Production of Meat from Ruminant Animals

By

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INTRODUCTION

ANYONE who attempts to look into the complex problems of the economic development in a low-income country soon discovers that he is dealing with incomplete or inaccurate statistical data on agricultural production and marketing. This lack of adequate data makes planning difficult and measuring the progress of regional and national development plans nearly impossible. It is usually the livestock sector of agriculture for which information is most lacking, and it is not uncommon for estimates of livestock numbers and productivity to be pure guesswork.

With the rapid rate of population growth that the world is witnessing, it is a must that the animal protein production be increased. Urbanisation and rising incomes are creating a growing demand for more food in addition to the increase in population growth. Income expansion and urbanization not only enlarge the demand for traditional foods, but rising incomes also enable greater consumption of preferred foods such as vegetables, fruit, meat, fish, and poultry. Other factors that shift food demands are increased familiarity with and availability of foods which result from education and urbanization.

Nigeria is an excellent example of a nation in critical need of expanding its agricultural production, particularly the livestock sector.

Livestock's share of the Gross Domestic Product (GDP) amounted to only 5% (Ferguson, 1967). Nevertheless they are very important to the national economy. According to Oyenuga (1966) livestock accounted for only 10.91% of the total value of agricultural activities in 1960.

Before dealing with the production of meat from the ruminant animals it is necessary to go through a cursory survey of the population of both human and the ruminants, the level of nutrition of the population in the context of the protein supply.

Livestock Population

One of the most limiting factors to livestock improvement is the lack of precise knowledge of the Nigerian livestock population. Differing estimates have been given, varying from 5.3 million (FAO, 1950) to 9.6 million (National Livestock Development Committee 1971), to 11.6 million (FAO, 1970) heads for cattle. Estimates of livestock population in Nigeria by the F.A.O. Agricultural Mission to Nigeria (1965) are shown in Table 1. If the information in this table is related to the 1963 human population census of 55.67 million, the value of 20 heads of cattle, 38 of goats, 13 of sheep and one of pig for every 100 Nigerians is arrived at. These figures show that the proportion of livestock population to human population is relatively low and calls for considerable livestock expansion so as to meet the need of the rapidly increasing human population. However, the present state of low animal products in the country can be attributed more to the low rate of output by the animals rather than to shortage of livestock numbers. For instance, while the European or American breeds of cattle reach slaughter weight between 1.5 and 2.5 years of age the indigenous breeds do not attain slaughter weight until they are 4 to 7 years. Their mature body weight is low, with a carcass weight of about 150 kg for the White Fulani (Zebu) and 100 kg for the N'Dama, compared with 220 kg and 269 kg in the European and the North American cattle respectively (Oyenuga, 1966).

TABLE 1
Estimated Livestock Population in Nigeria 1963/64
'000

Horses	431.2
Donkeys	2,085.0
Camels	16.8
Cattle	10,858.6
Goats	21,205.7
Sheep	7,234.8
Pigs	680.4
Poultry	66,039.6
Total	108,551.9

Source - Agricultural Development in Nigeria 1965-1980 F.A.O. Rome (1966).

Protein Requirements

Of the 53g protein consumed per head per day by Nigerians in 1967, only 7 g or 13.2% was derived from animal sources, while countries such as New Zealand obtained 73.6 g or 67.8 %; Denmark, 61.5 g or 64.9 %; the United States of America, 61.5 g or 70.8 %; and the United Kingdom, 52.7 g or 59.3 %, of their protein needs per caput per day, from animal sources.

The estimated minimum protein requirement of an adult Nigerian varies between 65 and 75 g per head per day, out of which 35 g or approximately between 53.8 % and 48.6% should be from animal sources. Assuming that 25 g out of this 35 g could be obtained from meat, this would amount to about 9 kg of protein annually from meat. If further assumption is made that meat contains 15% protein, the annual per caput consumption of 60 kg of meat will be needed.

Oyenuga (1969) estimated the protein requirements and supplies for the years 1963 through 1970, calculated on the national body weight (lower) and on the F.A.O. reference body weight (upper limit), using the 1963 population census figures, the figures arrived at are shown in Table 2. The data in Table 2 indicate that while the mean daily per caput supplies of protein in 1963 were approximately 51 g, the daily requirements were 53 g at the lower and 61 g at the upper levels of estimates per day, resulting in a total shortage of 115,000 kg and 1.2 million kg at the two levels respectively for the 55.7 million Nigerians in 1963. In 1968 the shortages amounted to

18,000 and 510,000 kg respectively and by 1990, there should be a surplus of 739,000 kg at the lower limit, and, should the level of protein intake per caput rise to 61g per day, there will still be a slight protein shortage. On the basis of an average of annual 4% rate of growth of animal protein, obtained between 1958 and 1966, the estimated amount of animal protein supplied in Nigeria per head per day is shown in Table 3. Using these data, the supply and need of animal protein between 1970 and 1990 is estimated and the values arrived at are shown in Table 4. The data in Table 4 show that supplies of protein from animal sources in Nigeria would be less than 50% of requirements in 1980, 50% in 1985 and a third under half in 1990. It is obvious that there is an acute shortage of animal protein and if requirements are to be met by 1990 the annual rate of increase would have to be increased considerably over the estimated 4%.

Meat Production

The F.A.O. Mission to Nigeria (1965) has estimated that 437,500 metric tons of meat were produced from Nigeria's domestic livestock in 1963/64 (Table 5). To this can be added 158,000 m. tons of offals which together gives an average annual consumption of 10.5 kg of meat and offal or 7.7 kg of meat. Based on the estimated cattle population, annual rate of slaughter (about 10%) and the total meat output an average carcass weight of about 180 kg was obtained. When the average production of milk estimated to be about 93 gallons per cow, is considered, it is

TABLE 3

Mean estimated per caput animal protein supply in Nigeria between 1963 and 1990 [g/day]

1963	1968	1970	1980	1985	1990
6.6	7.9	8.5	10.0	12.0	14.4

Source—Oyenuga (1969).

TABLE 4

Supplies in relation to requirements of animal proteins in Nigeria in 1970, 1980, 1985 and 1990

1970	1980	1985	1990
(a) Total daily supply (8.5 x 67m.) 569,500 kg	(a) Total daily supply (10 x 86,6m.) 866,000	(a) Total daily supply (12 x 99.6m.) 1,195,200 kg	(a) Total daily supply (14.4 x 115.6m.) 1,664,640 kg
(b) Total daily requirements 1,603,000 kg.	(b) Total daily requirements 2,078,400 kg	(b) Total daily requirements 2,390,400 kg	(b) Total daily requirements 2,774,400 kg
(c) Daily shortage (b)-(a) 1,038,500 kg Per caput 15.5g Shortage % supply: 182%	(c) Shortage (b)-(a) 1,212,400 kg Per caput 14 Shortage % supply: 140%	(c) Shortage (b)-(a) 1,195,200 kg Per caput 12.0g Shortage % supply: 100%	(c) Shortage (b)-(a) 1,109,760 kg Per caput 9.6g Shortage % supply: 66.7%

Source - Oyenuga (1969)

TABLE 5

Nigeria's Meat Supplies 1963-64

Type of meat	Quantity (m. tons)	Per cent
Beef	196,000	44.9
Goat	96,500	22.1
Mutton	42,000	9.5
Pork	50,000	11.4
Poultry	53,000	12.1
Total	437,500	100.00

Source—Agricultural Development in Nigeria 1965-1980
F.A.O. Rome (1966).

obvious that relative to those in the more developed countries the amount of "harvested" meat including milk from Nigerian cattle is very low. Except for South America, Asia, Central America and the Caribbean and the mean for Africa, which it exceeds, the mean "harvested" meat per cattle in Nigeria is 32.6 % that of U.S.A.,

26.7 % that of Canada, 19.3 % that of Europe (excluding U.S.S.R.) and 4.4 % that of Australia and New Zealand.

The Joint Planning Committee on Agricultural Development in Nigeria (1973-1985) has estimated the number of cattle needed to be slaughtered annually in order to meet the protein requirements from beef and these are shown in Table 6.

The Committee's comments on Table 6 are straight forward and simple "the Figures suggest the nutritionists view of the protein needs and possible source for an adequate diet in Nigeria. . . . These estimates demonstrate the short fall in beef production, and, by extension in all meat, and for that matter protein, from all animal sources in Nigeria. They also expose for examination a vast area of opportunities in production, marketing and servicing animal industries in Nigeria".

Some of the factors which combine to create more demands for meat and all animal products in general have already been touched upon in this paper. These, as well as some other factors such as (i) habits (beef once a week or beef for feasts and banquets), (ii) tastes (personal choice; beef before other meat), and (iii) availability and price of competing meats, and, in addition, estimates of an annual increase in demand of 0.75 to 0.85%, were considered by the Committee and arrived at

TABLE 6

Estimates of Annual Cattle Slaughter Needed to meet the Protein Requirements from Beef in Nigeria, 1963-64 and 1970-80*

Item	At 25g protein daily per caput		At 10g protein daily per caput	
	1963-1964	1970-80	1963-64	1970-80
Annual Consumption per caput beef (kg)	27	21	21	8
Quantity Needed for Nigeria (tonnes)	1.35m.	1.68m.	0.55m.	0.64m.
Conversion (annual million head, no offal) Lean Meat at 68 kg beef/carcass (Nigerian Tean)	20	24.7	8	9.4
At 96 kg beef/carcass (FAO estimates)	14	17.5	5.6	6.7

*Source: Agricultural Development in Nigeria 1973-1985.

TABLE 7

Project Demand and Supply of Beef Cattle in Nigeria

Year	Effective demand*	Anticipated Supply +	Theoretical Deficit ++
1970/71	1,050,000	1,050,000	0
1971/72	1,090,000	1,040,000	50,000
1972/73	1,130,000	1,030,000	100,000
1973/74	1,170,000	1,020,000	150,000
1974/75	1,210,000	1,010,000	200,000
1975/76	1,250,000	1,010,000	240,000
1976/77	1,290,000	1,015,000	275,000
1977/78	1,330,000	1,020,000	310,000
1978/79	1,380,000	1,030,000	350,000
1979/80	1,430,000	1,050,000	380,000

* Within the limits of purchasing power.

+ To be available from within the four Chad Basin countries.

++ This deficit can be left outstanding, made up by alternate species or finally defrayed by importation of chilled beef for the coastal cities at least.

Source: Agricultural Development in Nigeria 1973-1985.

"the projected demand and supply" with respect to slaughter cattle in Nigeria for the years 1970-1980 as shown in Table 7. It can be observed in the table that even though the deficits shown are theoretical ones but they can be real and are real as evidenced by the importation of large quantity of chilled meat into the country in recent months.

Improvement of Ruminant Animal Production

More than half the cattle of the world are raised in the tropics, where human undernutrition and malnutrition that could be remedied by greater use of animal products are still rife. Progress, which depends on better production and use of grass, has been limited hitherto by misuse of cattle, by overgrazing, and by disease. The potential output of beef as well as of mutton and goat meat in Nigeria is vast and could eventually lead to export business (McIlroy, 1962). This statement by the late Professor McIlroy can become a reality provided the tasks before us in the scientific production of these classes of livestock are taken with the seriousness they deserve and tackled with the zeal and all the resources at our disposal.

Fortunately for us more than 80% of the total land area of this country is covered with grass, the main diet of the ruminant animal. However, the grass that these animals have lived upon for centuries is of low or poor nutritive quality. The most important and urgent task to be solved therefore, is the improvement of the plane of nutrition of the ruminant animal.

Grassland Improvement

Short and tall grass species which cover a substantial part of the country's agricultural land have a two-fold role to play in the national agricultural economy. They form the main source of food for the three categories of livestock being discussed and, in addition, grasses help in building up soil fertility. There is need for more intensive study of the grass species that characterised the natural grassland in Nigeria so as to know their distribution, palatability, seedling vigour, seasonality of herbage production and their

nutritive value so that the carrying capacity can be increased. There is also the need to know the response of these grasses to management practices such as rotational grazing, stocking rate, fertilizer application, burning and the length of the resting period.

In the northern Guinea Savanna grazing management, controlled burning and shrub control coupled with oversowing of rangelands with legumes such as *Stylosanthes* have been recommended to improve herbage quality (Ademosun, 1973). In the Southern Guinea and Derived Savanna, there are potentials for ranching, because the rainfall is higher and the dry season is shorter in these zones. Grass species such as *Andropogon gayanus* and *Hyparrhenia rufa* are more productive. The natural species in these zones can be improved by oversowing with legumes such as *Centrosema pubescens* and *Stylosanthes guyanensis*, the provision of water and other proper management practices.

Sown Pastures

The need to increase forage production by replacing natural rangeland with highly productive and more nutritious intensively managed sown pastures has been emphasized in many reports. There are varying types and species of grasses in the country (Oyenuga, 1957). Important among those that are indigenous to the country are the *Pennisetum* species, *Andropogon* species, *Chloris gayanus*, *Panicum maximum*, *Cynodon* species, *Melinis minutiflora*, and *Setaria sphacolata*. A number of exotic grasses such as *Cenchrus ciliaris* and some others have been successfully established. Unlike grasses the choice of tropical legumes is not so wide. The many varieties that exist are either short-lived or less drought-resisting or do not withstand trampling by animals. *Centrosema pubescens* and *Stylosanthes guyanensis* (*Stylo. gracilis*) have proved very valuable.

The amount of work already carried out in the country would seem to indicate that investments of money on grassland research with a view to improving livestock production in both the humid and the dry zones would yield great dividends in the form of animal productivity. More

studies, however, are still necessary on the appropriate states of growth and maturity at which various types of Nigerian grasses should be harvested or grazed in order to obtain from them maximum energy, protein and mineral content.

protein yields were of the order of 773 kg/ha and 814 kg/ha respectively. At Ibadan, the annual mean yields of dry matter for the same grass species ranged from approximately 12 ton/ha to approximately 34 ton/ha when the grass was

TABLE 8

Mean annual yield (t/ha) of dry matter, crude protein and the mean crude protein and mineral content of four grass-legume mixtures.

	H	J	K	L
Dry matter tons/ha.	36.9±5.1	41.3±2.63	44.0±10.2	47.0±8.69
Crude protein tons/ha.	4.2±0.59	5.1±1.27	5.1±1.87	5.1±1.18
Crude protein (%)	11.3	12.2	11.4	10.8
Calcium (%)	0.52	0.49	0.47	0.45
Phosphorus (%)	0.22	0.23	0.23	0.21
Magnesium (%)	0.20	0.24	0.25	0.22
Iron (mg/kg)	298	320	305	280
Copper (mg/kg)	16	16	14	13
Zinc (mg/kg)	52	41	42	45

H = *Cynodon nlemfuensis* var *robustus*, *Centrosema pubescens* (Benth), and *Stylosanthes cracilis* (H.B.K.)

J = *Pennisetum purpureum* (Schum) in mixture with the two legumes in H.

K = J plus *Panicum maximum* (Jacq).

L = a mixture of all grass and legume species in H, J, and K.

Source: Oyenuga and Olubajo (1975).

On Table 8 are summarised the mean yields of dry matter and of crude protein and the mineral and crude protein contents of some grass-legume mixtures grown in the country. It can be seen from these data in Table 8 that the dry matter yield of the mixtures are high enough for the more humid areas of the south. The animal production (Zebu Steers) without supplementation on these pastures were 0.38, 0.40, 0.31, and 0.38 kg/head/day for treatments H, J, K and L respectively during the rainy season and -0.05, 0.07, 0.04 and 0.03 kg/head/day respectively for the same treatments in the dry season over a three year period. There is no doubt that there could have been substantial improvement in mean daily weight gain if the grass available during the dry season was supplemented with a high protein source such as legume hay.

At Samaru, Zaria, means of 8.6 and 11.7 ton/ha of dry matter have been reported for old and young stands of *Pennisetum purpureum* respectively, fertilized with between 150 to 300 kg N/ha. The crude

harvested at intervals of three and twelve weeks respectively. The corresponding values for crude protein yields were 1.7 and 3.3 ton/ha. At Ife an estimated value of approximately 40 ton/ha per annum was obtained for the same species of grass. *Panicum maximum* gave the same amount of dry matter yield as *Pennisetum purpureum* when harvested at intervals of three weeks but gave 33% less dry matter when cut at twelve week intervals. The crude protein yields for the two intervals of harvesting were 1.34 and 1.47 ton/ha per annum respectively.

The composition, digestibility, and animal production of some sown pastures are presented in Table 9. The data in Table 9 show the need of supplementary ration for livestock in the dry season. The live weight gains made during the dry season for the pure stands of the grass species in treatments M, N, P, and Q were as a result of feeding the steers hay made from the same pastures.

Haggar (1970) and Zemelink *et al* (1972) have reported improvement in the

TABLE 9
Composition, digestibility and Animal Production of some Pastures

Pasture	Dry Matter (%)	Crude Protein (%)	Crude Fibre (%)	NFE digested (%)	DM (%)	Weight gain kg/day	
						Rainy season	Dry season
B	31.9	12.0	31.8	42.8	71.8S	0.27N	-0.009
1 C	31.4	12.0	31.8	42.7	70.6S	0.26N	-0.006
D	31.6	12.2	31.8	42.4	71.9S	0.25N	-0.009
E	33.4	11.7	36.5	42.8	63.3F	0.21F	—
2 F	33.1	11.8	36.2	42.4	64.5F	0.23F	—
G	30.4	13.3	37.2	38.6	61.3F	0.16F	—
M	28.8	13.5	33.7	46.0	64.2S	0.28F	+0.11
N	17.5	14.5	31.9	43.5	55.6S	0.46F	+0.15
3 P	30.4	12.9	35.0	44.5	66.4S	0.49F	+0.03
Q	23.4	12.4	35.4	44.7	53.4S	0.47F	+0.24
4 <i>Pen. purpureum</i>	—	—	—	—	59.1S	—	—
	—	—	—	—	55.2G	—	—
5 <i>Panicum maximum</i>	—	10.1	38.6	38.9	52.3G	—	—
6 <i>Stylosanthes gracilis</i>		13.2	32.2	44.6	59.7G	-0.3	
		"	"	"	56.5S	-2.2	

Note 1 B = *Cynodon plectostachyus* + *Centrosema pubescens*
C = B + *Chloris ghayana* + *Digitaria decumbens*
D = C + *Stylosanthes gracilis*

Note 2 E = As in B above.
F = E in mixture with *Stylosanthes gracilis*.
G = *Digitaria decumbens* + 2 legumes in F.

Note 3 M = Pure stand of *Cynodon nlemfuensis* var. *robustus*
N = " " " *Pennisetum purpureum*
P = " " " *Cynodon nlemfuensis* var. *nlemfuensis*
Q = " " " *Panicum maximum*

Source: 1 Okorie *et al* (1965)
2 Olubajo (1969)
3 Olubajo and Oyenuga (1975)
4 Ademosu (1970)
5 Ademosu (1973)
6 Ademosu (1970)

s = sheep c = White Fulani g = goat N = N'Dama

intake and therefore the digestibility of *Andropogon gayanus* hay supplemented with either good legume hay or other protein source.

Reports from Samaru indicate that young stock given access to previously ungrazed *Stylosanthes guyanensis* pasture in the dry season (March) made an average of 0.4 kg/head/day during the first four weeks but lost an average of 0.3 kg/head/day until the early rainy season. Wet season grazing at three stocking rates of 4.3, 4.1 and 1.6 head/ha resulting in an average liveweight increases of 0.28 kg/

head/ha for the highest stocking rate and 0.44 kg/head/day for each of the other stocking densities. Report from the same station of sheep grazed on pastures of *Cynodon plectostachyus* and *Digitaria smutsii* in 1972 and 1973 resulted in an average liveweight gain of 20 g/head/day and 40 g/head/day for the grasses respectively.

Sheep and Goats

These two species of ruminants are the most maligned because of their characteristic habit of grazing low. The allegation has also been made that they destroy

farmlands. These two species of livestock have an important role to play in the production of meat for the human population, particularly in the southern part of this country where they only thrive as scavengers. There is the need to study their feeding characteristics more closely whereby they can be integrated into the farming system of the local farmer on a semi-intensive scale of between fifteen to thirty head per farmer. Goats in particular have an added advantage of being highly prolific. Results have shown at Ife that out of a total 67 kiddlings, 35 % were singles, 55 % twins, and 10 % triplets, while in a flock of sheep 63 % of the lamblings were singles and the rest twins.

One of the main problems limiting sheep and goat production is the high incidence of diseases such as helminthiasis and pneumogastroenteritis (kata) which take a large toll of the flock under intensive system of management.

In summary it can be said that the low plane of nutrition that the various classes of livestock have been exposed to over the centuries had not enabled them to express their genetic potentials to the maximum. More intensive studies are still needed on the various indigenous grass and legume species as well as the imported ones particularly on commercial lines to be able to give true meaning to the results of research work done so far.

There must be provision of more water in the tsetse-free zone either through the construction of dams across small streams or by means of bore holes and reservoirs to provide water for irrigation so as to allow for a longer grazing period. The more tripanosomiasis-tolerant breeds of cattle must be introduced into the tsetse infested areas of the Guinea and Derived Savanna regions of the country. Also, the present natural rangelands needs to be improved by seeding with the more adapted and highly nutritious legumes, and there must be adequate provision of supplementary feeds in the form of conserved forages for dry season feeding. In this connection more studies still need be undertaken to look into the suitability of otherwise of agroallied industrial waste products which can replace some of the

conventional and highly expensive feeds in current use.

Provision of feedlot may prove expensive in the long run except feedlot overhead can be reduced considerably by increased forage production by the use of higher levels of fertilizer.

At present there is a keen competition between human beings and livestock in the use of cereal grains as sources of food. This is more so in developing country like ours. It is now more pressing than ever before that we investigate other sources of concentrate feeds such as cassava and sweet potatoes as alternatives to maize, sorghum or millet.

Finally may I seize this opportunity to appeal to the authorities concerned that now is the time to give serious thought to the burning issue of livestock census in this country. Without knowing the accurate number of cattle, sheep, goats and other species we have in this country, future planning with a view to improving and increasing the population of these animals, particularly in terms of stocking rate, feed production etc. will be made difficult and a futile exercise.

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