SUSTAINABILITY AND DEVELOPMENT:
PARADIGMS FROM NIGERIA'S LIVESTOCK INDUSTRY

An Inaugural Lecture Delivered

by

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The Vice-Chancellor,
Deputy Vice-Chancellors,
The Registrar,
Provost, College of Medicine,
The Dean, Faculty of Agriculture and Forestry,
Deans of other Faculties and the Post Graduate School,
Distinguished Ladies and Gentlemen.

INTRODUCTION:

The provision of food for the table has become of serious concern to the average Nigerian family to which you and I belong. Fasting has become the order of the day, not as a voluntary means of drawing nearer the creator, but as a means of sustaining hope for another day's meal. The consumption of meat, egg and milk in particular has become a forgotten issue even on so called middle class dining tables, in response to non-existent expendable income. And when meat and meat products are persistently excluded from meals, the human body reacts by draining its already scarce nitrogen reserves, resulting in a negative nitrogen balance with attendant adverse effects on growth, reproduction, lactation, health and survival. The ability of the average Nigerian family to sustain animal protein consumption therefore becomes a sensitive barometer for assessing not only the physical but also the economic well being of the nation.

About two decades ago, the first inaugural lecturer from the Department of Animal Science, Professor G.M. Babatunde, warned of the impending doom facing Nigeria's Livestock Industry in his lecture entitled "The tottering Nigeria Livestock sector: Its problems and possibilities" He predicted, rightly too, that like most inaugural lectures, it might end up in the waste paper basket as they make very little or no impact on individuals or government agencies. However documentations of this nature have their merits as they give the

opportunity of hind sight, revealing that the Professor not only professes but can also prophesy. Yes, that lecture was prophetic, as barely half a decade after its delivery, our country embarked on the Structural Adjustment Programme (SAP) in 1986. Then, like many other industries, Nigeria's Livestock Sector was exposed as a tottering, legless giant that came crumbling and tumbling in the face of ban on importation of its basic inputs and supply shortages from within. Like the Completely Knock Down (CKD) engines, without imports, there were no spare parts from within for its sustenance. Given the harsh economic climate and the fact that poor and populous regions of the world are most dependent on crop products, survival of the Livestock Industry remains bleak. With shrinking expendable income and purchasing power, it is convenient for the majority of Nigerians to 'step-aside' into the tradition of dotting or decorating a plate of food with meat, particularly on festivities, not as a means of meeting any nutritional needs, but at least to keep to tradition and relieve memories of the "good old days" when meat was affordable to the average Nigerian. Indeed, it is not unusual to find the household head enforcing that he takes the lion share or even all of the meat. Thus, the goal of 35g per caput per day as recommended by WHO and entrenched as a development goal of government might be a delusion unless socio-economic conditions improve. However, it is important to note that for large cities, the market for livestock and livestock-products can be sustainably developed if and only if the challenges of producing livestock at affordable prices can be addressed. Wherein, therefore, lies sustainability for Nigeria's livestock industry?

SUSTAINABILITY AND DEVELOPMENT:

Mr. Vice-chancellor Sir, the terms sustainability and development have globally become articles of faith, a shibboleth, often used, but little explained. Sustainability has been defined in so many different ways that it no longer has an accepted (or acceptable) meaning.

Nevertheless, it is being used as a label to confer respectability on corporate plans and research proposals, practical projects, attitudes and intellectual positions. As pointed out by Spedding (1995), "It would appear that everyone is in favour of sustainability, and this alone is sufficient reason to doubt that it has a useful meaning and to suspect that it is being used by individuals to suit their own purposes"

In Agriculture, and often in the physical sciences, it is clear that there are some senses in which it can be legitimately used. As follows:

1. Physical sustainability, which in systems terminology, would be expressed as "without generating negative physical feedback".
2. Biological systainability-which involves reproductive and other essential processes of living organisms without which they would cease to exist.

Sustainability is also increasingly expanded to include economic and social criteria which connote a development process that is equitable, responsive to felt-needs of people and generates development benefits on a continual, replicable basis. This would imply a general improvement in quality of life and especially food self-sufficiency. It is geared to eradicate poverty.

But in Nigeria, poverty itself has become highly sustainable, particularly as poverty alleviation programmes only serve to enhance the affluence of the few elites in our society. Indeed, globally, cruelty and poverty are partially sustainable but not (to many of us) desirable. Therefore, although sustainability in its physical sense is a necessary condition, it is by itself, insufficient justification for an activity, process or system.

Development on the other hand is no longer seen exclusively as a matter of the growth rate of national income or the rate of capital formation or in our present discourse, as economic sustainability. The new emphasis is on wider and more qualitative aspects of development, such as improvements in income distribution, employment, health, housing, education and so forth. One fact that emerges clearly is that an increase in economic growth does not

necessarily benefit all sections of society. The conventional wisdom was that an increase in national income would somehow filter or "trickle down" to the under-privileged. For the most part, this has not happened. This is partly because the growth process itself does not necessarily bring about changes in the structure of the society. By abandoning the narrow "sectoral" approaches in development and promoting instead, comprehensive approaches, nations will be able to bring about improvements in income disparities, unemployment, housing, nutrition and health standards and *inter alia*, general quality of life of all.

My aim in providing this background is not to establish an Animal Kingdom in a welfarist state, but rather to identify the key ingredients of sustainability for stable development of Nigeria's Livestock Industry, thus promoting food self-sufficiency and improvement in the nutrition and health standard of Nigeria's teeming populace.

In examining Nigeria's Livestock Industry, it is pertinent to identify the essential attributes of the various production systems that can make or mar their sustainability and development. I do not intend to dole out hecatombs of gushing theories or bore you with stereotyped borrowed speeches on livestock production systems. I will however within the constraints of time, attempt to share with you some of the paradigms currently evident in our livestock production systems as these help in raising issues relevant to its sustainability and development.

Mr. Vice-Chancellor Sir, in attempting to do this, I shall distil from some of the significant efforts of the government via livestock research centres and the university system against the backdrop of the major constraint of the sector. My own humble contribution to these efforts, I submit before this noble audience, in the dogged match towards sustainable development of this very important sector of the economy.

OVERVIEW OF THE LIVESTOCK SYSTEM: IT'S PATTERNS, PERFORMANCE AND CONSTRAINTS

Production Patterns

Nigeria's livestock resources include 13;885,813 cattle; 34,453,724 goats; 22,092,602 sheep; 3,406,381 pigs and 104;247,960 poultry (RIM, 1992) as shown in Table 1. Traditionally managed stock is over 85% for all species while commercially managed ones is only significant for poultry at 13.8% and to a lesser extent for pigs at

Table 1: Livestock Populations in Nigeria

Species	Total	Traditionally managed (%)	Commercially managed (%)
Cattle	13,885,813	99.50	0.50
Goats	34,453,724	99.97	0.03
Sheep	22,092,602	99.84	0.16
Pigs	3,406,381	96.76	3.24
Chickens	72,400,856	86.17	13.83

Source: RIM (1992)

3.24%. Cattle are the single most important livestock species in Nigeria in terms of animal protein, value and biomass. They supply not only meat and milk but also skins, bone, blood and horns and are used to transport people and loads, to pull ploughs, carts and ridges and to lift water from wells. They are kept all over Nigeria, but are most common in the northern three quarters of the country. As shown

in Figure 1, cattle production systems are largely pastoral and the vast majority of cattle are found in transhumance and agro-pastoralist systems. Although there are exclusive pastoralists in Nigeria, they constitute a very small proportion of all cattle owners. Indeed, estimates are that only 12% of the Fulani are fully nomadic, 38% are semi-settled and 50% are settled (ILCA, 1979). Thus, over 80% of cattle in Nigeria are reared under the traditional pastoral,

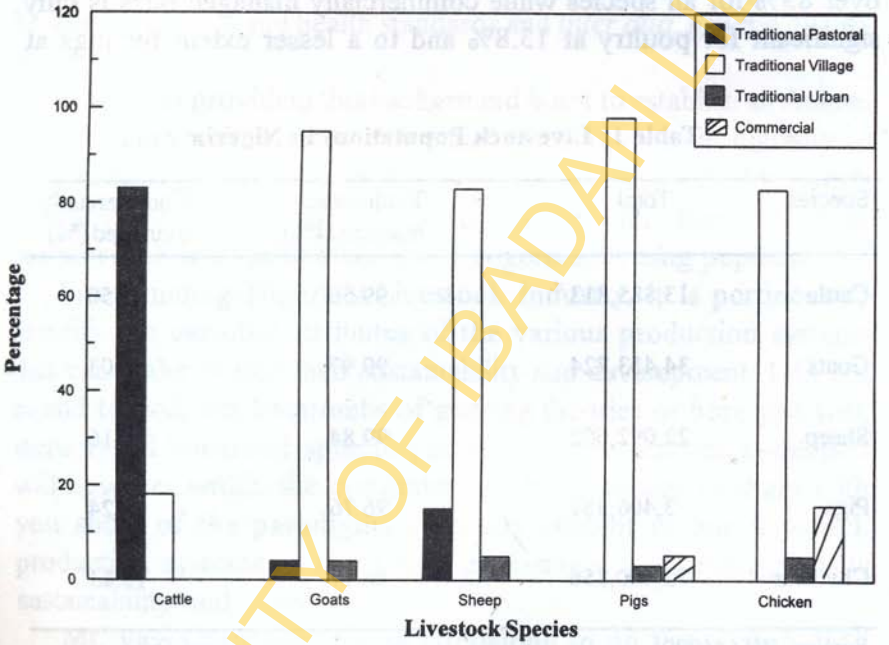

Fig 1: Livestock Numbers in Different Management Systems as percentages of their totals

18% in the traditional village and the rest around urban centres. Also in Figure 1, it is clear that most of Nigeria's livestock resources are kept under the traditional extensive system of rearing except in the case of pigs and poultry where commercial rearing in the intensive farming systems have some significance. This traditional system is composed of the pastoral, village and urban small-holder farmers.

This scenario cannot but pose problems of productivity in a country of 100 million people where teeming urban population all depend on the limited output from the existing suboptimal systems. Indeed, on the basis of the livestock herd population provided by RIM 1992, and take off rates as indicated in the Nigerian Food Balance Sheet (NISER, 1985), the actual production of various livestock products amounted to 3.24g per caput/day of animal protein intake from domestic livestock. Adding that from imports, wild life and fish it totals only 4.82g. This is much lower than the F.A.O minimum recommendation of 35g/caput/day from livestock products (NARP 1997).

Productivity

Nigerian indigenous breeds of cattle, sheep, goats, pigs and poultry are also not very productive. Meat yields from indigenous cattle rarely exceed 120kg/cattle, whereas the average is 170kg and 800 kg for developing and developed countries respectively. Such differences also exist for milk yields, poultry products and so on. Our breeds of livestock are largely characterised by poor growth rate, low fertility, poor feed utilisation, small mature body size and poor yield in terms of milk and eggs. Importation of exotic breeds have only made impact with commercially raised domestic chickens and pigs. Parent stock are still largely imported for the domestic chickens while indiscriminate cross breeding has occurred with commercial pig herds thus compromising their productivity.

Marketing

The Nigerian livestock market is rather primitive, largely consisting of collection, redistribution and consumption markets with a wide array of middlemen. While these middlemen contribute substantially to meat (particularly beef) distribution between the north and the south, their activities have considerably contributed to escalation of

prices in southern the markets. As shown in Figure 2 there are substantial differences between northern prices and those charged to southern customers. In Lagos, prices for cattle, sheep and goats are

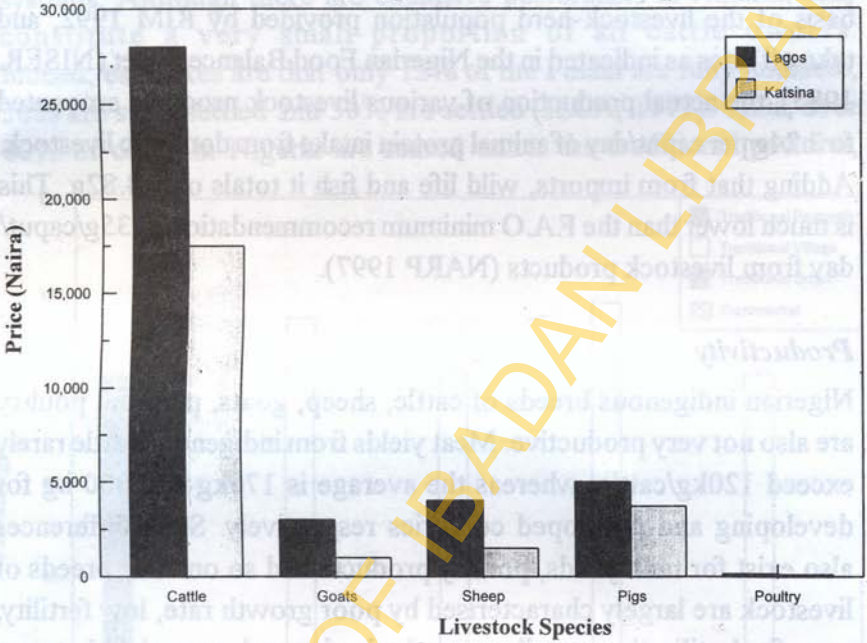

Fig. 2: The value of Traditionally Managed Nigeria Livestock Resources

N28,025, N3,574.04, N2,371.28 while in Katsina they are N17,702, N1003.56 and N752.2 respectively. The average increase in value as stock moves from North to South is more than 100%.

The three main classes of producers with their peculiar marketing abilities and constrains are (1) The subsistence-oriented producers. The nomadic and settled Fulani are under this group whose degree of marketing is limited to crucial family needs and emergency sales of livestock during drought. (2) The semi-subsistence producers who are represented by the traditional urban producers and (3) The commercial specialised producers who are represented by the intensive producers of poultry and pigs. While this trend is discernible, in Nigeria today, a greater degree of market integration has occurred. Hence pure subsistence or pure commercial livestock farming are

virtually non-existent. The vast majority of households occupy an intermediate point in the demand supply continuum.

The first group, despite the rudimentary nature of their production system constitute the major producers of livestock. The sustainability of this traditional system therefore hinges on how well it can enhance livestock management and especially livestock feeding towards improved productivity.

Livestock Feeding

The bulk of Nigerian cattle, sheep and goats depend on fodder from range lands and grazing reserves. But the stage of development in most grazing reserves in the country is still very poor. Up till now, only 23% of the reserves have been gazetted as shown in Table 2.

Table 2: Recognised Grazing Reserves in Nigeria

State	No	Area	No	Area	%Area
Abuja	8	NA	NA	NA	NA
Akwa Ibom	-	-	-	-	-
Bauchi	53	390,253	4	108,208	27.73
Bendel	-	-	-	-	-
Benue	11	59,190	0	0	0.00
Borno	93	549,477	10	119,793	21.80
Cross River	-	-	-	-	-
Gongola	58	181,858	28	113,540	62.43
Imo	-	-	-	-	-
Kaduna	11	120,043	1	33,425	27.84
Kano	NA	NA	NA	NA	NA
Katsina	1	123,175	1	123,175	100.00
Kwara	6	85,874	2	24,156	28.13
Lagos	-	-	-	-	-
Niger	16	68,429	1	33,000	48.23
Ogun	-	-	-	-	-
Ondo	-	-	-	-	-
Oyo	-	-	-	-	-
Pleateau	12	218,800	1	74,400	34.00
Rivers	-	-	-	-	-
Sokoto	55	977,760	0	0	0
Total	323	2,774,859	48	629,697	22.69

Source:PTF, 1992

Gazetted ones are mainly in Gongola, Katsina and Niger states while over 75% of the recognised reserves remain ungazetted. Reservation procedures are incomplete in most of them. Moreover, the inability to ensure rational utilisation in the reserves results in extensive range deterioration and friction between varied interests. Pastoralists finding themselves squeezed within the limited utilisable area, in the face of poor infrastructural development, are progressively moving out and settling especially in Kwara, Niger and the northern boundaries of Oyo, Ogun and Ondo states as shown in Figure 3. The settlement of fulani pastoralists in Borno state as shown is not recent.

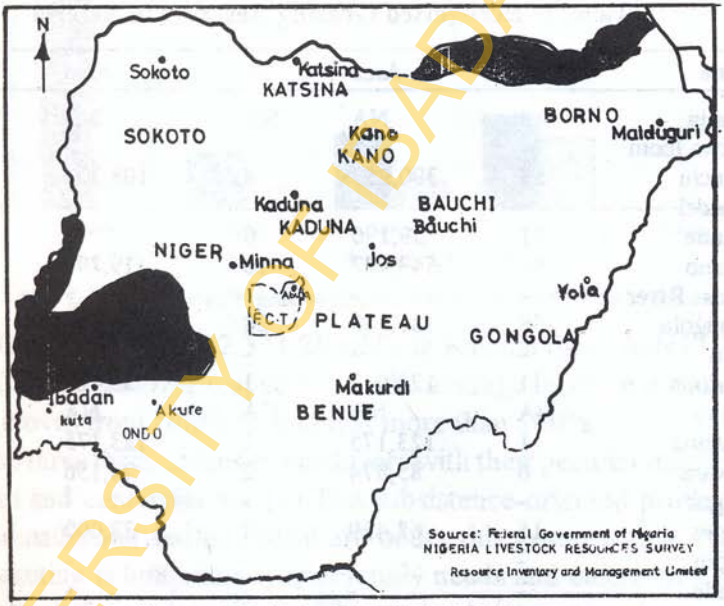

Fig. 3 : CATTLE FULANI SETTLEMENTS

The commercial poultry and pig population on the other hand depend on compounded feeds from livestock feedmills.

As shown in Table 3 there was a rapid increase in the number of feedmills in the country between 1980 and 1984 reaching a total of 468 in 1988.

Table 3: Capacity and Utilisation of Feedmill in Nigeria

	1980	1981	1982	1983	1984	1985	1986	1987
Total no of feedmills	104	189	265	303	414	443	458	463
Total installed capacity (mt/hr)	364	605	795	1039	1438	1556	1635	1685
Expected production per year (million tonnes)	0.7	1.2	1.5	2.0	2.9	2.0	2.1	2.2
Actual production per year (million tonnes)	0.64	0.46	0.55	1.80	0.89	1.14	1.10	0.856
Efficiency of Industry (%)	92	38	37	90	31	57	52	39

Source: Update from Poultry Industry profile in Nigeria-A memorandum submitted to the Federal Military Government of Nigeria on the State of Poultry Industry in Nigeria.

Utilisation of installed capacity however dropped drastically from 92% in 1980 to 26% in 1988 due to acute shortage of local supplies of livestock feed ingredients and high cost of imported materials.

The result is production and marketing of livestock products at astronomically high and unaffordable prices as shown in Table 4.

Table 4: Unit Prices of Some Poultry Input and Output (N) (1982-1997)

	1982	1985	1988	1997
Maize (per ton)	270	650	1800	22,000
Concentrate (Per ton)	520	760	2320	30,000
Feed (per 25kg bag)	8.0	16.50	38.00	500
Eggs (Per tray of 30 eggs)	3.0	6.50	11.50	180
Poultry meat (per kg)	3.30	7.50	13.00	250
Culled layers (per one)	6.00	13.00	18.00	300

Maize now costs N22,000/ton as compared to N270 in 1982. In consonance, a tray of 30 eggs is N180 for compared to N3.0 in 1982. The high cost in feeds which accounted got 60-80% in livestock production has been further compounded by the internally stiff competition for maize and other ingredients between man beast. In such a situation the beast must inevitably "step aside" and be disadvantaged. Mr. Vice-Chancellor Sir, we are now confronted with the all-pervading problem of management of Animal Malnutrition, the eradication of which is the most important consideration in this new paradigm of livestock development. This is my humble submission.

The poor productivity and high mortality of stock is largely explained by inadequacy of feeding the right quantity and quality of feeds to various livestock species. While delivery of veterinary services is poor and hence unable to deliver common veterinary supplies to livestock owners particularly in the last decade, the inadequacy of feeding seriously aggravates the disease burden. It is important at this juncture to dwell on the interrelationship of nutrition and disease as it helps to clarify the roles of the Animal Nutritionists

and the Veterinarians and allows each to appreciate the role of the other. Indeed, the rivalry between the Animal Scientists and the Veterinarians has been a major problem adversely affecting the execution of livestock programmes in this country. While both complement each other, it is also worth noting that when animals are well fed, well managed and well housed, with good sanitary practices, they hardly succumb to diseases. Proper management therefore at least involves and complements aspects of Preventive Veterinary Medicine.

Other constraints to livestock production are numerous, including poor genetic quality of indigenous breeds, theft of commercial stocks, high investment costs especially in terms of housing and labour costs, lack of markets and market orientation, inconsistent government policies, inadequate infrastructure, lack of credit facilities and poor incentives.

What has been the roles of Government and Research Centres in addressing these constraints towards sustainability of the industry?

ACTIVITIES OF GOVERNMENT, RESEARCH CENTRES AND UNIVERSITIES IN THE LIVESTOCK SECTOR.

The role of government has been largely in the area of policy formulation to assist producers to accelerate production at costs that consumers can afford. This role is predicated on its main objective of making Nigeria self-sufficient in livestock production.

Strategies outlined to achieve this objective include:

* ecological specialisation in livestock production
* sedentarization, particularly of the nomadic Fulani
* provision of feeds and fodder improvement
* breeding to improve indigenous stock
* provision of veterinary services to alleviate animal health problems
* provision of domestic credit

Inspite of these laudable objectives and strategies, the persistently woeful performance has been attributed to various causes including inconsistent government policies, poor execution of programmes, fiscal indiscipline, underfunding of the livestock sector, lack of credit facilities and the effects of a depressed economy, among others. It is my humble submission that successive governments, have failed to take into cognisance the changing trends in livestock production patterns and adjust efforts at developing the sector accordingly.

To date, four national research institutes are involved in livestock research. These are the National Animal Production Research Institute (NAPRI), the National Veterinary Research Institute (NVRI), the National Institute for Trypanosomiasis Research (NITR) and to some extent the Institute of Agricultural Research and Training (IAR&T). Out of these, only the National Animal Production Research Institute NAPRI has the country wide mandate to conduct research into livestock production. NAPRI has some research links with the International Livestock Research Institute (ILRI), International Institute for Tropical Agriculture (IITA), the National Livestock Project Department (NLPD), the Federal Livestock Department (FLD) and other agricultural institutes within the country. Its linkage with the Universities and other tertiary institutions are however very weak. This is inspite of the serious bottleneck of manpower shortage, that it faces. Presently, National Animal Production Research Institute (NAPRI), has 56 researchers with about 40 holding Ph.D. or M.Sc. There are 45 technical staff, 12 senior administrative staff and 499 Junior Staff. How can these alone cover the national mandate on livestock production?

Recently, attempts are being made to test parent-layer stock in some Universities. Hopefully, this will encourage future collaborations as the Universities in particular and other tertiary institutions have considerably high manpower quality in their staff and students to address livestock production problems in various agro-ecologies in the country. Indeed, instead of creating research outstations without adequate man-power, Institutes will do better by

collaborating with Universities and other tertiary institutions for their on-farm adaptive studies.

Specific mention must be made of the research focus of the International Livestock Research Institute (ILRI). The basic thrust of the institute is cattle milk and meat; that is, to increase the sustainable output of milk and meat from cattle in the mixed crop-livestock small holder production systems of sub-Saharan Africa. ILRI's research programmes focus on these production systems because they appear to offer the best opportunities for increasing protein output and hence food production as a whole, in the foreseeable future. The settled Fulani Agro-pastoralist is mainly targeted in their research drive towards sustainability of Nigerian's meat and milk industries. Specific interventions and models adopted include Alley farming, Fodder Banks, Crop Residue Utilisation and Feed supplementation.

Successes in these have however been rather limited. This can be attributed to its relatively short period of operation compared to other research institutions in the country and the limited manpower at its disposal to have effective coverage of these tasks in different agro-ecologies. It is again necessary to stress the importance of the need for collaboration with Universities and other tertiary institutions in carrying out these tasks. It is gratifying to note that with the proximity of ILRI sub-humid station (based at IITA) to the University of Ibadan, some interaction takes place with the department of Animal Science including student training up to Ph.D. Level. There is however large room for expansion through seminars, workshops and collaborative studies in various agro-ecological zones of Nigeria. Let me again emphasise that training students along these lines will not only assist in development of manpower, it will also help in strengthening the manpower needs of such institutes with cheaper costs of research execution both, on-station and on-farm. Faculties of Agriculture in Universities should be active partners in the National Agriculture in Universities should be active partners in the National Agricultural Research Systems (NARS).

Livestock Research in Nigerian Universities started in 1949 with the establishment of a department of Agriculture at the University of

Ibadan. The department of Animal Science was established in 1966. Presently, there are 22 Universities including three Universities of Agriculture which offer courses in livestock production in their faculties/colleges of Agriculture.

In the past, some of the Universities were actively engaged in livestock research and did undertake some long-term programmes in pasture improvement, by-product utilisation, stock improvement and disease diagnosis. However, in the last decade, such activities have been seriously cut back due to a chronic shortage of funds. Research is done by and large, on an individual basis and dependent solely on the interests of the scientists. Central bodies are unable to fund long-term research programmes that might have a significant impact.

In a general sense, the areas of achievement in terms of livestock production research in the Universities and the Research Institutes include nutrition, breeding and selection, housing and management. However, most findings are not yet widely adopted nation-wide as shown in Figure 4. For example the developed Niger-Hyb pig is

Fig. 4 Livestock production Technologies and Adoption rate Nationwide

TECHNOLOGY	ADOPTION RATE
Upgrading of local domestic chicken through cock exchange (North)	
Upgrading of local domestic chicken through cock exchange (South)	
Upgrading of indigenous pigs to the Niger Hyb	
Cross breeding of indigenous and exotic cattle	
Improved housing for sheep and goats (raised platform)	
Management, housing and feeding of rabbits	
Crop residue processing (North)	
Crop residue processing (South)	
Browse supplement for sheep and goat feeding (alley farming)	
Ration formulation and mixing (among peasant farmers)	
Ration formulation and mixing (among large feed manufactures)	
Improved pasture and range land management including fodder bank	
Beef cattle feed lot (North)	
Beef cattle feed lot (South)	
Vaccinations for cattle and small ruminants (North)	
Vaccinations for cattle and small ruminants (South)	
Poultry vaccination (Commercial producers)	
Poultry vaccination (Peasant farmers)	
Control of mange and other ecto-parasites on sheep, goats and pigs using indigenous (local) drugs	
Tsetse controlled technologies	

Source: Federal Ministry of Agriculture and Natural Resources. 1997

Legend: High Average Low Nil

unadopted while cock exchange is widely adopted particularly in the North. Generally, impact of research finding is more apparent with commercial farmers than with traditional livestock producers that form the bulk of the industry and most of the research activities were carried out on-station with very little on-farm components. The on-farm Adaptive Research (OFAR) carried out through the extension arms of the ADP's countrywide has little livestock component but more importantly does not draw much from the tremendous expertise lying untapped in staff and students of our Universities. It is therefore gratifying to note the recent inclusion of the Universities in the World Bank assisted Nationally Co-ordinated Research Programmes (NCRP's) of the National Agricultural Research Project (NARP). This involves scientists from Research Institutes and the Universities participating in problem solving, on-farm research projects that have been identified and documented in the National Agricultural Research Strategy Plan.

The medium term research plan is to last between 1996 and the year 2000. It is still highly disturbing that one year after commencement of these programmes, it has barely gotten off the ground. The system of fund disbursement is cumbersome, with money released in trickles. This does not allow purchase and timely supply of inputs for meaningful agricultural research. For example, the University of Ibadan is to obtain N10.8 million for the first year of operation. As at the end of September 1997 (One year 3 months after) only N1.338 million or 12.0% of the allocation has been released. The capacity building component involving replacement and rehabilitation of equipment and other facilities needed for proper execution of the projects have not been put in place by the National Agricultural Research Project (NARP). If this laudable programmes will not go the same way as previous Livestock Research Programmes, it is crucial to address the issues of funding and facilities in our Universities which are supposed to be active partners in the National Agricultural Research Systems (NARS). This is our opportunity at the close of this century to promote livestock productivity. We Scientists are eagerly waiting for urgent respites to these bottlenecks.

CONTRIBUTIONS AND RESEARCH ACHIEVEMENTS

Two and half decades ago, at the inception of my post-graduate training. Emeritus Professor V.A.Oyenuga, my mentor, a distinguished scholar of international repute, a visioner, a dogged and relentless fighter for equity and sustainability in Nigeria's Livestock Industry invited me to his office. He was the Head of Department of Animal Science. He informed me of my award of a Research Fellowship to Centro International de Agricultura Tropical (CIAT) in Cali, Colombia, South America. He then instructed me to embark on a comprehensive programme of feeding cassava to all species of livestock. This instruction struck me and still strikes me like the instruction of our Lord and Master "Go ye into all nations...". I have since then found myself in this ministry toiling to accord cassava its rightful place in livestock feeding in Africa.

As shown in Figure 5, cassava is largely consumed as human

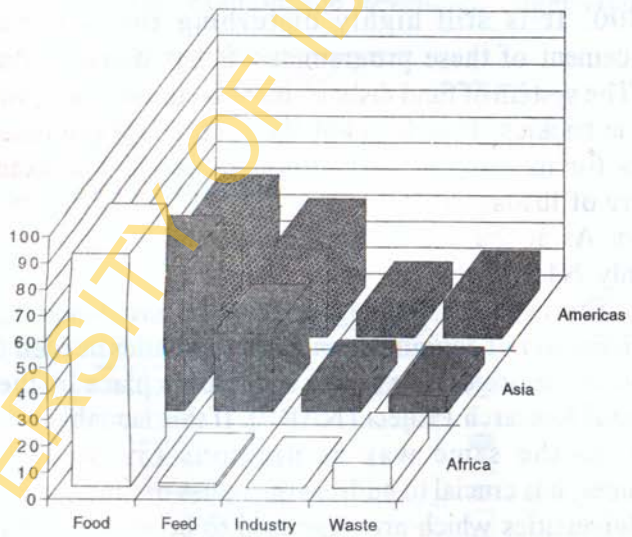

Figure: 5 Cassava use on different continents.

food in Africa. While in more industrialised nations, it is used more for livestock and industrial purposes. Over 90% of cassava is for

human food in Africa. Indeed, Nigeria is the largest producer of cassava worldwide with an estimated 30 million tonnes produced annually. Inspite of our various studies and numerous publications on poultry, pig, sheep, goat and cattle at the University of Ibadan for instance (*Tewe et al.* 1979, Tewe 1981, 1982, Tewe and Egbunike 1982, Tewe and Oke 1983, Tewe 1988) all demonstrating the efficacy of cassava as a suitable replacement to maize, it is not until the last decade that our feed manufacturers started turning to our recommended formulations. As shown in Table 5, cassava can replace

Table 5: Conventional and Alternative Ingredients in A Typical Non-Ruminant Ration Formulation

Nutrient	Conventional Ingredients	Percent Ration	Alternative Ingredients	Maximum Inclusion rate (%)
Energy	Maize	55	Sorghum	55
			Cassava	45
			Sweet potato	15
Fibre	BDG	15	Maize offal	10
	Rice bran	15	Wheat offal	2.5
			Sorghum offal	10
			Rice husk/bran	5
			Cassava peel	10
Protein	GNC	15	Palm kernel	15
	SBM	15	meal	10
			Cotton seed	10
			cake	10
			Jackbean	5
			Poultry offal	
	Fish meal	3	meal	
			Blood meal	
Minerals	Oyster shell	7.5	Periwinkle	7.5
	Bone meal	2.5	shell	5
			Limestone	2
			Malt dust	
Additives				
	Vitamin premix	1		
	Salt	0.25		
	Others	0.75		

up to 45% of feeds at the expense of maize, while cassava peels can replace up to 10% Brewers dried grains or Rice Bran. Other alternatives for replacing conventional feed ingredients include palm kernel cake, cotton seed and poultry offals. With a maximum inclusion rate of 45% of cassava at the expense of maize, considerable savings of the latter for human consumption can be achieved as shown in Table 6. Hence only 0.8 million tonnes of maize would be required

Table 6: Maize Requirement ('000 Tonnes) at Different Inclusion Ration of Cassava in Feeds

Year	Inclusion of cassava meal			
	0%	15%	30%	45%
1996	4267	3103.27	1939.55	775.82
1997	4496	3269.82	2043.64	817.45
1998	4737	3445.09	2153.18	861.27
1999	4994	3632.00	2270.00	908.00
2000	5266	3829.82	2393.64	957.46

to compound rations this year instead of about 4.5 million metric tonnes. This would have resulted in value saving of N2.9 billion, because while cassava chips currently cost N14,000/tonne, maize costs N22,000/tonne. Today, the large feed-millers in Nigeria have adopted its incorporation into commercial feeds particularly for poultry. It is noteworthy that the experience of the European EconomicCommunity (EEC) in its successful use of cassava as livestock feed had been documented since 1973 (Nestel, 1973), but has taken the economic recession, the ban on maize importation and rising cost of other feed to force livestock feed millers to adopt cassava as livestock feed in Nigeria. Recently, cassava has been attracting interest as an industrial crop having found various uses in the starch, pharmaceutical, bread and biscuit industries. The price is on the increase. More importantly, the harsh economic climate has

considerably increased the human population that depend on cassava as salvation from hunger and starvation. It is therefore beginning to raise serious conflicts whether these competing uses are not more desirable and sustainable than the use of cassava for livestock feeding. Indeed, as a natural economic phenomenon, even before its full adoption, rising cost of cassava flour and chips has begun to limit its use in our feed mills.

In anticipation of this development, we have in the past one and half decades focused our research more on the use of other wastes from the cassava plant notably the peels, leaves and resides from human food and starch industries as feed ingredients for different classes of livestock (Tewe 1986, Tewe *et al.* 1987, Tewe and Egbunike 1988, Tewe *et al.* 1994, Tewe 1996). In other words, the total utilisation concept approach is our thrust in the use of cassava for livestock feeding. Through our studies, we have succeeded in improvising a pelleting machine from locally fabricated oil palm expeller which is capable of producing pelletized cassava feeds for different classes of livestock. Through this process, complete replacement of maize has been attained for poultry, pig, rabbit and fish feeds. We have also incorporated the otherwise wasted leaves, tender stems and peels to prepare balanced feeds for these species. Further studies on this pelletizer which can be used in rural settings is on with our department of Agricultural Engineering and the Tuber and Root Improvement Programme (TRIP) of the IITA.

In realisation of the highly fibrous nature of the residues from cassava, we have also embarked on the use of polysaccharidases (enzymes) as feed additives to improve the utilisation of cassava components for the feeding of pigs and poultry (Tewe, 1996, Iyayi, Tewe and Oki 1997). With Nigeria producing 30 million tons of cassava annually, it is estimated that the peels, leaves and pomace from starch, and garri residues will amount to about 5 million tons. This is considerable feed for cattle, sheep and goats. With on-going enzymic degradation studies, there is high potential for its use as energy and protein sources in the feeding of pigs and poultry. By

incorporating cassava leaves into rations for poultry and pigs, the protein deficiency of cassava based rations has been eliminated (Tewe et al. 1994). Cassava leaves are popular as human food in a few countries like Zaire: its possibilities for animal feeds is immense. It is important to note that a number of countries in East and South Africa are presently soliciting our assistance in utilising cassava as replacement for maize in their livestock industries particularly in the face of successive droughts which has made the production of cereals less favourable as compared to the hardy starchy tuberous staple cassava. This prospect is not without its constraints.

The three major limitations to the use of cassava in animal feeding are:

1. the dustiness of the flour which limits the level at which it can be incorporated.
2. its low protein content which demands inclusion of high levels of expensive protein concentrates and
3. the fear of poisoning from the hydrocyanic acid liberated from its cyanogenic glucosides linamarin and lotaustralin.

In this respect our studies on the cyanogenic character of cassava and their implication in productivity of livestock have made significant international impact. Safe levels of cyanide in cassava based rations has been deduced from various studies for different classes of livestock and poultry. At a level of 100 ppm (100 mg HCN/ Kg), satisfactory growth can be obtained in livestock, provided the feed is adequately supplemented with protein (or specifically methionine) and iodine. In our long term trials the carry over-effect of cynanide particularly for gestating animals, can be deleterious.

Studies with pigs (Tewe, 1991, 1994) revealed that low serum thyroxine levels occur in pigs fed with cassava based feeds containing 96 ppm cyanide or more. Also placental thiocyanate transfer occurs in gestating pigs consuming cassava based feeds with hydrocyanic acid level of 500 ppm. Through proper processing however, cyanide levels of less than 50 ppm can be obtained particularly in sun-dried

samples. The significance of our studies with pigs on feto-maternal relationships in humans and animal consuming cassava based diets is a landmark that is globally acknowledged. As a serving member of the International Working Group on Cassava Safety, our studies are currently being used in extrapolating safe cyanide levels in diets for the populace in cassava consuming areas of the tropical world particularly pregnant women and children.

Presently, safety limits for cyanide in cassava food set by the Codex Alimentarius Commission of FAO/WHO (1988) is 10 ppm (or 10 mg/kg dry weight. This even makes "garri" with about 20 ppm cyanide unsafe for human consumption (Bokanga and Ottoe, 1994) as shown Figure 6. The FAO/WHO (1988) recommended level of 10 ppm also makes most cassava dishes in Nigeria unsafe. However levels below 100 ppm are considered safe by EEC, plant breeders and as confirmed in our studies. For pregnant stock only a

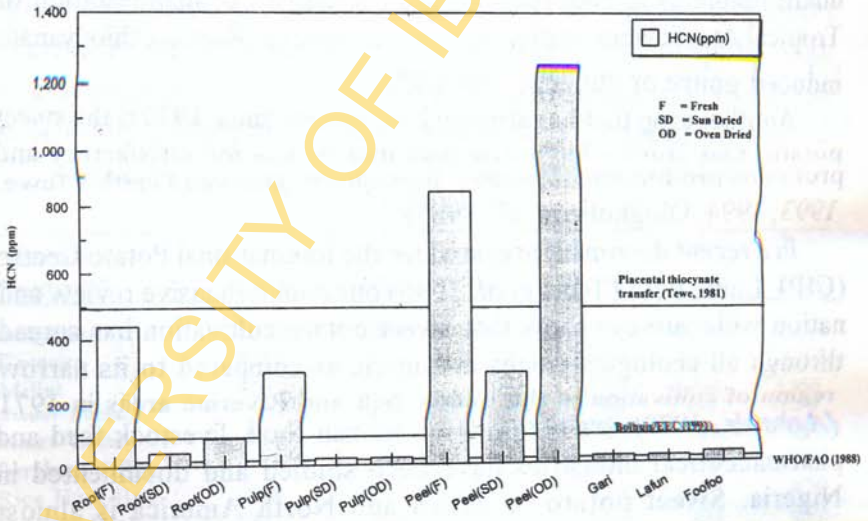

Fig. 6 Levels of Hydrocyanic acid in Cassava products and Established Toxicity Levels

consumption of up to 500 ppm cyanide breaks the placental barrier against thiocyanate transfer. This hydrocyanic acid level is rarely encountered in cassava foods for humans except for the rampant adulteration of yam flour with dried cassava peels in Nigerian markets. The disparity between the recommended safe levels by different authorities is of concern and is being addressed presently by the International Working Group on Cassava Safety.

The importance of cassava for food security in Africa cannot be over-emphasised. This crop has been circumstantially implicated in a number of neuro-endocrinological anomalies (Ekpechi 1967, Osuntokun, 1968, Delange *et al* 1982). Successive governments and scientists have however failed to see cassava as a barometer for assessing poverty thresholds as none of these anomalies express themselves in cassava consuming well-fed human or animal population. Only in areas of drought, starvation or serious economic depression which makes meat and other protein rich foods unaffordable as in Nigeria, do we have the risk of manifestation of Tropical Ataxic Neuropathy, Spastic Paraparesis (Konzo), thiocyanate induced goitre or endemic cretinism.

Another crop that has attracted my interest since 1975 is the sweet potato. Our studies have demonstrated its use for satisfactory and profitable production of poultry, pigs, sheep, goats and cattle (Tewe, 1993, 1994, Ologhobo *et al.*, 1985).

In a recent document prepared for the International Potato Centre (CIP), Lima, Peru (Tewe *et al.* 1996) our comprehensive review and nation wide surveys show that sweet potato cultivation has spread through all ecological zones in Nigeria as compared to its narrow region of cultivation in the middle belt and Riverine areas in 1971 (Agboola, 1979). It's potentials in human food, livestock feed and pharmaceutical industries have been studied and documented in Nigeria. Sweet potato in Africa and North America is almost exclusively for human food. In Asia and South America, substantial quantities are used for animal feeding. This crop is bound to play important roles in the feeding of humans and animals in this country in the years ahead.

I was opportuned to serve as Secretary to the Presidential Task Force on Alternative Formulations of Livestock Feeds between 1989 and 1992. Coincidentally, the first inaugural lecturer from the Department of Animal Science-Professor G.M. Babatunde was the Chairman and Co-ordinator of this programme initiated by the then Secretary to the Federal Government, Chief Olu Falae, to find a lasting solution to the teething problem of perennial shortage of livestock feeds in Nigeria. The task force carried out feeding trials on-station in Universities, and Research Institutes countrywide on the suitability of Nigeria's numerous feeding stuffs for satisfactory and economic performance of livestock. From these findings, least coast star diets were formulated for broilers, layers, chicks, growers, pigs, rabbits, fish, cattle, sheep and goats. It was recommended that pilot schemes for popular alternative formulations adjudged best should be established country wide. But this was not backed up with funding and hence it has not materialised. In its medium to long term recommendations, accelerated development of cassava and sweet potatoes for industrial and livestock feed usage was advocated. With an assessment of feed ingredient requirement for livestock (as in Table 7) Nigerian Livestock will require a total of 3.7 and 4.3

Table 7: Alternative Feedstuff Requirement (1995-2000) ('000 Tonnes)

Alternative Feedstuff	1995	1996	1997	1998	1999	2000
Sorghum	4053	4267	4496	4765	4994	5266
Cassava	3316	3492	3678	3898	4086	4308
Millet	4053	4267	4496	4765	4994	5266
Sweet Potato	1105	1164	1226	1299	1362	1436
Maize Offal	737	776	817	866	908	957
Sorghum Offal	737	776	817	866	908	957
Rice Husk/Bran	368	388	409	433	454	479
Cassava Peel	737	776	817	866	908	957
Cocoa Husk	368	388	409	433	454	479
Rubber Seed Meal	368	388	409	433	454	479
Poultry Offal Meal	737	776	817	866	908	957
Shrimp Heal Meal	368	388	409	433	454	479
Periwinkle Shell	553	582	613	650	681	718

million tonnes of cassava flour, 1.2 and 1.4 million tonnes of sweet potato among others for the years 1997 and 2000 respectively. Estimates of crop residue availability from within the country, as in Table 8 shows that availability of crop residues that can even replace

Table 8: Projected Availability of Crop by-Products and Residues ('000 Tonnes)

By-Product	1996	1997	1998	1999	2000
Rice Bran	255.45	264.14	273.12	282.41	292.01
Rice Straw	1703.02	1760.93	1820.80	1882.70	1946.72
Maize Offal	20.16	21.31	22.53	23.81	25.17
Maize Stover	8961.09	9471.88	10011.7	10582.5	11185.6
Cowpea Vines	8619.56	8800.57	8985.89	9174.08	9366.74
Soyabean Haulm	566.72	597.89	630.77	665.45	702.06
Beniseed Haulm	1895.80	1905.27	1914.80	1924.37	1934.00
Groundnut Haulm	3302.32	3345.25	3388.74	3432.80	3477.42
Cotton Seed Cake	10.78	11.01	11.24	11.47	11.71
Cassava Peels	545.33	566.60	588.70	611.66	635.51
Yam Peels	1.57	1.60	1.63	1.66	1.69
S/Potato Peels	4.28	4.39	4.50	4.61	4.72
Sweet Potato Vines	0.61	0.63	0.64	0.66	0.67
Sugarcane Tops	10.23	101.74	102.24	102.76	103.27

most of these if properly processed, far exceeds requirement. For example 65 million metric tonnes of crop residues can be obtained annually from major cereals and legumes alone. These will include Rice Bran, Rice straw, maize offal, maize stover, cowpea vines, soyabean haulm, Benniseed haulm and groundnut haulm (as in Table 8). All of Nigerian cattle will consume just 41% of this all year round while sheep and goats will consume 21% of the available crop residues to meet all of their feed requirements, if only these are

processed into acceptable and digestible forms. Indeed as our work presently shows, with enzymic degradation, a large proportion of the energy and protein needs of poultry and pigs can be derived from these crops residues. Nigeria will therefore have no problem of feed shortage at affordable prices if only these areas of strategic crop-residue collection, processing, and distribution as livestock feeds can be addressed as a matter of priority and urgency. Herein lies a critical role and opportunity for the womenfolk that form a significant labour force in food processing and small scale animal management. These crop residues and by products are mostly available at the post-production stage. Improving the entitlement of the women who generate these wastes through their very cheap labour, into income earning opportunities is a viable step in the right direction. Women can also be propelled for full control, management and ownership of cottagebased alternative feed industries for sustainability of Nigerian livestock industry. In this regard the Family Economic Advancement Programme (FEAP) of the federal government will do well to consider setting up cottage industries in rural areas for the collection and processing of these crop residues which abound in scattered locations largely on rural based farms. I hereby call on the First Lady through this laudable programme to consider this as a major programme of the Family Economic Advance Programme (FEAP)

Mr. Vice-Chancellor, Ladies and Gentlemen, exactly two decades ago, I initiated a collaborative study with Professor S. S. Ajayi then of the Wildlife unit of the Department of Forest Resources Management, University of Ibadan. This study was on the domestication and nutrition of the African Giant rat *(Crycetomys gambianus,* waterhouse) which was then already known country wide as "Okete-U.I." Other species were the grasscutter *(Thryonomys swinderianus)*. the African Giant snail *(Achachatina maginata)* and the Guinea fowl *(Numida meleagris)*. To me, this was, in addition to my research interest, a welcome respite as I was finding my area of research unsustainable, due to shortage of funds for research from within and outside the University. It was therefore also a survival

strategy as I doubled up with my research interest on root crops utilisation and toxicology as well as actively participating in research funded by National Science and Technology Development Agency (NSTDA) for domestication and commercial production of these wild mini-stock. Within a period of five years, our collaborative efforts had blossomed into formidable campus wide projects engaging over 10 scientists involved in multidisplinary studies on these species and fish, with more than 40 publications emerging to our credit. These include Tewe and Ajayi, 1976, 1979, 1982, Ajayi and Tewe, 1978, 1981, 1983, 1986, Ayeni, Tewe and Ajayi, 1983, 1985, Falaye, Jauncey and Tewe, 1996 among others.

More importantly, the Wildlife Unit did undergo rapid development to attain its present status of a department of Wildlife and Fisheries Management which was created in 1981. Indeed, at its inception, I held and still hold an Associate Lecturership position in that department.

Distinguished listeners, it si not only the fruit but also the constraint of such collaborations that I wish to draw attention to. In academic communities such as ours, nobody is an island nor the repository of all knowledge. We have been able not only to make considerable international impact on these species, and more importantly, we were able to domesticate and breed them in confinement: Nutrient requirements of the giant rat was established and also used in comparative biomedical research on cyanide toxicity, along with the pig. Our colonies of giant rat, grass cutter, giant snails and guinea fowl were thriving until incessant pilfering from neighbours around the animal house decimated the flock. Indeed we developed production systems which were set up for private organisations and individuals countrywide, but sadly, without exception, all to date, have been decimated by poaching. These rodents and molluscs continue to attract attention nation-wide as good backyard stock as they are disease resistant, eat a variety of freely available plant foods and household scraps and generally require little maintenance. It is important to stress that the introduction of

these unconventional species into the gene pool where animal monoculture is our current practise will enhance the sustainability of our livestock industry. Through a polyculture involving for example grasscutter, snails, pig and fish in an integrated agricultural system, meat can be produced at affordable prices for the citizenry.

It is common in academics to look at these types of collaboration as diversification but indeed to me it shows versatility and ability to evolve a multidisciplinary and holistic approach to solving problems. I can therefore see a continuum in the production of domestic and wild animal species. In terms of development of sustainable animal protein industry in Nigeria, the departments of Animal Science and Wildlife and Fisheries Management of this University are playing and will continue to play pivotal roles in the years ahead. Indeed, biodiversity and sustainability of the world's fauna certainly depend to a large extent on a thorough mix of these disciplines.

It is also pertinent to note that encouragement of research through adequate funding is essential to development of a sustainable livestock industry. In 1986, I visited the Benin Republic to find a student trained by our Wildlife Management Group at Ibadan, starting off his grasscutter colony with the financial support of the government of that country, in conjunction with the Belgian government. Today grasscutter production in Benin is like the production of day old chicks in Nigeria.s poultry industry. Large grasscutter farms have been established all over that country. Perhaps in Nigeria, we will require electrocuted wire fences to ward off poachers. It remains important that when supported with adequate funding, our scientists will make tremendous impact in development of the Nigerian economy.

A RESEARCH AGENDA FOR SUSTAINABLE LIVESTOCK PRODUCTION IN NIGERIA

At this juncture it is necessary to proffer a research agenda for sustainable livestock production in Nigeria. Undoubtedly with feed gulping between 60-80% in different livestock production systems, reduction in the cost of feed will go a long way in reducing input

costs and making price of meat and meat products affordable by the citizenry. The various production systems must be targeted and peculiar requirements for feed must be met with locally available low cost ingredients.

As the bulk of meat is produced by the nomadic Fulani, a central focus must be the diagnosis and packaging of farm ready technologies that will encourage this group towards sedentarization and improved market integration. The importance of integrated crop/livestock farming among settlers and arable crop farmers cannot be overemphasised. The judicious use of crop residues in such a system is paramount to improved productivity and cost reduction. The traditional small scale village livestock producer holds the bulk of small ruminants, poultry and pig population. Research efforts must also be directed at this group. It is also important to recognise the continuum between this and the urban livestock producer-another important emerging group. With the inability of the populace to afford food for the table, we hardly leave remnants on our plates. We must therefore look somewhere else for waste food which in times past was sustaining the small scale village and urban based pigs, goats, sheep and poultry. Efforts to encourage small scale livestock/crop integration and use of our recommended alternative feeds and crop residues must be promoted. We need to reach out to large scale feedmillers and livestock producers in the efforts to solve problems of the commercial producers. Particular emphasis must be placed on polyculture of livestock whether domestic, wild or semi-wild in different production systems. This is germane to the sustainability of the species and our livestock industry. In all, our research agenda must focus on on-farm research, targeting feed availability at reduced cost through alternative inputs to ensure an affordable meat market for the citizenry.

For successful execution of this agenda Dillons (1973) concept of Farming System Research becomes relevant. He stressed and I quote "that only a holistic approach with openness and teamness through interdisciplinary endeavour, can lead to capturing an adequate

understanding of a livestock system for the purpose of improving performance". Also as observed in Asian countries (Amir and Knipscheer 1989), the cost of on-farm research declines sharply if more students become involved in it, particularly if staff from different specialities work together. The pay off on this type of research is that it provides a continuum for diagnosing, designing, testing and evaluation of new technologies.

It is of interest to relate these to sustainability of the university system.

SUSTAINABILITY AND DEVELOPMENT OF THE UNIVERSITY SYSTEM

The task of building a sustainable livestock industry certainly goes beyond research efforts to grapple with the perennial problems of unstable government policies, provision of improved technology for different agroclimatic regions, provision of inputs like credit and provision of marketing support at assured remunerative prices and above all provision of meat at affordable prices for Nigerian's teeming population. Numerous recommendations have been given in the past to address these problems. It is time we start grappling with what we in the university system should do in contributing our quota to the solutions rather than waiting hopelessly for windfalls from government agencies. Indeed, it is pertinent that we look inwards to grapple with our own share of the problems if we will retain our relevance and if the academia will remain relevant in the country's march towards encapsulating its vision by the year 2010.

In this regard, it is relevant to refer to the state of the University Teaching and Research Farm which has been ably and vividly described by Professor V.A. Anosa of the department of Veterinary Pathology in the third of his series of the 1995/96 University Lecture and I quote "the farm has become a carcass of its old self today. The population of animals in the farm has plummeted to a level when we must either do something immediately to change the situation or

stop awarding degrees in Animal Science and Veterinary Medicine. The total population of animals owned by the Teaching and Research Farm peaked to 30,917 in 1973 but in 1996 the farm has only 31 cattle and let me add, an unstable number of pigs, goats, sheep and chickens, brought in from time to time, largely by individual research interests of staff and students. Meanwhile the quality of teaching staff has improved tremendously as judged from the number of professors increasing from 2.3 professors per 100 students in 1973 to 6.4 in 1996. Whereas in 1973, there were 368 farm animals to one undergraduate student in the Faculty of Agriculture, Forestry and Veterinary Medicine, in 1996, these are only 0.18 and 0.03 animals per academic staff and student respectively".

We in the Faculty of Agriculture and Forestry have noted with deep concern the constant challenge by the present University administration to rekindle the "good old days" when meat, milk, eggs, fruits and vegetables were produced in adequate quantities for the university community. We have deliberated exhaustively on this in recent times and we are resolved to make this a reality again, in terms of provision of good quality, affordable meat and meat products including milk, cheese and eggs. Let me add that this effort is not new as we have made humble beginnings through our practical year programme, that produce and sell items including maize, cowpea and vegetables.

Expansion of this programmes as presently conceived, goes beyond an image laundering exercise but seriously addresses the issue of development of a sustainable livestock production system in Nigeria's premier university. More importantly, students need to participate in these types of programmes to build their confidence in future involvement in Agriculture when they leave the university system.

To ensure relevance of training to our community and society at large, it is imperative that our training and research be harmonised to tackle agricultural problems in a holistic approach rather than being confined to the narrow limits of our individual specialisations. We

need to involve staff and students in production and marketing to impart the confidence in possibilities of profitable and sustainable entrepreneurship in agriculture. We must, as a matter of urgency ensure that we all work together, first to provide food for over 40,000 students and staff of our community. Also by shifting demand for available food from animals through the provision of alternative feed resources for them, we will work towards sustainability of human and animal populations on campus. Such programmes will be the stimuli to encourage graduating students from Nigerian's premier university to get impatient with perpetually seeking the fast dwindling or even non-existent government or multi-national jobs, but rather to embark on creating jobs for themselves and other Nigerians in various niches of our multifaceted agricultural sector.

Mr. Vice-Chancellor, at this juncture I wish to recommend that the curriculum in Agriculture be completely overhauled to orientate students from the onset to viewing their training as a preparation to be job creators and not job seekers on graduating. The pay off of this re-orientation is that it will stimulate logistic support from funding agencies and industries who need such graduates once the manpower is well trained and equipped for the needed services. In this regard the mandate in our faculty should address FOOD PRODUCTION AT AFFORDABLE PRICES TO THE POPULACE. Indeed, with the Department of Forestry maturing to another Faculty, I will recommend that Agriculture be re-christened the FACULTY OF FOOD AND AGRICULTURE, in recognition of this mandate. This is in consonance with the United Nation's recognition of food self sufficiency as a special focus within agriculture, hence its Food and Agriculture Organisation (FAO).

The Vice-Chancellor Sir, we do not expect your administration to provide all the wherewithal to achieve our objectives as in this submission. However, looking through the trends from past and present administrations, we are confident that you will not hesitate to provide the enabling environment in our efforts to achieve these laudable objectives.

In the years ahead, our aim in the Department of Animal Science is to work along with others to focus attention on livestock research and services for our immediate and larger communities.

Distinguished listeners, let me reiterate my submissions on the attributes of the Animal Scientist who is the educated shepherd of our age. The shepherd is of tremendous relevance to every stable society. Taking a look at the scriptures, we can see how men are prepared for noble tasks through tutelage in shepherding. Moses, David, and Amos are just a few of these. Even the Psalmist referred to The Lord as his and my shepherd. I make bold to submit that the birth of Christ in the manger underscores the importance of shepherds in the scheme of human history.

Proper training of Animal Scientists offers tremendous opportunities to acquire leadership skills including dedication, humility, patience, punctuality, positive aggression, alertness, tenacity of purpose, swift discernment of behavioural patterns whether in man or animals and considerable marketing skills. While the discipline certainly teaches the science of animal production, these stated attributes must be in place in the successful livestock producer. It is unfortunate that our successive governments had continued to relegate agriculture and agricultural training particularly since oil became the main foreign exchange earner. Our forgotten agrarian tradition largely explains the lack of discipline in all facets of our national life. Until agricultural training in all our institutions from primary to university level is viewed with the seriousness it deserves, gross indiscipline will persist in our National life and governance.

In our efforts to provide affordable food, we intend to build an enviable crop of students. Let me add that in all of these, the training of minds is of paramount concern to us, as we know assuredly that for sustainability and true development of this society, people-oriented initiatives are needed with human beings (in this case staff, students and livestock farmers) as the resources in the concept.

It is our conviction that a demonstration of this in our livestock disciplines will help stimulate the university community towards self-

reliance and relevance to our society. This is our surest way to autonomy, sustainability and enviable development of our university system as we march through the dusk of this century into the dawn of a new one.

ACKNOWLEDGEMENTS

Finally, I must express my profound gratitude to those who have led me thus far. Professor Emeritus, V.A. Oyenuga deserves special mention as my mentor. His life and achievements have constantly motivated me in the pursuit of my career as an Animal Scientist. Professor S. S. Ajayi whose belief in my ability and his constant challenges in wildlife management and research have broadened my vision beyond being a creator of ideas to an initiator of practical, problem solving projects. I must also acknowledge the constant encouragement from Professor Wale Omole, the Vice-Chancellor Obafemi Awolowo University, Chairman Committee of Vice-Chancellors and a renowned Animal Scientist. My interaction with him has been a worthwhile tutelage in shepherding, particularly as related to administration. Funds for my research and travels were provided at various times by the International Development Research Centre (IDRC) of Canada, International Foundation for Science, Sweden, International Institute of Tropical Agriculture (IITA), Pfizer Nigeria Plc, International Cassava Safety Working Group, Cassava Biotechnology Network, International Society for Tropical Root Crops (ISTRC), International Potato Centre (CIP), Lima, Peru and The WennerGren Centre in Stockholm, Sweden. I must not fail to acknowledge the long term collaboration with the Tuber and Root Improvement Programme of the IITA. Special mention needs be made of Dr. M. Bokanga and other members of the International Cassava Safety Working Group on different continents. The research support from Livestock farmers and companies countrywide did strengthen my on-farm adaptive studies. Livestock Feeds Plc, Sanders and the Animal Care Consult Services Ltd deserve recognition.

To my parents, I remain forever grateful. My late father, Senior Chief C.A. Tewe built in us the joy of sacrificing and standing for the truth. In those days of deprivation when politics was all about sacrifice and not sacrilege, he stood firmly by the late sage Chief Obafemi Awolowo, while my mother sacrificed all she had for our education. I am glad for her, though she is far away holidaying in the United States of America, she must know that her sacrifice has led me thus far today. My nuclear family has through all the changing scenes of life, remained an oasis in the desert of life. For this I am immensely grateful. I also thank my siblings for caring. I cannot but mention my numerous students many of who I am proud to say, are today holding management positions in reputable livestock enterprises. They sustain my vision and hope for a developed livestock industry.

Mr. Vice-Chancellor Sir, Distinguished College and Faculty Heads, Ladies and Gentlemen, I am sincerely appreciative for your patience in listening to my paradigms as they relate not only to sustainable development of Nigeria's livestock industry but also to that of the university system and our dear country, Nigeria.

Thank you all.

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