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Inaugural Lectures Series 3

ALL  
FLESH  
IS  
GRASS

by A. A. Adegbola



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# ALL FLESH IS GRASS

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## Introduction

"And I will seed grass in thy fields for the cattle,  
that thou mayest eat and be full".

*Deuteronomy 11, 15.*

THESE words are as true today as they were before 600 B.C. when they were probably written. Indeed the dependence of man and his animals on plant life is one of the most widely accepted facts by students of biology. Plants, as the main source of organic matter are able with energy derived from the sun, to combine carbon-dioxide from the air with water and minerals from the soil in a process known to biologists as photosynthesis. This process leads to the formation of sugars as the primary storage product from which the vast majority of other plant products can be synthesized. Animals depend on plants as sources of food and are generally classified into *herbivores* or those that feed directly on plants like sheep, goats and cattle, *carnivores* or those that feed on other animals either as predators or parasites, and *omnivores* who feed on both plants and animals. This latter class includes man. Professor Ensminger of the University of Wisconsin summarised the situation quite aptly when he wrote: "Behind the livestock, we would see vast expanses of pasture and rangeland, feed grains, and such by-product feeds as cull potatoes, beet by-products and surplus citrus fruits—all being utilized as animal feeds. Back of the feeds are the soil resources, spring rains, and the energy of the sun".

Perhaps, we should note here that man's attempts to convert solar energy into much more storable forms of energy for his own use can only be a follow-up of what plants have been able to achieve over the ages.

However, since this is not a lecture on general ecology, which I am confident my colleagues in the biological sciences will give adequate coverage within this series of lectures, I shall confine myself henceforth to a discussion on the supply, production and nutrition of those animals of importance to man as food. These animals are very fortunately, largely herbivores.

## Some Historical Notes

Somewhere in the dim ages of the past, man in his struggle to live a better life possibly emerged from a hunting era into some form of pastoral type of husbandry. Archaeological evidence shows that by about 5,000 B.C. a settled type of agriculture featuring the keeping of all the domesticated animals except horses, was already in progress in the Nile Valley, and along the basin of the Indus in Central Asia, which is sometimes referred to as the "Fertile Crescent". It is quite

clear that by about 3,000 B.C. poultry such as hens, geese and ducks were kept for eggs and flesh, cows and sheep were milked and oxen and donkeys were used for transport and ploughing. There is further evidence from paintings in tombs and sculptures to support the conclusion that animal types were varied. Cattle were of two sorts; short and fat, and very big. They were a type of Longhorns. Some had humps, and there were occasionally polled oxen. The sheep, too, had large curved horns and might have been of the mouflon or urial type. During the flood in Egypt, these beasts were fed on tree sprouts and glumes from cereals obtained after threshing. Thus, there is reason to believe that even in these early times, man gave thought to the feeding, breeding, care and management of his domesticated animals.

The main purpose of domestication of animals and their subsequent husbandry appears to be the desire by man to ensure a more dependable supply of meat and clothing than could otherwise be obtained from hunting. While it is now true that in most temperate countries of the world, more productive types of domesticated animals which are better able to convert feed to flesh, milk and eggs have been consciously selected for thousands of years since domestication, and the process still continues, livestock types in tropical Africa continue to convert feed at low efficiency levels possibly similar to the levels of productivities of their wild ancestors.

## **Animal Science in the Service of Man**

Modern animal science is the total body of knowledge concerned with the selection and breeding, rearing, feeding, housing and health management of livestock as obtained through research and experience for the nutrition and well-being of man. It includes the processing and intelligent marketing of these animal products.

There appears to be little doubt of a world preference for animal products although this preference may vary according to national or ethnic background. Thus, while the Australian prefers lamb and mutton and the Chinese his pork, the Argentinian would rather have beef. The Masai prefers a diet consisting of a mixture of milk and blood, in the same way as the Fulani's preference is for curdled milk; the Hausa likes "suya" which is much like the Iranian's shesh-ke-bab and closer home, the Ondos cherish "asun" made from goat meat. It is however pertinent to mention at this stage that there are vast majorities of people in this world, most especially on the Indian continent, who do not eat animal products with the possible exception of milk and probably eggs. These people are referred to as vegetarians. They have to consume a large number of plant proteins and in large quantities in order to meet their bodies' demand for

the essential amino acids. Plant proteins may also be much less available for digestion by non-ruminants. The main nutritional advantage of animal protein to man is that its amino acid content is more closely attuned to the needs of human beings than those of most plant proteins.

Besides the provision of food for human consumption, animals have a number of other uses to man. For example, animal fibres have been used by man from the hunting age as protection against the elements. In modern times, wool is commonly used as fabric, yak-hair for cloths and tents, rabbit pelts and camel hair for coats. I wonder how many here gave a thought to the poor animal during the last harmattan weather when we put on mohair suits or was it alpaca sweaters and pullovers? How many of us can visualize a world without leather from which those expensive shoes and handbags are made? We should also not forget the vast variety of pharmaceuticals used daily in our hospitals which have been prepared from glands such as the thyroid, pituitary, ovary and the pancreas. Animals have also been used as sources of power in agriculture, although there seems to be very little evidence of this in Nigeria until the early 1930's. Horses and donkeys are in great use in the northern part of Nigeria for transportation of man and his loads. Sometimes, man worships animals or is in need of them for religious purposes.

## **Animal Production in Nigeria**

The 1963/64 census figures for Nigeria show that for every one-hundred Nigerians, there were an average of twenty cattle, thirty-eight goats, thirteen sheep, one pig and 120 chickens. In comparison, for every one-hundred Danes in Denmark in the same year there were an average of seventy-two cattle, 176 pigs, one sheep, and 548 hens and chickens. While in the year 1965/66, Denmark had a total daily per caput protein intake of 94.8 g. of which 61.5 g. were derived from animal sources, Nigeria recorded a daily per caput protein intake of 52.7 g. of which only 9.2 g. or 15.6 percent of total protein intake were of animal origin. The proportion of protein required for adequate intake to ensure the adequate supply and balancing of essential amino acids is roughly forty-five percent of the total protein intake. There is little doubt that Nigerians are short of animal protein, due to a number of factors.

Early efforts to develop agriculture in this country seem to have been directed towards the supply of raw materials for export purposes with little or no consideration for contributing to the local economy through production for local consumption, thus saving foreign exchange, or improved nutrition of Nigerians, thus ensuring

the development of sound bodies with sound minds. Emphasis in agricultural development was on crops like cocoa, oil palm, rubber and groundnuts for export purposes and any interest in the development of livestock seemed to have stemmed from the urge to increase the quantity of hides and skins for oversea markets rather than the need to develop adequate sources of protein for home consumption.

There is a shortage of livestock and as earlier pointed out, most of what we have does not give economic returns at the level of inputs necessary to sustain a viable industry. The animals are unselected and therefore unproductive. There is also a lack of know-how necessary to sustain the level of productivity of imported breeds or to develop local ones. Our traditional systems of livestock husbandry must be changed in order for us to meet the ever-increasing demand for animal products from our growing population. The development of the animal industry in Nigeria is also limited by poor organisation of the marketing system, resulting in high cost and low quality animal products. In a city as large as Ibadan there are no abattoirs and most cattle for slaughter are still transported on the hoof from places as far away as Niger and Maiduguri to consumer markets in Ibadan, Benin, and Lagos. Veterinary services in Nigeria are poor and inadequate. Coupled with poor pest and disease control, these have resulted in the low level of animal production activity in the country. The occurrence of a high level of worm infestation limits the increase in the number of our sheep and goats as well as the productivity of these species while the absence of sufficient quantities of vaccines and other prophylactics aggravates the control of new-castle disease virus and coccidiosis in poultry. The small size of farmers' holdings and other sociological and religious factors also contribute to poor animal production in Nigeria. I will now pay particular attention to the problems of livestock nutrition in Nigeria, as this represents my special area of interest.

## **Livestock Nutrition in Nigeria**

Perhaps the most important factor contributing to the low efficiency shown by local breeds of livestock is the low plane of nutrition and poor quality feed intake. There is little knowledge of the nutritive requirements of animals under tropical conditions and the extent to which these requirements can be met. Feed shortages, particularly during the dry season, have been a major limiting factor to the nutrition of poultry, cattle, sheep and goats in most parts of this country. The situation is very often aggravated by overstocking and overgrazing of our natural grasslands.

It has been suggested that the small size of local livestock types may be partly due to nutritional factors such as inadequate rations

or deficiency of specific nutrients and minerals, and partly due to genetic or other managerial factors, e.g. early breeding. Whatever it is, research into livestock nutrition deserves priority attention in Nigeria if only because about sixty percent of the cost of producing animal products for human consumption can be attributed to the cost of feed.

The greatest increase in livestock production activity in Nigeria has occurred during the last decade in the area of poultry, particularly egg production of which by 1966, there was an estimated production of about two million eggs a month in Western Nigeria alone or a total of twenty-four million eggs a year or 2.4 eggs per person per year for an estimated population of ten million people. There is definitely room for expansion but unless there is a rapid increase in the production of maize and guinea corn, the present rate of growth of the poultry industry is bound to fall. At the current market price of £50 per ton, very few farmers in the country can afford to feed maize as the main component of their layers' mash. The survival of the poultry industry, as well as of pig production in Nigeria will depend largely on the availability of surplus grains or alternative concentrate feed of fairly good quality at relatively cheap prices.

During 1969/70, Nigeria produced 1.6 million tons of maize, 3.2 million tons of millet, 4.0 million tons of guinea corn and 250,000 tons of paddy rice, or a total of 9,050,000 tons of cereals in addition to 2.4 million tons of plant proteins including groundnuts. It seems to me quite clear that if the 62.5 million Nigerians are to survive, the competition between us and our livestock, particularly pigs and poultry, must be drastically reduced. We must find other sources of energy and protein for the sustenance of these classes of livestock. A few obvious alternatives such as dried ground forage legume species supplemented with crop residues including rice bran, broken rice grain and brewer's waste could be used as feed for poultry, while swine rations can be supplemented with groundnut cake and soyabean meal. A number of other exciting possibilities exist which, with adequate treatment through biological or chemical processes, and supplementation with synthetic amino acids and vitamins, may yet revolutionize poultry and pig production in this part of the world. I refer to the possible uses of discarded cocoa beans, groundnut husks, as well as sawdust from our many sawmills as sources of food for pigs and poultry, as well as sheep and goats. There is also a shortage in the supply of feedstuffs of animal origin, including fish meal, which are essential for adequate nutrition of poultry.

Nigeria is an oil-producing country. It is therefore within the realms of possibility for her to think in terms of a steady source of protein derivable from petroleum products, e.g. yeast grown on paraffinic hydrocarbons. While such proteins may not be readily



acceptable to human beings, they can be fed to animals like pigs and poultry which will serve as ready converters. These animals may also be used to convert leaf protein and proteins from algae fed on sewage effluents to acceptable animal proteins for human food. Above all, there is a need for appropriate legislative action to retain adequate amounts of groundnut and palm kernel cakes in Nigeria to meet the needs of our growing livestock industry.

As I pointed out earlier, cattle, sheep and goats are herbivores and naturally live on grass as their main source of food. Nigeria is largely a grassland country with an estimated 150 million acres of natural grassland. This represents three-fifths of the country's total land area, most of which is subject to annual burns and frequent overgrazing from uncontrolled herds. Nearly half of this area is in the middle belt zone of the country with a low population of livestock and human beings, due to the occurrence of the tsetse fly. These biting flies carry the disease trypanosomiasis which is deadly to livestock and man. Despite this, the middle belt area of Nigeria has been described as the frontier for agricultural development in this country, although there is little hope that the tsetse will be eliminated in the face of recent findings of extreme adaptive mechanism exhibited by these flies. A different approach to the problem? It seems to me that livestock must be made to adapt in the same way as we are adapting to malaria parasites by raising the level of livestock nutrition and through the increased use of prophylactics for clinical cases of trypanosomiasis.

If we succeed in getting rid of the tsetse fly, and I must admit that that is a great "if", then this country should be able to provide enough feed to sustain an estimated livestock population of twenty million heads of cattle and fifty million sheep and goats from her natural grassland resources, provided these are properly managed. It is therefore an irony of fate that today we suffer from chronic malnutrition resulting from lack of sufficient animal protein in our diets. It is true that we cannot eat a blade of grass directly but we can feed it to livestock, the polygastric ruminant which possesses a compartmentalized fore-stomach or rumen, a fermentation factory through which the animal is able to use complex polysaccharides such as cellulose for energy and synthesize its required amino acids from dietary proteins and non-protein nitrogen sources. Ruminants are thus able to convert grass into juicy, tender sirloin steaks and legs of mutton. This means that by following good range-management practices, this country can become a major exporter of good choice beef instead of a consumer of inadequately nourished, tough, stringy beef derived from walking "bags of bones" which we refer to as cattle, and which continue to move in an unending stream from the north to the south of the country.

Results from research designed to evaluate the productivity and feed quality of tropical forage crops indicate that Nigeria has the potential for high dry matter production from many adapted grasses and legumes, especially in the high rainfall areas of the country. Increased use of these forage grasses and legumes may however be limited by a shortage of seed for their propagation and a lack of knowledge in establishment, grazing management as well as conservation practices. Tropical forage crops however tend to mature much more quickly and have lower protein contents compared to temperate grasses at comparable stages of growth.

Work is currently underway to improve both the yield and protein content of these forage crops through plant breeding and selection in order to make the supply of good quality roughage as feed for ruminants a feasible and economic proposition in Nigeria. Our current four-year development plan includes the development of urban dairy schemes in many states. The success of any such scheme will depend on the availability of cheap and adequate supply of high quality roughage derived from grazing, or fed as soilage or as silage during the dry season.

It seems therefore that with a better co-ordinated plan for the utilization of Nigeria's natural grassland resources and given the potential for production inherent in our improved pasture species, we certainly should have adequate feed for livestock production to satisfy not only our needs for animal protein but also those of our neighbouring countries.

But why, you may ask, must we suffer in the midst of such vast potential resources? The answer is simple—because we are an ignorant people; but ignorance is a disease and not a curse; it can be cured through knowledge. We need to know a lot about our natural grasslands in order to bring more land into profitable economic use. In 1966, I wrote *inter alia*:

“First of all, there should be an improvement in the understanding of the present use and land tenure patterns including knowledge of the response of forage species to management and other conditions of use imposed by the livestock grazer. Second, reliable information should be developed concerning the nutritional value of the principal forage species, estimates of present and potential water available for livestock use, an evaluation of the seasonality of forage production and the alternatives available for livestock feeding during the periods of low forage quality and production”.

A lot more knowledge is required on how best to manage important forage grass species like Northern Gamba grass, (*Andropogon gayanus*) or Elephant grass, (*Pennisetum purpureum*) or Guinea grass, (*Panicum maximum*) and forage legumes like (*Stylosanthes gracilis*)

and (*Centrosema pubescens*), grasses and legumes known to be adapted to our soil and climate, which, to my mind, are destined to become the pillars of our future beef and dairy industries. We need to learn to use fire more as an instrument of management of our natural grasslands and less as an agent of destruction. Perhaps the prophet Joel had us in mind when he wrote: "The beasts of the field cry unto thee; for the rivers of waters are dried up and the fire hath devoured the pastures of the wilderness".

Besides their ability to feed on grass, ruminants are also able to utilize crop waste products which are often unusable directly as food by man. It is not generally realised that maize stover, guinea corn stalk and rice straw form a high proportion of the "harvest" which can only become food for man if fed to livestock. Let us take an example known to us. The Western State last year produced about 300,000 tons of dried cocoa beans for sale. Cocoa husk represents seventy-five percent of the dry matter of the cocoa pod. This means that an estimated 900,000 tons of cocoa husk can be made available as feed to ruminants provided it can be turned into a meal and treated to remove any toxic substances it may contain. Chemical analyses of cocoa husk show that it contains adequate levels of carbohydrates and protein for the nutrition of ruminants and with supplementation with other concentrates such as groundnut cake, and cotton seed meal for example, it could become an acceptable feed for cattle, sheep and the much maligned dwarf goat. It is pertinent at this stage to point out that these small animals have a lot to contribute to our supply of meat and meat products in this part of the world. They are particularly suited to our hot, humid climate and are reported to be tolerant to local strains of trypanosomiasis. They often live as scavengers on village waste products supplemented with occasional peelings of yams and cassava. The potential for supply of meat and animal products would therefore seem unlimited under our environment.

So far I have called attention to the very few conventional domesticated stock living on the more traditional feed sources. Yet there occurs as part of our ecological communities several ungulates presently referred to as "game animals" which can become regular sources of good, acceptable meat for our people. This group of animals may not depend on the traditional feed sources as they already exist in different ecological niches, each animal type living on different groups of plants. I am referring to animals such as the duiker, cane rat and guinea fowl of which very little is known about their types and habitats, modes of reproduction, nutritional and environmental requirements, conditions necessary for successful domestication and their possible roles in our search for more meat for more people.

## Research in Animal Science at Ife

Some work is already underway in our Department of Animal Science directed towards solving some of the problems of livestock nutrition highlighted in this lecture. Our scientists are already looking into the possibilities of alternative sources of feeds for pigs and poultry based on discarded cocoa beans and brewer's waste from the nation's beer factories. Forage crop legumes have been incorporated into the rations of our livestock in place of other imported feed ingredients like alfalfa meal and "luru". The nutrient requirements for the maintenance and growth of sheep and goats are actively under investigation, using various grass species plus supplemental feed as the basis for developing improved husbandry systems of production of sheep and goats. Local breeds of cattle are being tested on our university farm for their ability to utilize improved pastures and legumes in beef production enterprises, while we are co-operating with the International Atomic Energy Agency, the Institute of Agricultural Research and Training, and the Department of Biological Sciences in solving production problems of our natural grasslands. This work involves the use of heavy nitrogen and radioactive phosphorus. Work is also progressing, on the nutritive evaluation of major forage crops like guinea grass (*Panicum maximum*) and giantstar grass, (*Cynodon plectostachyum*), using sheep and goats as test animals. With more funds we hope to embark on solving the problems of the provision of dry season feed to Nigerian livestock through research into the nutritive quality and chemical composition of silage and hay as related to species composition, stage of growth and level of fertilization. The role of fertilizers in extending the grazing season for specific forage crops will also be investigated. Research into utilization of pasture and forage crops by ruminant stock is backed by fundamental studies on the nature and physiology of rumen microbes under our environment.

We have planned research into the possibilities of utilizing molasses waste products from the Bacita factory with urea supplementation for fattening beef animals as well as for feed for sheep and goats. Within a couple of months, work will be underway to test the acceptability of otherwise of cocoa husks by ruminant stock on our farms. These practical studies are designed to give farmers and extension officers information necessary to meet their day-to-day managerial production problems. We are concerned primarily with those principles that govern the conversion of all classes of feed into flesh, milk, eggs, hides and skins. We are involved in accumulating the scientific knowledge necessary to turn all grass into flesh.

I have briefly presented in fairly general terms some of the problems I consider require urgent attention to improve livestock

nutrition and numbers in Nigeria. Nutrition, of course, is not the only area of interest to animal producers. Indeed, it is becoming more and more important to have animals with the right genetic make-up which will be able to make the most economic gains or produce the most milk from the limited quantity of feed resources available. The selection and breeding of livestock is an essential forerunner to adequate livestock nutrition. It is relevant to point out here that so far very little effort is devoted to this aspect of the animal improvement programme in Nigeria. Our Department of Animal Science at the University of Ife may soon become the only breeding centre for poultry in the country if we continue to get the kind of support from the University hitherto given to our development efforts. We have now established a large number of local strains of poultry some of which compare favourably in growth rate with the imported strains. We are also co-operating with the Western Nigeria Development Corporation in a bid to change the objective of livestock development of the cattle ranch at Upper Ogun from simply serving as a livestock multiplication centre into one of a regional breeding station capable of supplying breeding stock, including proven bulls, to other livestock stations in the country.

Besides tackling problems of undernutrition and malnutrition including specific deficiencies of minerals and vitamins, lack of grazing and reduction of the high cost of feed, research is going on at Ife into the diagnosis and control of livestock diseases that tend to reduce **efficiency of feed utilization** and generally predispose the animal to **poor performance**. Emphasis is directed towards the control of **worm infestation** in sheep and goats. A survey on the identification of blood mineral levels as a basis for the establishment of an index of adequacy or deficiency of supply of specific minerals in cattle is planned for next rainy season. The Department is fully conscious that efficiency of production by livestock is a function of breed, good feed, adequate shelter and maintenance of health. Animal production is in many ways similar to other processing industries engaged in the transformation of raw materials into finished or semi-finished products.

## Conclusion

It has not been possible to discuss costs, returns and profitability in this lecture. Yet the incentive to seek returns in terms of increased livestock production can only come from a profit motive. Most of our country's cattle owners and graziers continue to regard their animals as some form of insurance and as savings and are not sufficiently motivated to seek monetary rewards, yet if the results from the research that we propose must make any impact they must add

to the efficiency and profitability of the livestock industry. Hence, I will advocate, last but not least, that research into the economics of livestock production, processing and marketing as a profitable venture be taken urgently in hand by our agricultural economists.

Finally, ladies and gentlemen, I must hasten to point out that improvement in livestock production in Nigeria is only possible within the context of an overall improvement in all other aspects of agricultural development in this country. Just as we need a grain surplus as a basis for development in pigs and poultry production, we need adequate soil management and water conservation practices to keep our soils productive, good storage facilities and a cheap and efficient processing technique for our crop and animal products, good roads and communications for fast transportation of highly perishable products and efficient distribution at low costs to consumers. We need to develop adequate organization for getting scientific information to the farmer. But above all, we need to guarantee adequate returns to our farmers and to provide incentives like good water supply, adequate housing and rural electrification to our farming communities. It is only in this context that we can truly develop the capacity necessary to convert all grass to flesh for the benefit of this nation. Schultz, in his book *Changing Traditional Agriculture*, rightly pointed out that the rate at which the agriculture of countries like Nigeria can be improved is dependent to a great extent on the general level of literacy and education in the population and on the willingness of governments to provide generous support for agricultural education and research.

“And the earth brought forth Grass . . .  
whose seed was in itself, after its  
kind: and God saw that it was good”.

*Genesis 1, 12.*

“And it was commanded them that they  
should not hurt the grass of the earth,  
neither any green thing . . .”

*Revelation 9, 4.*

001439