset of puberty must be well documented (Tables IX & X).

Studies have shown that the Savanna Brown goats can attain puberty as early as 4 months of age (Fasanya, et al., 1987). At this age, liveweight was recorded to be about 9.5kg. Attainment of puberty and reaching sexual maturity are not the same. It is possible for an
SCHEME 1
HOUSING AND PRODUCTION STRATEGIES

Latitude of Zone
Altitude of Place
Distance from Sea
Ocean Current & Winds
Shape of Land
Vegetation
Clouds and Rainfall
Solar Radiation

**Influence**

Ambient temperature and Humidity, Wind Current, Light

Environment exert influence

Climatic Factor

Direct

Thermo-receptors in skin

Climatic stress

1. Vegetation kind and quality
2. Parasitic Load

Neural input

Hypothalamus

Neuro-entncrine mechanism

Depression of Enzymatic & metabolic activity

Depression in oxygen consumption

- Body resistance
- Biochemical changes
- Energy balance

Depends upon the extent to which the animal reacts
Such as e.g.

Breed, Temp. of heat stress,
Holstein 24-26°C
Jersey 26-28°C
Brown Swiss 29-30°C
Zebu 32-35°C

**Adaptation effects**

Growth, Production & Reproductive efficiency


d| A          | B          | C          | D          |
---|------------|------------|------------|------------|
Mean initial body weight (kg) | 16.33±3.17a | 18.00±1.00a | 14.00±1.00a | 11.83±1.92a | ±1.84NS |
Mean final weight (kg) | 22.33±1.20a | 22.87±0.88a | 17.66±2.73a | 18.00±2.64a | ±1.75NS |
Mean weekly body weight gain | 0.34±0.09a | 0.39±0.06a | 0.38±0.30a | 0.54±0.00a | ±0.13NS |
Mean weekly feed consumption (kg) | 4.31±0.00d | 4.14±0.10c | 3.59±0.01a | 3.64±0.00b | ±0.01* |
Mean feed conversion ratio | 0.45±0.11a | 0.82±0.37ab | 0.66±0.33a | 1.42±0.29b | ±0.17* |
Mean specific growth rate | 0.21±0.06a | 0.25±0.39a | 0.32±0.15a | 0.47±0.07a | ±0.27NS |
Mean weekly length of hind limb (cm) | 42.35±1.34a | 39.99±0.86a | 40.28±1.80a | 39.64±0.83a | ±1.27NS |
Mean weekly body length (cm) | 111.50±0.19a | 109.48±3.26a | 104.72±3.35a | 105.11±2.68a | ±2.7NS |
Mean weekly length of fore limb (cm) | 38.45±0.68a | 36.91±0.87a | 36.64±1.18a | 36.00±0.63a | ±0.86NS |
Man weekly earli girth (cm) | 62.92±1.44a | 64.71±0.44a | 60.49±1.18a | 60.30±2.91a | ±1.94NS |
Mean weekly height at withers (cm) | 55.63±2.90a | 56.04±1.63a | 53.39±3.19a | 54.22±0.63a | ±2.61NS |

Values on the same row with the same superscript do not differ significantly from each other (P>0.05)
SEM - Standard error of means. A-10%CP; B-12%; C14%; D-16%.

**Fig VI. Feed conversion ratio in Savanna Brown does fed four different diets**
Local feed materials provided for the Savanna Brown goats can be utilized in variable manner. For example the bucks (under the semi-intensive management practice) will utilize *Leucaena leucocephala* (Table III and Fig. I-XI) in a slightly different form than the does (Olatunji *et al.*, 2002). There were initial positive responses in body weight changes, which then become negative and later improve. Species variation and age play important roles in this situation. This is because younger animals have been found to be more positive in terms of growth response while older animals are slower.

Micronutrients of varying degrees play significant role in the production capabilities of domestic livestock. These micronutrients include Copper, Molybdenum, Cobalt, Zinc, Selenium and Iron. The interactions of these micronutrients with other major nutritional materials, such as energy, protein and vitamins allow the domestic animal maintain a production balance.

However, inadequacies in the lack of these ingredients i.e. nutritional materials, minerals and micronutrients have manifested themselves either in reproductive failure, lack of growth or death of affected species. To further meet the nutritional requirements of most domestic livestock, development of fodder resources and range management has engaged the attention of researchers. Adegbola (1982) notes that forage represents a major nutritional input for ruminant livestock production and that assuming a satisfactory level of disease control and husbandry forage production limits cattle nutrition thereby beef production. This is important because of the production pattern adopted in Nigeria, which is related to the agroclimatological characterization of the country. This has led to the seasonal distribution and movement of cattle and livestock within the country. Based on this, the ecological zones and their vegetation cover has in no small way allowed for the success of distribution and production of livestock in Nigeria (Figs. II & III).

**ENERGY:** The energy indices are usually a function apparently exhibited during growth, which has an interaction with the genetic capacity of the species. Sauvant (1981) notes that the total energy requirement for growth and maintenance in young goats was about 837 KJME/kgW . This in the goat could vary depending on the breed, age and the body weight. In Nigeria, the Savanna Brown goats at the age of about 4 months will have attained a body weight of between 9.5 and 10.0kg and readyto be bred (Fasanya, 1986; Fasanya *et al.*, 1987; Fasanya *et al.*, 1988; Fasanya and Beb-Iwe, 1995). At this time the body conformation and phenotypic representation has become so obvious that her performance is well enhanced. This is attributable to the fact that most of the energy requirements are made available from the food nibbling it acquires when grazing and little dietary supplementation provided to it.

---

### Table VI: Recommended air temperature within livestock building, which can indicate comfort and critical production levels.

<table>
<thead>
<tr>
<th>Animal Species</th>
<th>Type</th>
<th>Recommended production or comfort temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>New born calf</td>
<td>10-20(25-35)</td>
</tr>
<tr>
<td></td>
<td>1 month old</td>
<td>0-25(20-30)</td>
</tr>
<tr>
<td></td>
<td>Veal Calf</td>
<td>-5-22</td>
</tr>
<tr>
<td></td>
<td>Store Cattle</td>
<td>-5-22</td>
</tr>
<tr>
<td></td>
<td>Beef Cows</td>
<td>-5-22</td>
</tr>
<tr>
<td>Sheep</td>
<td>Ewe maintenance</td>
<td>-5-20</td>
</tr>
<tr>
<td></td>
<td>Newborn</td>
<td>10-20</td>
</tr>
<tr>
<td></td>
<td>Growing lamb</td>
<td>0-20</td>
</tr>
<tr>
<td>Pig</td>
<td>5-140kg</td>
<td>0-30</td>
</tr>
<tr>
<td>Poultry</td>
<td>Broilers, Layers</td>
<td>10-20</td>
</tr>
</tbody>
</table>

COMFORT AND REST

It is essential to the welfare of any animal that it should have unrestricted access to an area where it can rest and sleep without discomfort or disturbances. Major parameters, which characterize the area where an organism or animal takes its rest is presented in Table VII. Furthermore, these will affect the comfort temperature indices reflected in Table VI.

### Table VII: Ranking of the properties of the resting area according to the needs of different farm animals.

<table>
<thead>
<tr>
<th>Animals</th>
<th>Dryness</th>
<th>Hygiene</th>
<th>&quot;Give&quot;</th>
<th>Warmth</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry</td>
<td>Broilers</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>(+)</td>
</tr>
<tr>
<td></td>
<td>Layers</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>(+)</td>
</tr>
<tr>
<td>Pig</td>
<td>Weaners</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Dry sows</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Calves</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Beef, Fattened</td>
<td>+</td>
<td>0</td>
<td>++</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Dairy cows</td>
<td>++</td>
<td>++</td>
<td>0</td>
<td>++</td>
</tr>
<tr>
<td></td>
<td>Neonates (General)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>(+)</td>
</tr>
</tbody>
</table>

The parameters indicated have been proven to be important in production strategies in the goats. Most importantly, observation on the goats show that they are sensitive to the state of their environment.
Pasture Production

De Leeuw and Konandreas (1982) note that simulation models can be employed to estimate the productivity of pastoral systems in West Africa. Major pasture species available for production and utilization in Nigeria include *Cynodon nlemfuensis var robustus*, *Cynodon nlemfuensis var nlemfuensis*, *Pennisetum purpureum* and *Panicum maximum* among others. Other grasses that have been employed in livestock production include *Hyperichia rufa*, *Stylosanthes guayanae* and the likes (Akinola et al 1985). This is because animal husbandry cannot be successful without a well-organized pastoral production system.

HOUSING STRATEGIES

HOUSING AND STRESS IN ANIMAL PRODUCTION

One of the fundamental articles of the veterinary surgeon’s creed is that adequate ventilation is essential to ensure good health and high productivity in livestock. Housing in livestock practice takes cognizance of the provision of adequate ventilation. This may be mechanical or natural and will serve to remove from the environment some products of the animal such as heat, moisture, dust, noxious gases and microbes. These are then replaced with a supply of fresh air and other related materials, which will ensure that production is maintained as enumerated in Scheme 1.

When plans on the provision of housing are to be effected, Wathes et al (1983) noted three major objectives to be considered. They include:

i. That the animal health can be maintained and productivity sustained.
ii. That the stockman can accomplish task in comfort and without risk to his health.
iii. And that the building and its equipment are protected from corrosion or physical damage.

The criteria used, should include, the control of air temperature and speed at animal height, control of relative humidity and the prevention of condensation, maintenance of tolerable concentrations of gases, dust and airborne microorganisms. The interactions of each of these parameters as they relate to the animal production capabilities is provided in the scheme on physiological regulation of the animal system (Scheme 2) responds to environmental stress in various methods which can be measured from the production trait.

The efficiency of the hypothalamus and the neuro-endocrine mechanisms has helped to identify constraints in livestock building, which can maximize or decrease production (Tables VI and VII).

PROTEIN: Sengar (1980) indicates that protein requirement is a function of energy intake and protein requirement for growing goats varied from 4.3-4.7g digestible crude protein (DCP)/kgW⁰.⁷⁵. When this is compared to the Savanna Brown goats, it was observed in some of our studies here in the Federal University of Technology Minna that low levels of protein (10% and 12%) favored twinning while higher levels (14% and 16%) favored singles. The protein requirement for the various species of animals in the Nigerian ecosystem will not be the same since the agroclimatological variation is quite significant. It must be mentioned that with the rate of waste generation in the country biodegradation will help to standardize some of these differences and reduce waste with the optimum aim of income generation. In other studies in some parts of the country these protein insufficiency has been well tackled by the special process of harvesting poultry waste and growth of maggots and processing for maximum protein in cattle and small ruminants.
In a few studies on the Savanna Brown goats, the use of protein diet has played significant role in the reproductive performance (Fasanya, 1986; Fasanya et al. 1987). Increase protein intake to recommended levels have enhanced the rate and number of production in these group of animals. Also, adequate protein intake has enhanced the attainment of puberty in these species and others including the cow (Fasanya, et al. 1992a&b, Oyedipe et al. 1982, Alemede et al. 2002).

MINERALS AND VITAMINS: Akinsoyinu (1985) showed that calcium (Ca) and phosphorus requirement were 26 and 56-mg/day/kg liveweight respectively for maintenance and 138 and 199-mg/day/kg liveweight for growth. Several other researchers Mba (1982), Oyenuga and Akinsoyinu (1976) have indicated several figures but noted that there is no cause for noticeable deficiency in most of the small ruminants particularly goats due to shortage of vitamins. This is because most of the forage made available to our livestock in Nigeria is rich in these minerals and vitamins.