

Livestock Development Policies in the Humid and Sub-Humid Zones of Sub-Saharan Africa

Proceedings of a seminar held in Abidjan, Côte d'Ivoire,
5–9 February 1996



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Technical Centre for Agricultural and Rural Cooperation (ACP-EU)

The Technical Centre for Agricultural and Rural Cooperation (CTA) was established in 1983 under the Lomé Convention between the African, Caribbean and Pacific (ACP) States and the European Union Member States.

CTA's tasks are to develop and provide services that improve access to information for agricultural and rural development, and to strengthen the capacity of ACP countries to produce, acquire, exchange and utilise information in these areas. CTA's programmes are organised around three principal themes: strengthening facilities at ACP information centres, promoting contact and exchange of experience among CTA's partners and providing information on demand.

CTA
Postbus 380
6700 AJ Wageningen
The Netherlands

Tel: (31) 317 467100
Fax: (31) 317 460067

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Foreword

According to World Bank estimates, the animal production sector in sub-Saharan Africa needs to expand 4% annually to ensure an adequate supply of animal protein for the region's growing population and to curb imports. An effective policy environment is a precondition for meeting this challenge especially in the current context of economic liberalization. Appropriate policies that take into account both the socio-economic factors affecting the development of livestock production and the scientific and technical environment in which livestock programmes evolve must be formulated and implemented.

Livestock producers formerly had to deal with just one player, i.e., the government. Now government is just one element in a more diverse group of actors whose roles are interdependent. That group includes the producers themselves, either individually or collectively, private service providers and international aid agencies. Increasingly, the formulation of strategic plans for research is also geared toward the division of labour among national, regional and international institutions so as to meet the criteria for efficiency and effectiveness.



Participants in informal discussion before a plenary session.

The processing of animal products and the marketing potential for livestock underscore the favourable prospects for diversification and development of rural incomes and pave the way for the emergence of a monetary economy in the livestock sector. However, in the wake of human population growth, the space reserved for pastures and fodder production is shrinking as more land is devoted to food crop production. In parallel, there is a growing demand for animal products as a result of the migration of rural people to the cities.

It is in this context that CTA organized a seminar in Abidjan, Côte d'Ivoire, from 5-9 February 1996. The meeting allowed for an examination of the policies needed for the sustainable development of livestock production in a way that also respects natural resources. This seminar topic falls within one of CTA's specific objectives, namely to promote the exchange of information and experience among ACP countries.

We sincerely thank the European Commission, ISNAR, ILRI and the FAO for their scientific and technical support in the design and organization of this meeting. CTA hopes that the seminar allowed national policy-makers and the representatives of regional and international institutions to define, as a group, key program proposals for research, training, and the sharing of experience to ensure sustainable development of the livestock sector in the region.



*R.D. Cooke,
Director, CTA*

Abbreviations

ACCB	Association Centrafricaine des Commerçants de Bétail (Central African Republic)
ADB	African Development Bank
ACP	Africa/Caribbean/Pacific
AFRNET	African Feed Resources Network
ANADER	Agence Nationale d'Appui au Développement Rural (Côte d'Ivoire)
ANBC	Association Nationale des Bouchers Centrafricains (Central African Republic)
ASEAN	Association of South East Asian Nations
ATLN	African Trypanotolerant Livestock Network
CBLT	Commission du Bassin du Lac Tchad
CEAO	Communauté Économique de l'Afrique de l'Ouest
CEBV	Communauté Économique du Bétail et de la Viande
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIC	Comité Interprofessionnel de Coordination (Central African Republic)
c.i.f.	cost, insurance, freight
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel
CIP	Centro Internacional de la Papa/International Potato Center
CIRAD-EMVT	Centre de Coopération Internationale en Recherche Agronomique pour le Développement — Département de l'Élevage et de Médecine Vétérinaire (France)
CIRDES	Centre International de Recherche-Développement sur l'Élevage en Zone Subhumide, formerly CRTA, Centre de Recherches sur les Trypanosomiasés Animales
CMA/WCA	Conference of West and Central African Ministers of Agriculture
CORAF	Conférence des Responsables de la Recherche Agronomique Africains
CTA	Technical Centre for Agricultural and Rural Cooperation
DG XII	Directorate General for Science, Research and Development, of the Commission of the European Community
ECF	East Coast Fever
FAO	Food and Agriculture Organization of the United Nations
FIC	Fonds Interprofessionnel de Coordination (Central African Republic)

FIDE	Fonds Interprofessionnel de Développement de l'Élevage (Central African Republic)
IBAR/OAU	Inter-African Bureau for Animal Resources/ Organization of African Unity
ICARDA	International Centre for Agricultural Research in the Dry Areas
IC-LPG	Inter-Centre Livestock Program Group of the CGIAR
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for Research on Animal Diseases
ILRI	International Livestock Research Institute
INSAH	Institut du Sahel
ISNAR	International Service for National Agricultural Research
ITC	International Trypanotolerance Centre
NATURA	Network of European Agricultural (Tropically and Subtropically Oriented) Universities and Scientific Complexes Related to Agricultural Development
NGO	non-governmental organization
OIE	International Office of Epizootics
PDEGP	Projet de Développement de l'Élevage et de Gestion des Parcours (Central African Republic)
SIVAC	Société Ivoirienne d'Abattage, de Viande et de Charcuterie (Côte d'Ivoire)
SLI	System-Wide Livestock Initiative of the CGIAR
SODEPA	Société de Développement et d'Exploitation des Productions Animales (Cameroon)
SODEPRA	Société pour le Développement des Productions Animales (Côte d'Ivoire)
SPAAR	Special Program for African Agricultural Research, World Bank
SSA	sub-Saharan Africa
TAC	Technical Advisory Committee to the CGIAR
UACI	Union des Agriculteurs de Côte d'Ivoire

Objectives of the Seminar

The seminar was organized as a contribution to the ongoing debate on policies aimed at bringing about sustainable livestock development whilst respecting the natural resource base in developing countries. It was intended to focus mainly on the 18 countries of West and Central Africa located entirely or partially in the humid and sub-humid zones as well as on the main regional and international organizations operating in this part of sub-Saharan Africa.

The seminar had three main objectives:

- to make policy makers aware of the factors which are to be taken into consideration in formulating livestock development policies
- to identify themes on which additional knowledge is required in order to facilitate the formulation of livestock development policies
- to promote consensus views, at both the national and international levels, on the utilization of natural resources, on economic and social policies and on the institutional environment, in order to ensure livestock development on an efficient and sustainable basis.

The organizers hope the seminar will provide a basis for formulating proposals on research, training and information flow and for strengthening the exchange of experiences throughout the region.

Opening Remarks

Address by the Minister of Agriculture and Animal Resources of the Republic of Côte d'Ivoire

The Honourable Konan Lambert Kouassi

Seminar participants, distinguished guests, ladies and gentlemen:

It is a great pleasure for me to be with you today, to bring you the Government of Côte d'Ivoire's contribution to the proceedings of this seminar on Livestock Development Policies in the Humid and Sub-Humid Zones of West and Central Africa.

I wish to welcome all of you who have travelled to Abidjan, our economic capital, to take part in this international cooperation meeting. We are indeed very gratified to see you in such large numbers.

Please allow me also to express my sincere thanks to the Technical Centre for Agricultural and Rural Cooperation whose financial and technical support were key to the organization of this seminar. We also wish to express our gratitude to ILRI, ISNAR and the European Commission, for the scientific support they are lending to the meeting.

This seminar, ladies and gentlemen, is being held after a series of studies and reflection on redefining the roles of the State and the private sector in the development of livestock in our various countries. The seminar also coincides with a worldwide awareness of the need for long-term management of the earth's natural resources.

Three-quarters of the world population, namely the citizens of the developing countries, make use of only a quarter of livestock products yet produce 60% of the world's livestock. Despite the considerable efforts deployed, the technical and technological strides made in increasing livestock production still fall short of expectations.

The consumption of animal products in developing countries accounts for only 6.5% of caloric intake, as compared with 31.7% in industrialized countries.

Undoubtedly, then, it is by intensifying livestock production, rather than by simply increasing the number of animals, that we will be able to reduce and eventually make up for the serious shortage in animal products.

We are now convinced that the major development efforts dictated by the growing needs of our populations can only be achieved by mobilizing all initiatives and skills aimed at preserving and improving our agro-economic potential.

Distinguished guests, Côte d'Ivoire, one of the countries in the zones dealt with by this seminar, depends heavily on the international market for its animal protein supplies. The extent to which domestic production meets needs varies according to protein source: 50% for meat; less than 10% for milk and dairy products; and 40% for fishery and aquaculture products.

Livestock accounts, in Côte d'Ivoire, for 4.5% of the agricultural GDP and about 2% of the national GDP.

Livestock, still a secondary activity, remains a Government priority — a means of developing the potential of available resources, diversifying and increasing farmers' income and, above all, giving a fresh impetus to agriculture by increasingly making use of animal traction and organic manure. Over the past 15 years, the results obtained have been encouraging:

- an increase in meat production by a factor of 2.5
- an increase in egg production by a factor of 6.5
- the development of rural infrastructure and grazing lands
- the establishment of working poultry and pig-rearing industries
- the setting up of management systems for breeding operations and for improvement of indigenous stock
- a more clearly defined structure for the veterinary profession so as to speed up the process of liberalization.

For some years now, the Ivorian Government has opted for a divestiture policy with respect to production, supply and distribution, and has set up an agricultural services restructuring programme. In setting up this programme, the following measures were taken:

- A multi-purpose institution, the Agence Nationale d'Appui au Développement Rural (ANADER, the national rural development support agency), was set up to replace sectoral development institutions. It provides support to professional agricultural organizations, research and development agencies, and agricultural extension.
- Decentralized departments were restructured to enable them to play an effective role in the planning and control of regional development.

Thus, the functions previously performed by sectoral institutions have been handed over to other agricultural development actors, namely

- the private sector, for production, marketing and distribution of veterinary inputs, as well as for veterinary care
- public administration, for planning and management of contagious disease control
- livestock producers' associations, for marketing, supply and, in the long run, supervision.

All these actions are based on the following major goals:

- encouraging livestock professionals individually, or as a group, to take responsibility for linkages within and between livestock production sub-sectors
- enhancing the Government's role in economic monitoring and evaluation of the sector and as an investment promoter
- gearing training and development programmes toward an overall economic approach for farms
- maximum participation of livestock production in the development of a diversified, integrated and more productive and sustainable agriculture, while preserving and improving upon the country's agro-ecological potential.

Ladies and gentlemen, you would all agree with me that this seminar is of prime importance for consolidating the new agricultural policy directions taken by the various countries concerned. What we are saying here is that farmers, technical experts and decision-makers alike place a lot of hope in your meetings. Indeed, we have to get crop farmers and livestock producers to change their habits by encouraging the integration of livestock and crops.

Also, I invite you to be realistic and show pragmatism in the proposals and recommendations you make. This will help ensure that the measures coming out of this meeting are understood and accepted by the rural population and have immediate application.



Côte d'Ivoire's Minister of Agriculture and Animal Resources, the Honourable Konan Lambert Kouassi (second from left), opens the seminar, calling on participants to make realistic and practical recommendations.

It is my opinion that, given the quality of the participants, the outcome of this seminar will help breathe new life into cooperation not only among the countries of West and Central Africa and with countries friendly to the region, but also with specialized institutions and organizations.

Before I end, I would like to call on all of you to cultivate fruitful personal and professional relations while you are here so that you have fond memories of your stay in Abidjan.

Wishing you all a good stay in Côte d'Ivoire, I declare open this seminar on Livestock Development Policies in the Humid and Sub-Humid Zones of Sub-Saharan West and Central Africa.

Thank you.

Address by the Chairperson of the National Organizing Committee

Luc Koffi, Director General of Animal Resources, Ministry of Agriculture and Animal Resources, Côte d'Ivoire

Honourable Minister, ladies and gentlemen:

It is a great privilege for me to welcome such a large number of distinguished delegates to this seminar on livestock development policies in the humid and sub-humid regions of sub-Saharan Africa.

Minister, your presence here today is an indication of the Côte d'Ivoire Government's commitment to a cause the importance of which cannot be ignored, particularly in view of the vast animal resource needs of the sub-region's fast-growing population. We see your attendance at the seminar as a herald of its success. Please accept our sincere thanks.

To those of you who represent regional and international organizations, I can say that your participation in this seminar once again demonstrates your concern for the development of livestock production in the region, and particularly in Côte d'Ivoire. That for me is confirmation that you share our determination to establish policies that will provide for the effective and lasting development of livestock production in general and animal resources in particular.

The city of Abidjan is honoured to have been chosen to host this seminar and proud to welcome such eminent livestock production experts. Thank you for your continuing support.

Ladies and gentlemen, I would also like to give the warmest thanks, on behalf of everyone here and on my own account, to the Technical Centre for Agricultural and Rural and Cooperation, whose financial support for the seminar has allowed for the highest standards of organization.

Last but not least, I would like to thank each of you for the part you have played in the practical organization of this Côte d'Ivoire Ministry of Agriculture and Animal Resources/CTA meeting, with scientific support from ILRI, ISNAR, the Commission of the European Union (DG XII) and FAO.



Luc Koffi, chairperson of the National Organizing Committee for the Seminar and Director General, Animal Resources, for Côte d'Ivoire.

The policy objectives concerning the development of livestock production in the humid and sub-humid regions of sub-Saharan Africa reflect the concerns of the Côte d'Ivoire Government with regard to livestock production. They may be summarized as follows:

- continuing to improve traditional livestock farming practices, building on progress made so far
- diversifying and modernizing production systems by accelerating the spread of short-cycle livestock production (poultry and pig raising) and by promoting new cattle and sheep farming systems
- creating an economic environment conducive to the development of livestock production and private enterprise.

Ladies and gentlemen, you are well aware of the opportunity this seminar represents for finding solutions to the problems we all face every day. I believe that policies which will both increase output and meet the basic needs of the region's people need to be pragmatic. They need to take account of such internal and external constraints on all areas of animal production as the purchasing power crisis and the slow progress of modernization at both national and regional level.

Regional cooperation or, better still, regional integration is — despite the many and varied difficulties of which we are all well aware — crucially important for the animal resources sector.

Ladies and gentlemen, may I remind you all that the Organizing Committee, which it is my honour to chair, is at your service to ensure that you have optimal working conditions and a thoroughly enjoyable stay in Abidjan.

Thank you for your cooperation.

Address by the Representative of the Technical Centre for Agricultural and Rural Cooperation

T.M. Narain, Special Adviser to the Director of CTA

Honourable Minister of Agriculture and Animal Resources, representatives of donor organizations, distinguished guests, ladies and gentlemen:

The Director of the ACP-EU Technical Centre for Agricultural and Rural Cooperation, Dr Rodney Cooke, was unable at the very last moment to be present at this seminar and offers his apologies. I am privileged and honoured, on his behalf, to welcome you to this meeting organized by CTA.

I would first like to thank the authorities of the Republic of Côte d'Ivoire through the Ministry of Agriculture and Animal Resources for their full cooperation in the logistical arrangements for this seminar.

The team from the West Africa Rice Development Association (WARDA) have also provided valuable assistance.

I would also like to thank the following representatives of the institutions which have collaborated closely with CTA in the scientific and technical organization of this seminar:

- the Commission of the European Union: Prof. Dr Tilak Viegas
- the International Service for National Agricultural Research (ISNAR): Dr Christian Hoste
- the International Livestock Research Institute(ILRI): Dr Simon Ehui
- the Food and Agriculture Organization of the United Nations (FAO): Dr H.Carsalade and his collaborators
- the Centre de Coopération internationale en Recherche agronomique pour le Développement (CIRAD): Dr Didier Richard
- Members of CTA's Advisory Committee: Profs. Drs K. Bruhn, J. Mortelmans and W. Van Vuure

CTA, which celebrated its first 10 years of existence in 1995, is certainly known to all present at this meeting. Nevertheless, for those who are only familiar with its bimonthly bulletin *Spore* and who know the Centre itself less well, I would like to present a brief summary of CTA's role.

Essentially, the Centre has been established within the framework of agricultural and rural cooperation of the Lomé Convention and is at the disposal of ACP States to facilitate their access to the information they require for agricultural development. This implies a passive role for the Centre. But since its establishment, its aims have evolved towards an active role which is to strengthen the capabilities of ACP agricultural documentation centres to acquire and supply information to ACP nationals.

CTA pursues four specific objectives within its operational framework.

- It aims to promote contact and exchange of experiences between experts in the field of agriculture and to organize seminars (such as this one) through financing the participation of ACP nationals at regional and international meetings or study visits.
- It aims to provide agricultural information on demand. In the pursuit of this objective, CTA produces its bimonthly bulletin *Spore* in English, French and Portuguese (40,000 copies) and gives priority to the distribution of books on agriculture and rural development. CTA also provides a Question-and-Answer Service and a Selective Distribution of Information Service for researchers.
- It aims to strengthen ACP information and documentation services. The programme of activities in this field includes training managers of documentation centres; supplying reference publications on agriculture (DORA); and providing CD-ROM stations and discs.
- It aims to develop strategies for planning, implementation and evaluation of agricultural information programmes and services in ACP States. This is achieved through specific studies at the national and regional levels to define information needs and to facilitate collaborative activities with institutions and information networks.

These are the main objectives of CTA's programme of activities.

My colleague André Vugayabagabo and myself will be at your disposal during this meeting to provide you with any additional information you may require.

Let us now return to the subject at hand: this seminar. Its main objective is to promote contact and exchange of experiences.

It is to preach to the converted at this meeting if I highlight the importance of livestock in the development of the agricultural sector in our countries. However, it has been noted that, for some time, there has been a decrease in funding from donors for research projects and for the development of the livestock sector, the reason being the weak performance in terms of production and improvement in food security in relation to the investments. The negative impact of livestock on the ecological environment has also been put forward as a reason. These are the challenges which the seminar will have to address.

Of course, the increase in human population has given rise to the need for the production of more food crops. The land needed for grazing cattle and producing fodder crops has therefore decreased. There has been a drift of rural populations to towns, resulting in an increased demand for animal products.

All these factors require national policies to promote livestock production and marketing. The objective of this seminar is to come up with recommendations pertinent to the formulation of these policies.

I would like to share with you a comparison recently made between the production sector and the role of the government. As in a football match, on one side you have the production sector and marketing; on the other, the consumers, and therefore demand.

The government acts as the referee. It sets out regulations and ensures that these are respected.

However, the government often commits two errors:

- It provides all its assistance to the producer at the expense of the other players.
- It enters the game itself.

Result: once the projects come to an end, the producer is left impoverished and remains helpless on the field.

However, if the government were to support all the players — researchers, extension officers and the private sector which provides traders with inputs, etc. — together these participants could form a close team which would remain intact even when the projects come to an end.

When the wind of change blows, in terms of market liberalization, it can be influenced by appropriate policies put in place by the government in its role as referee. It is important to ensure that the government does not withdraw and take the ball away.

To conclude, I hope that this seminar will provide an opportunity to examine the various factors to be considered in the formulation of appropriate and necessary policies which will lead to continued development of the livestock sector.

I thank you for your attention.

*Economic, Political
and Scientific Environment*

Impact of the Economic Environment on Livestock Development Policies: Introductory Issues

Bernard Rey, Delegation of the European Commission, Nigeria

Introduction

The purpose of this paper is to put a few questions to seminar participants in the context of a preliminary debate on livestock sector policies in the sub-humid and humid regions of sub-Saharan West and Central Africa. It so happens that these questions are among those which prompted the seminar and, as such, reflect the concerns of the steering committee. We have identified two important economic phenomena which may have repercussions on policies in the livestock sector:

- the devaluation of the CFA franc and the instability of other currencies in the region
- the implementation in the majority of countries of structural adjustment programmes which take an increasingly sectoral approach to rural development policies.

Questions on Sectoral Policies

Status of Livestock Production

The first question concerns the status of livestock production in the agricultural economy and where it stands in a sectoral approach to development: what level of priority is accorded livestock production in terms of resource allocation, and do some sectors receive more attention than others? Setting priorities is generally a matter for the politicians.

Development of Sectoral Policies at the Regional Level

The second question is whether there is consultation between States in developing sectoral policies on livestock production. The ethnic groups involved in livestock production, transhumance and the trade in meat and livestock are an integral part of this sector in the region. Policies implemented in one country may therefore have synergistic or antagonistic effects in neighbouring countries. Regional organizations do exist in the fields of research, marketing and even production, and it would be useful to know if they are capable of playing a part in developing sectoral policies in individual States.

The implementation of a sectoral approach to rural development, with the support of donors, particularly the European Union, needs to take account of the various sub-sectors and the actors involved in various stages of each: consumption, processing, marketing of inputs and products, and production.

Sub-Sectors

Increasing Demand and Sectoral Organization

As regards consumption, it should be noted that the region's largest urban centres — for example, Abidjan, Lagos and Accra — are concentrated along the coast, mostly in the humid region. The urban population accordingly has a significant influence on policy development in the coastal States. Changes in urban consumption patterns have led to faster growth in demand for meat from monogastric animals than from ruminants. (The ruminant sub-sector is generally organized along traditional lines.)

The question is therefore whether the policies implemented tend to favour the consumer or the producer. The terms of the balance are known, but has the devaluation of the CFA franc in the countries concerned not tipped the scales in favour of producers?

Changing Trends and New Research Requirements

A trend toward liberalization has emerged in recent years in the processing and marketing of both crop and livestock products. The removal of direct State intervention has brought new operators into the sector and increased the importance of some of those already present.

The impact of this trend on development in the livestock sector therefore needs to be assessed. It must also be established whether the changes have improved the way the sector operates and increased value added in its sub-sectors. Moreover, since new operators can bring in new techniques, have the corresponding research requirements been identified and are they reflected in the research agendas of the relevant organizations?

The Diversity and Development of Production Systems

At the producer level, there are clearly a great variety of traditional production systems linked to the agro-ecological environment. Some emerging and/or rapidly expanding systems, such as industrial monogastric production and peri-urban ruminant farming, are also of economic significance.

There again, the question is whether there are still technical problems relating to these production systems to be resolved through research as a matter of priority, or whether efforts should be focused on establishing a political and institutional environment conducive to the use of known production techniques. The dilemma can probably never be entirely resolved, but policy-makers will need to bear it in mind.

The withdrawal of State intervention connected with structural adjustment policies can be seen both at the production level and in intermediate operations. The result is that the beneficiaries are now taking responsibility for their own development and the trade associations are gaining in influence.

A Shift of Responsibility

The pace of this shift of responsibility away from the State raises a number of questions: To what extent is it speeded up when the adjustment programmes involve cuts in the State payroll? And do States have the means to ensure a smooth transfer of responsibility? The pace of change is also affected by the motivation of those involved: What drives them? And what forms of consultation currently exist?

Conclusion

These are just some of the questions connected with the impact of the economic environment on livestock sector policies in the humid and sub-humid regions. They are based on trends which we believe to be visible at the regional level. However, the disparities between countries cannot be denied, so it would be helpful to discuss national variations in these trends.

Socio-Economic Problems Associated with Livestock Development in Sub-Saharan Africa

Andrew James, Veterinary Epidemiology & Economics Research Unit, Department of Agriculture, University of Reading, U.K.

Abstract The paper identifies some principles in the economics of livestock development that are relevant to a wide range of livestock production systems found in sub-Saharan Africa. However, each situation should be treated on its own merits and the formulation of appropriate policies requires much more information than is generally available. Many of the "socio-economic" problems of livestock development have their roots in development policies that have failed to recognize the biological complexity of livestock production and mixed farming systems, and the objectives of livestock owners. In the experience of the author, livestock owners almost invariably respond perfectly rationally to any situation with which they are confronted. Unexpected or undesirable responses can therefore usually be attributed to faulty analysis of the production system or to producers' objectives.

If the behaviour of people is to be explained and predicted, it is essential to take into account all of their values and not just those involving money. Of course, to compare different values, they must be expressed in common units which are usually monetary. This implies that economists must seek to quantify values such as the social prestige of herd ownership that are not easily convertible into money. Techniques for doing this are imperfect, but if there is to be a rational basis for livestock development policy, it is essential to use methods that balance monetary income against other values. This is particularly important in sub-Saharan Africa where livestock play an important role in many cultures.

The paper considers the objectives of livestock owners and the development objectives of government policy-makers. Techniques for characterizing livestock production systems are reviewed. The author describes techniques for the economic analysis of livestock production systems with a view to identifying constraints and opportunities for development. Various types of government policies and interventions are discussed, with analysis of their probable effects on production systems and on the welfare of producers and consumers.

Introduction

Sub-Saharan Africa has an enormous diversity of livestock production systems. Each has evolved to suit a particular geographical, cultural and economic environment, and the production systems change in response to the rapidly changing conditions of the region. This paper seeks to identify some principles in the economics of livestock development that are relevant to a wide range of these production systems.

There are exceptions, however, to every rule, and no recipes for development solutions can be offered. Each situation needs to be treated on its merits, and the formulation of

appropriate policy requires much more information than is generally available. Many of the "socio-economic problems" of livestock development have their roots in development policies that have failed to recognize the biological complexity of livestock production and mixed farming systems and the objectives of livestock owners.

In the experience of the author, livestock owners almost invariably respond perfectly rationally to any situation. Unexpected or undesirable responses can usually, therefore, be attributed to faulty analysis of the production system or the objectives of livestock owners.

It is, perhaps, these deficiencies in analysis that have led to the addition of "socio-" to economics. This is, or should be, unnecessary. Finance is the analysis of money, whereas economics is a social science dealing with value. If the behaviour of people is to be explained and predicted, it is obviously essential to take into account all of their values and not just those involving money. It is true that to compare different values, they have to be expressed in common units, which are usually monetary.

This implies that economists must seek to quantify values such as social prestige that are not easily convertible into money. The techniques for achieving this are imperfect, but if there is to be a rational basis for livestock development policy, it is essential to use methods that can balance monetary income against other values. This is particularly important in sub-Saharan Africa where livestock hold an important place in many cultures, but it is not to be neglected in the developed countries; witness the popularity of Highland cattle among wealthy European landowners, and the rise of organic farming systems.

The paper considers the objectives of livestock owners and the development objectives of government policy. Techniques for characterizing livestock production systems and trends in their development are reviewed. It describes techniques for the economic analysis of livestock production systems with a view to identifying constraints and opportunities for development. The various types of government policies and interventions are discussed, with analysis of their probable effects on production systems, and the welfare of producers and consumers of livestock products.

Objectives of Livestock Production

The economics of livestock production must be considered in the context of production objectives. The situation is complicated, and confusion often arises, because analysis and policy-making are normally undertaken by governments, whereas the responses of the industry are determined mainly by livestock owners.

Governments and livestock owners have different objectives, and these often conflict. Similar conflicts of interest can occur at the household level, where there is separation of decision-making, day-to-day management of livestock and use of different livestock products.

Understanding the different objectives and motivations is essential for meaningful analysis of livestock production systems and constraints. The objective of livestock owners is to maximize their own economic welfare. To do this, they seek to maximize the economic margin (the difference between the value of outputs and the value of costs).

Economic welfare must not be confused with financial income; it includes a range of outputs and costs that can be very difficult to value in monetary terms.

It may be difficult to place a monetary value on the personal satisfaction and social prestige that come with owning cattle, but an economic analysis that ignores these issues is unlikely either to explain the behaviour of cattle owners or to produce policies acceptable to them. Livestock, especially cattle, play a central role in the culture of many African societies, and so social values are usually even more important in livestock economics than in other branches of agricultural economics.

Another feature of livestock is that they represent a capital asset — for many people, their main capital asset. For livestock owners with limited access to the cash economy, and in economies with high inflation and unreliable financial institutions, livestock have an important function as a capital reserve. Livestock owners may consider it worthwhile to hold livestock, even if they do not produce anything, as a means of preserving the value of capital.

Livestock owners have flexibility in the timing of production and in trading off production against changing the capital value of the herd. This can make it difficult to measure real production, especially in the short term, and may produce apparently perverse producer responses to changes in economic policies and conditions.

An increase in meat prices, for example, may result in a short-term reduction in animals being marketed, as producers try to increase their breeding herds and are able to maintain their income by selling fewer animals.

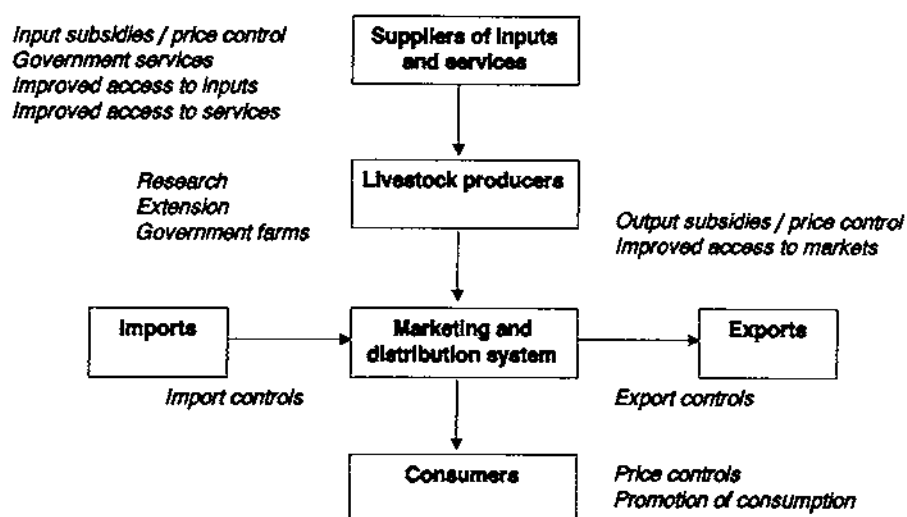
A list of the costs and benefits of livestock owning is shown in Table 1.

The objective of governments should be to maximize the economic welfare of society as a whole. This implies a balancing of the welfare of producers and consumers of livestock products and consideration of budgetary implications.

Government policy can affect the production and marketing chain at various points, summarized in Figure 1.

Table 1. *Costs and benefits of livestock owning.*

<i>Costs</i>	<i>Benefits</i>
Feed: - forage - purchased	Offtake: - for household consumption - for sale or exchange
Labour	Draught power and transport
Capital invested in herd (may be negative)	Change in capital value of herd/flock
Housing and equipment	Personal satisfaction
Water	Social prestige
Veterinary and medicine costs	Stabilization of household economy
Other inputs and services	

**Fig. 1.** *Government policy intervention points.*

Government action that affects prices will produce immediate welfare shifts between producers and consumers. In the longer term, it may also affect the efficiency of production, as producers respond to new price structures. Government policy that results in improved efficiency of production or marketing will benefit society as a whole, but may lead to shifts in economic welfare among producers, middlemen and consumers. Balancing the economic welfare of producers and consumers is, therefore, the most important objective of government policy and requires constant review as production systems and market conditions change, either due to government interventions or to external factors.

Production Systems

Despite the diversity of sub-Saharan Africa's livestock production systems, they have common features that can be used as a basis for classification. Most production systems use forage, defined here as a livestock feed resource that would have no major alternative use.

This definition would include grazing land not suited to other agricultural uses (including rangeland, if game are considered as livestock), many crop residues, household waste and the mixture of food scavenged by free-range poultry and pigs.

Forage presents a particular problem in livestock economics. Having little or no alternative use and being rarely traded, it is difficult to value. Its cost, therefore, tends to be omitted from economic analysis, which implies that it is of no value. This makes nonsense of the economic analysis, because forage is clearly an important, valuable resource in many economies.

From the definition above, forage derives its value only from its potential for livestock production. Its value can therefore be estimated as the value of livestock production that can be obtained from it, adjusted for other costs of production (including purchased feed).

This implies that the value of forage depends on the efficiency of the livestock systems that make use of it, and that the economic efficiency of livestock production should be assessed in terms of the economic margin per unit of forage resource. Figure 2 illustrates this principle.

The theory and implementation of this production efficiency index is described in James (1991) and James and Carles (1996). The value can be obtained from a series of production parameter estimates, and it is *not* necessary to measure forage intake directly.

This index is only relevant where livestock derive some of their feed from forage, so it would not be applicable to intensive poultry and pig production. Standard economic indices based on return to capital investment are most appropriate for these "factory farming" systems.

The "margin per forage unit" index differs from those more commonly used in agricultural economics: margin per hectare or margin per animal. It is usually difficult to calculate the margin per hectare for livestock enterprises, as the animals rarely have exclusive use of a particular land area for the whole year. For this reason, margin per animal has commonly been used.

This index, however, may not be appropriate in development situations where it is necessary to compare the productivity of different breeds and species. It always favours large, high-producing animals, which require high levels of non-feed inputs and may not be well adapted to using low-quality forage.

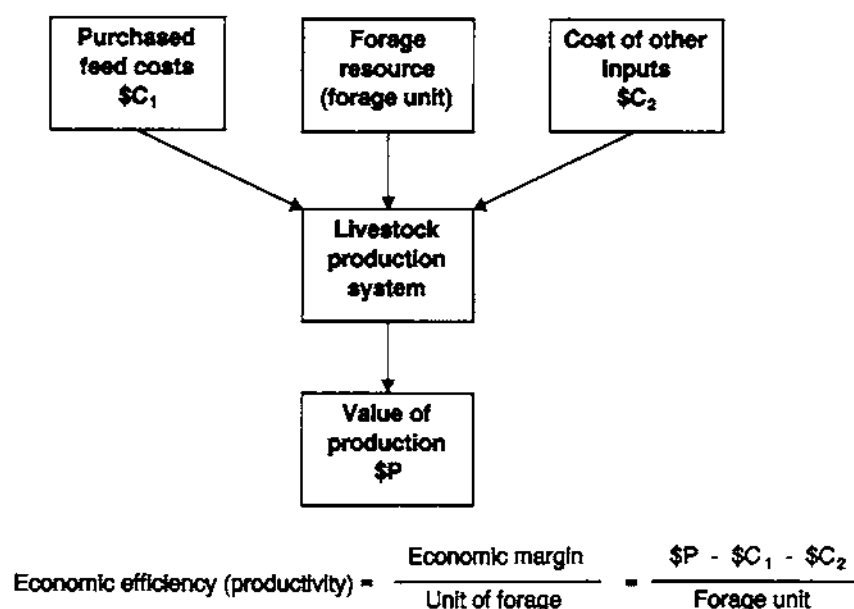


Fig. 2. *Efficiency of livestock production.*

A forage resource may be used more efficiently by a large number of small low-input, low-output animals than a lesser number of larger, more intensively managed animals. The use of margin per animal as an index of production efficiency, combined with neglect of high input costs and non-monetary outputs, has been responsible for many inappropriate introductions of exotic livestock breeds.

This is not to suggest that there is no real economic incentive for more intensive production; only that using margin per animal as an efficiency index tends to overestimate it. Higher-producing animals use more of their feed for production than maintenance.

There is, therefore, a trend toward more intensive livestock production systems because they are inherently more efficient. A number of issues, however, constrain progress towards intensification. These must be taken into account in economic analysis if appropriate livestock development policy is to result. They can also be the subject of government intervention to encourage livestock development and improve producer and consumer welfare.

Livestock Development Policy Issues

Market Development

Livestock owners will be motivated to adopt higher-output systems only if they have access to good markets for the produce. Milk production is particularly affected by this constraint, as it is bulky and perishable. If it has to be transported over great distances,

marketing costs can easily exceed the value of the product. Slaughter stock can be transported live to the areas of consumption, so marketing costs should be lower.

But animal health regulations often prevent the free movement of livestock. There is also a risk that animals will be wholly or partly condemned in abattoirs. Traders may move and slaughter animals legally or illegally, but face risks and high costs. Livestock dealers are also notorious for forming cartels to keep purchase prices low and prevent others from entering the market. These factors often result in large price differentials between areas of meat production and consumption.

Government efforts to develop marketing of livestock and livestock products have all too often failed. The main problem has been high overhead costs resulting from investment in plant and infrastructure, from poor management, and from following strict zoosanitary and hygiene regulations. High costs create incentives to use informal marketing channels, which governments often try to ban. The result is that the informal market becomes an illegal market, which depresses producer prices and puts human and animal health at risk.

Co-operatives owned and controlled by producers have a better record in the improvement of marketing. The majority of successful examples, however, have been dominated by large-scale commercial producers. These benefit from economies of scale, better financing and the management skills of their members. Such co-operatives have been attractive targets for government take-overs, which have all too often destroyed their commercial basis. Under structural adjustment programmes, these organizations are being re-privatized, but it is doubtful whether they will treat the marketing needs of small farmers as a priority.

Private traders and middlemen are much maligned, but they can and do serve the needs of small farmers and consumers if they are properly regulated and not driven underground by excessive restrictions. Governments need to pay attention to several factors:

- Zoosanitary and hygiene restrictions should not be too onerous and should be enforceable. Excessive regulation is counter-productive if it results in the establishment of illegal and totally unregulated marketing channels. Consumer confidence in hygiene standards, however, and control of major animal diseases must be maintained.
- Enforcement of the regulations should be free from corruption. This is a difficult problem in many countries. Although regulations are used as a mechanism for officials to make a living wage, livestock development objectives will be constrained by inefficient marketing and ineffective disease control.
- There is real competition between private traders. Traders often collude to manipulate markets to the disadvantage of both producers and consumers. They are only able to do this by preventing others from entering the market. Governments should ensure that markets are open and that traders are free to operate, provided that they observe the standard zoosanitary and hygiene regulations.

- Infrastructure such as roads, quarantines, abattoirs and milk processing plants need to be available and run efficiently. Some of these will be owned by government; where they are in the private sector, their development and operation is still a matter of public interest.

These duties of government are usually administered by different ministries, and the objectives often conflict with each other. There is a need to develop clearly stated and consistent policies, so that different ministries and departments work to the same standards and towards the same objectives.

Price Control and Stabilization

In economies with higher average incomes, the inelastic demand for food products produces a situation in which improvements in productivity result in reduced farm incomes, but this is not a major problem in most of sub-Saharan Africa at present.

Some countries have permitted the free importation of livestock products “dumped” on the world market as a result of agricultural support policies in developed countries. Depressed prices resulting from imports at artificially low prices are a disincentive to the development of livestock production, and may destroy commercial production where it has been established.

On the one hand, countries relying on the importation of livestock products at less than the cost of production will be vulnerable to any policy changes in the exporting countries. On the other hand, maintaining prices at artificially high levels acts against the interests of consumers, suppresses the development of markets and encourages the adoption of unsuitable production systems.

Governments need to determine target prices for livestock products, which provide sufficient incentive for the development of the domestic livestock industry, while ensuring that consumer prices are reasonable. Few sub-Saharan African governments have the resources to provide direct price support, or to enforce maximum prices for livestock products.

They can, however, set maximum prices by import policy, provided that the target price is higher than that of the world market. They may also be able to support producer prices through exports, but exports are often constrained by zoosanitary restrictions and commercial factors. Most importers have very high quality standards and require consistent supplies. Export markets require long-term investment and development, and can rarely be used for short-term price support.

Prices of agricultural products are subject to short-term variation, as their supply is affected by seasonal and longer-term climatic factors. Unstable prices discourage investment by livestock producers and reduce overall demand. Consumers are more likely to develop the habit of using products that are consistently available at stable prices. Governments may intervene in markets to stabilize prices, but price support by intervention buying is expensive. If imports are used to stabilize temporarily high prices — for example, during periods of drought — then producers receive lower prices for their reduced output at the very time when they need support.

The most effective policy of price stabilization is to encourage the adoption of production systems less vulnerable to seasonal and climatic factors. Forage conservation and the use of crop residues contribute to this objective. Commercially oriented livestock producers should be able to buy imported stock feeds, at least in the short term. In general, the output of more developed and commercial livestock production systems is less affected by adverse climatic conditions.

Producers' Objectives

If it is an objective of livestock development to increase marketed offtake — and for optimal use of national resources it probably should be — then the objectives of livestock owners need to be considered. Increasing marketed offtake may be in conflict with other objectives of owning livestock. If livestock owners have little use for money, their other motivations for keeping livestock are likely to be dominant. Higher prices are unlikely to persuade them to increase offtake.

The availability of alternative foods, consumer goods and services such as education tends to draw people into the cash economy, although it takes time for new tastes and consumption patterns to develop. As the need for money expands, so marketed offtake assumes higher priority in the objectives of livestock owners. At the same time, new patterns of consumption and standards of wealth may reduce the importance of traditional values and objectives. Whether this is beneficial is questionable, but it is probably inevitable. Even if traditional livestock owners do not wish to change their life-style, they are under increasing pressure as expanding agricultural populations encroach on traditional grazing lands, particularly dry-season grazing areas.

These trends produce agro-pastoralism and mixed farming systems. Crop residues substitute for dry season grazing, and overall production from the land generally increases. This development often takes place in environmentally fragile areas, and government policy should aim to ensure that sustainable systems are developed.

There are also social and environmental advantages, however. Mixed farming should be able to support more people than livestock keeping alone. Livestock owners operating in the cash economy and used to alternative food products are more likely to sell animals early in droughts, which improves food security and reduces environmental damage. Governments can facilitate this process by developing market outlets for low-quality animals in periods of drought.

There are two important non-market objectives of keeping livestock in mixed farming systems. These are the provision of draught power and the role of animals as a capital reserve that can be drawn upon when other crops fail. Both objectives can be compromised by shifting to systems aimed at higher levels of marketed offtake. Generally, high-producing cattle breeds are less well suited to draught purposes. Although animals of high-producing breeds have higher capital value, it may be more difficult to sell them (in times of drought for example) and even more difficult to replace them later.

In the longer term, it may be more efficient to replace these functions of livestock with mechanical traction and more effective financial systems to hold capital and provide credit. These developments, however, require long-term investment in infrastructure, services and education.

In the meantime, non-market functions of livestock will remain important, and they must be recognized in economic analysis. Failure to do so results in the formulation of inappropriate development policies and the promotion of production systems unacceptable to farmers because they do not meet all of their objectives.

Availability of Inputs and Services

Any country with a livestock industry needs services to control major epidemic and zoonotic diseases. Countries exporting livestock and livestock products will need to maintain more stringent standards. Effective control of these diseases cannot be the subject of individual producers' decisions, but must be determined at the national or regional level. In practice, these services have to be financed by government or other central agencies.

As production becomes more intensive, requirements for inputs and services of all types increase. Most of these can be delivered on an individual basis, and the benefit is largely confined to the individual user. Payment for such inputs and services is possible in view of the direct benefit and desirable as a way of limiting usage to optimal levels. It can be argued that it is in the national interest to promote the use of inputs and services by offering them on a subsidized basis. Once subsidized services have been provided, however, it is difficult to impose full cost recovery.

Governments in sub-Saharan Africa have found it increasingly difficult even to finance basic disease-control operations, and provision of other inputs and services has become impossible in most cases. Attempts have been made to impose cost-recovery systems, but these have met with only very limited success.

Cost recovery for the control of epidemic and zoonotic diseases encounters a serious problem: if the service is withheld from those who cannot or will not pay, the success of the whole programme is jeopardized. Furthermore, the cost of collecting fees later is likely to exceed the revenue collected.

Cost-recovery schemes for other inputs and services provided by governments have been plagued by administrative problems. Where the fees are paid into the central government system, it is difficult to transfer them back to finance the operations of the department. Revolving funds within technical departments have not generally been sustainable because government procedures are not designed to support the administration of such activities. They are usually delivered more effectively through private enterprise.

So far as animal health inputs and services are concerned, there would be inefficiency in delivering disease control and clinical services through different agencies. However, government staff responsible for epidemic and zoonotic disease control can also be authorized to provide additional inputs and services on a private basis. It is also possible for private veterinarians to undertake government disease control work under contract.

The second option has been adopted in most developed countries. The problem of accounting for private use of government resources is avoided, the private veterinarian

has an incentive to carry out the government work as efficiently as possible, and the government staff adopt their proper roles of regulation and supervision. It should also be emphasized that delivery of services through the private sector does not exclude the possibility of subsidies.

Most countries have much stronger capabilities in providing veterinary services than other livestock-related technical services. Provision of artificial insemination, feed analysis and advice on nutrition have been particularly difficult. These services are expensive, often badly delivered, and farmers have frequently been unwilling to meet the costs. Some countries have adopted the approach of training veterinarians to provide these services, which are in any case closely linked to health and fertility. Others have successfully organized co-operatives to provide inputs and services as well as marketing. Experience in Zambia and Kenya has shown that commercial farmers, at least, are willing to pay the costs of a wide range of services, provided that they are timely and effective.

In many countries, input-supply problems have hampered livestock development. It is difficult to manage commercial livestock enterprises without reliable access to quality stock feed, medicines and other inputs. For imported inputs, shortages of foreign exchange have often undermined supply. Recent economic changes have lessened the problem, but often substantially increased the cost of foreign exchange. In some countries the supply problem is compounded by tariffs on imported inputs to protect inefficient local manufacturers.

Many drugs required by livestock owners are protected by patents, and the system of sole agencies for their importation can lead to price differentials of several hundred percent between c.i.f. and retail prices. Compound stock feeds from many suppliers in Africa are of exceedingly variable quality, and this can be disastrous for commercial producers. Even where legislation exists to require manufacturers to state the contents of their products, it can rarely be enforced due to the lack of analytical facilities which are expensive.

Information for Livestock

Development Policy

All of the policy issues discussed in this paper have been presented in qualitative terms. Directions for development and balances between conflicting objectives have been suggested, but to implement policy for any particular country, quantitative information is required. Far too little is known about livestock production systems in most countries, and policy is being formulated in an information vacuum.

To confirm this, it is only necessary to look at estimates of livestock production in national accounts. A basic knowledge of the livestock industry and a few minutes of calculation will demonstrate the estimates to be wildly inaccurate for many countries.

For effective planning of government action on issues such as import policy, provision of inputs and services, marketing and research priorities, much more quantitative information on livestock production systems and economics is required. This must include information on non-market objectives of livestock keeping. It is impossible to obtain

adequate estimates of livestock production parameters from single-visit surveys and censuses. Longitudinal monitoring is necessary, and this requires the participation of livestock owners.

The effective delivery of advisory, animal health and fertility services also requires herd records to be maintained, and the provision of advisory services should involve a two-way flow of information between farmers and advisers. Information collected in this way has the potential to provide the basis for policy-making; however, individual confidentiality must be maintained.

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The Scientific Environment of the Livestock Sector in West and Central Africa

*Christian Hoste, International Service for National Agricultural Research (ISNAR),
The Hague, Netherlands*

Abstract The scientific environment for livestock production in West and Central Africa can be characterized under several headings: existing policies, available resources, and the results achieved by national, regional and international research. The paper describes the current situation and reveals, among other things, weak research planning efforts; an increasing number of better-trained researchers (although this is associated with a diminishing budget per researcher); few directly applicable results; and, consequently, few significant changes in livestock technologies. The second part of the paper outlines some major trends over the past few years in the area of livestock research: the fact that some countries are beginning to view research in terms of "national agricultural research systems" (NARS); regionalization; improved coordination of donor country support; renewal of the international system for agricultural research; and better division of tasks between national, regional and international institutions. These trends are a positive sign allowing for a degree of optimism. Finally, concrete proposals are presented for improving the situation in the areas of research planning and organization, management of human and financial resources, and research programs. The paper concludes that the development of the livestock sector in West and Central Africa is constrained more by the economic and policy environment than by the scientific situation and that this is an issue for the seminar to explore in more detail.

Introduction

"Research is the engine of development." This statement has almost become an axiom and no politician in the world would dispute it. Since the prime concern of most developing countries is still food security and self-sufficiency, agricultural research should play a dominant role. However, even a superficial review of the situation shows that this is not the case and that there is a considerable divergence between talk on the subject and reality. This observation is perhaps more true for livestock than crop production since research and development budgets devoted to livestock production reflect neither the economic importance of this sector nor the scale of the challenge to be met. Indeed, it is generally recognized that animal production must grow at a rate of 4% per year over the next decade to meet the needs of the population, whereas the rate for crop production is around 3%.

This paper briefly reviews the current position of livestock research in West and Central Africa, describes broad trends that have emerged over the last few years in this sector of agriculture, and puts forward some ideas for improving the scientific environment of livestock production in the region.

Current Situation

The scientific environment is highly dependent on policy decisions and the first step is to consider whether governments in the region have set objectives for agricultural research in general and livestock research in particular. The human, financial and material resources on which the region can call to conduct livestock research will then be examined. Lastly, an outline will be given of important research findings over recent decades.

Research Planning

While most countries have an agricultural development policy document that sets general objectives for crop and animal production, the situation is rather different for agricultural research. ISNAR is currently preparing a review of strategic plans for agricultural research in sub-Saharan Africa.

This study recognizes that the vast majority of countries have official documentation dealing with agricultural research. A distinction must be drawn, however, between first- and second-generation planning documents and, with regard to the first generation, among three types of documents. Table 1 presents this typology as well as the status of agricultural research planning in West and Central African countries.

Available Resources

The following two sub-sections present major trends observed over the last three decades with regard to the human and financial resources at the disposal of agricultural research in sub-Saharan Africa. The figures quoted have been taken from a recent study published by ISNAR (Pardey et al., 1995).

Although the data provided here cover the whole of sub-Saharan Africa, not just West and Central Africa, and are not specific to livestock research, the major trends still hold true and contain many lessons for the purposes of this paper. Details relating specifically to livestock research are mentioned when known.

The material resources available in the region for livestock research are described briefly in a third sub-section.

Human Resources

The last three decades have seen a large increase in the number of researchers in sub-Saharan Africa and a distinct improvement in their level of training. The number of researchers,¹ expressed as "full-time researcher equivalents," grew at the rate of 9.1% in the 1960s, 6.1% in the 1970s and 3.5% over the last decade.

¹ These figures include researchers in state agencies, parastatals and universities specializing in agriculture, animal production, forestry and fish farming.

Table 1. Status of agricultural research planning in West and Central Africa.

Country	Type of Planning			
	Type 1	Type 2	Type 3	Type 4
Benin			X	
Burkina Faso				X
Cameroon		X		
Cape Verde	X			
Central African Republic	X			
Chad			X	
Congo	X			
Côte d'Ivoire			X	
Equatorial Guinea	...			
Gabon	...			
Gambia	X			
Ghana			X	
Guinea		X		
Guinea Bissau	X			
Liberia	...			
Mali			X	
Mauritania			X	
Niger			X	
Nigeria		X		
São Tome & Príncipe	...			
Senegal		X		
Sierra Leone		X		
Togo	X			
First-generation plans: <i>Type 1:</i> sector-based strategies, summaries of research findings, preparatory documents, defined research priorities, annual programming, etc. <i>Type 2:</i> documents on research priorities, medium-term plans, five-year plans, ongoing strategic planning, outdated strategic plans, etc. <i>Type 3:</i> ongoing strategic plans (drafts or final versions). Second-generation plans: <i>Type 4:</i> revised documents of the three previous types. ... = no plans or information not available				

Source: ISNAR, 1995

Expatriates now represent only 11% of researchers working for national institutes in sub-Saharan Africa, whereas the proportion was 90% at the beginning of the 1960s and 30% in the early 1980s.

Almost 64% of national researchers in the 25 countries analyzed by ISNAR have post-graduate qualifications, as opposed to 45% only 10 years ago. One-fifth of researchers have doctorates, but 64% of these are concentrated in three countries including Nigeria.

With regard to the number and quality of researchers in the livestock sector, a distinction must be made between countries in the sub-humid regions, part of whose territory is generally in the Sahelian region, and coastal countries. Livestock populations are substantial in the former, but relatively modest in the latter, which are the main consumers of animal products. It is quite clear that the situation varies widely from country to country. Table 2 illustrates this with the data available on six countries in the region.

The few statistics which ISNAR has on this subject suggest that importing countries invest a proportionally greater amount of human resources in livestock research than exporting countries, if these figures are compared with the share of animal production in the national economies (Roseboom, personal communication).

Financial Resources

The ISNAR study clearly shows that growth in expenditure devoted to research (expressed in constant dollars) has not kept pace with the rising numbers of scientific staff.

Table 2. *Number of full-time researcher equivalents in six West African countries.*

Country	Number of full-time researcher equivalents				Annual growth rate (%, calculated using the least squares method)			
	1961	1971	1981	1991	1961-71	1971-81	1981-91	1961-91
Burkina Faso	10	25	91	142	11.3	12.3	2.8	9.8
Côte d'Ivoire	67	135	192	267	6.4	3.9	3.7	4.2
Ghana	57	132	180	278	9.6	2.8	4.4	4.2
Nigeria	136	364	944	1,013	10.4	10.8	-0.3	7.5
Senegal	60	71	184	175	2.2	11.5	-1.1	5.4
Togo	2	15	38	87	20.2	9.3	9.7	11.6

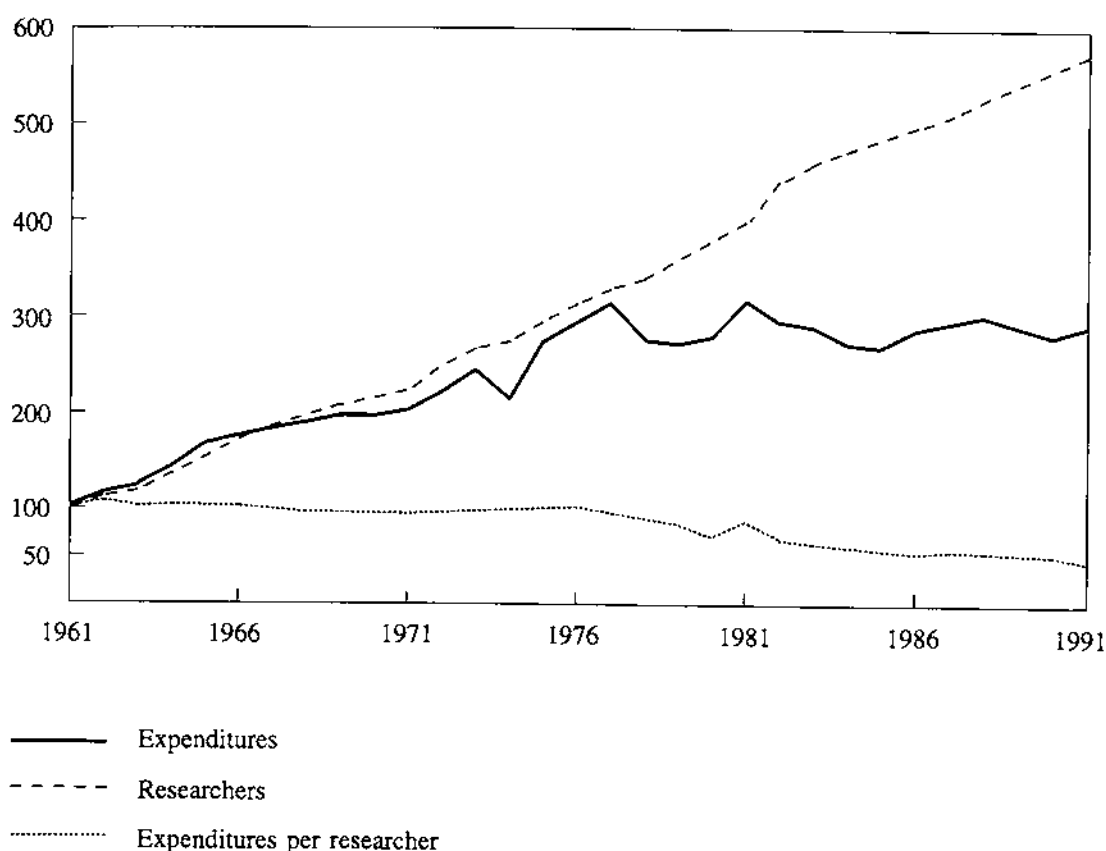
Source: Pardey et al., 1995.

Figure 1 provides a good illustration of this unfortunate situation of which everyone is well aware. Overall expenditure per researcher has been falling by 2.6% per year and, more disturbing still, the pace of this decline has accelerated from 1.6% per year in the 1960s to 3.5% in the 1980s.

To return to the more specific problem of financial resources allocated to livestock research, it does seem that the proportion devoted to this area is not commensurate with animal numbers or the importance of the livestock sector within the national economies. It would, however, be useful to have a detailed study to confirm this impression.

Material Resources

Naturally, each country has the infrastructure and equipment to conduct research in the livestock field: veterinary laboratories, research stations, breeding centres, etc. On-farm research has also developed considerably over the last decade, providing a near limitless testing ground. Clearly, the condition of these material resources and the way they are used vary greatly from one country to another and cannot be indicated here for individual countries.



Note: Index 1961 = 100

*Fig. 1. Developments in research staffing and expenditure.
(Source: Pardey et al., 1995)*

About 20 years ago, the Consultative Group on International Agricultural Research (CGIAR) set up two international centres to support livestock research in sub-Saharan Africa: the International Livestock Centre for Africa (ILCA) and the International Laboratory for Research on Animal Diseases (ILRAD). These two centres merged on 1 January 1995 to form the International Livestock Research Institute (ILRI) with a world-wide mandate. ILCA had branches in Mali, Niger and Nigeria.

Two international centres with a regional focus have also come into being with a view to realizing livestock production potential in the humid and sub-humid regions. One of them is CIRDES (international centre for livestock research and development in the sub-humid region), formerly CRTA (centre for research on animal trypanosomiasis). It is located in Burkina Faso. The other is the International Trypanotolerance Centre (ITC) in Gambia.

Outstanding Findings of Recent Decades

The main scientific constraints on livestock development in the humid and sub-humid regions of West and Central Africa are still largely pathological (trypanosomiasis, tick-borne diseases and internal parasitism) and nutritional (nutrient value, use and conservation of pasture and livestock feed).

The most important research findings in this field have probably been in describing the characteristics of indigenous cattle, sheep and goat breeds, especially their genetic disease tolerance and resistance, as well as their economic potential. The study of the bovine genome has been one of the major livestock research successes of the last few years.

In addition, researchers, particularly those at the national level, have concentrated a large proportion of their efforts on gaining better knowledge of the various livestock systems and, very recently, of peri-urban systems. Finally, there has been increasing awareness over the last few years of the need to find environmentally sound husbandry methods.

While there is an increasing body of knowledge about the vectors of the main diseases (tsetse fly and ticks), which has made it possible to develop environment-conserving methods of disease control, research into vaccines against animal trypanosomiasis and tick-borne diseases has not yet yielded the expected results.

Without wishing to be too negative or to generalize, we must recognize that there has been no real change with regard to the techniques recommended to livestock producers over the last few decades. However, it seems legitimate to wonder whether current constraints on livestock development are mainly other than scientific and technical in nature — a question which underlines the full significance of this seminar on livestock policy.

Lastly, the strongly national orientation of livestock research in West and Central Africa is another important characteristic to be stressed. Regional co-operation is even more

under-developed than for crop production. This has led inevitably to duplication of effort and limited dissemination of findings. A study of the impact of the few existing research networks — ATLN (African Trypanotolerant Livestock Network), AFRNET (African Feed Resources Network), the draught animals network, etc. — would no doubt be quite revealing.

New Trends

Livestock research is not, therefore, in particularly good shape, but it does have considerable potential that could be put to better use. Over the last few years, there have been promising signs of new developments, suggesting that the future might be brighter. These recent trends are described below under three headings: organization, funding and research programmes.

Organization of Research

National Level

At the national level, the concept of national agricultural research systems (NARS) according to the ISNAR definition² is beginning to catch on. Attempts to involve all the vital strands of the nation's research potential in defining and responding to national priorities are starting to produce results. The university system and agricultural research institutes are beginning to move closer together and it is reasonable to expect national research to grow more effective and efficient.

Nevertheless, the problem is more complicated for livestock than for crop production, since animal production and health have very compartmentalized systems for education (colleges and/or faculties of agriculture on the one hand, veterinary schools on the other) and research (veterinary research stations and laboratories) (Hoste, 1995).

These efforts have been accompanied by significant progress by various countries in the region in planning and establishing national and, more recently, regional priorities for agricultural research.

Regional Level

Countries in the region are demonstrating a fair degree of dynamism in improving the co-ordination of agricultural research at the regional level. CORAF (the conference of agricultural research institute directors) is expanding to cover all West and Central African countries. Its role, both in defining regional priorities and co-ordinating research programmes, seems to be accepted not only by countries in the region but also by donors. It is, however, a matter of regret that CORAF did not begin tackling livestock-related problems earlier.

² "NARS encompass all the agencies in a given country which are responsible for organizing, coordinating or conducting research contributing directly to developing agriculture and conserving the natural resources of that country. The term agriculture covers not only crop and animal production, but also fishery and forestry production" (ISNAR, 1992).

Another encouraging sign relating specifically to livestock research was the establishment of CIRDES at the instigation of the Entente Council countries. This has given it indisputable legitimacy. The co-operation agreements between CIRDES, ITC and what is now ILRI are also very promising.

International Level

The establishment of ILRI through the merger of ILCA and ILRAD has generated both hopes and fears for livestock research in the region's countries.

On the one hand, it is hoped that there will be better integration and thus greater efficiency of research on animal production and health. ILRI has, in fact, made integrated management of animal health and production one of its priority programmes. On the other hand, there are fears of seeing ILRI's mandate expanded to the global level without a corresponding rise in funding. ILRI's overall budget is very close to the sum of the budgets of its two previous components, despite the fact that restructuring and globalization will involve considerable additional expense.

Research Funding

National and donor contributions to agricultural research in general and livestock research in particular have decreased or, at best, stagnated over the last few years. It does not seem likely that the trend will be reversed in the near future. There are, nonetheless, some interesting new elements to be noted, which should help to improve the situation.

At the national level, there is a trend towards a more comprehensive approach to the agricultural sector and considerably better coordination of support from the various donors. Encouraging signs include the organization of donor round tables after national research priorities have been set, and the efforts of the Special Program for African Agricultural Research (SPAAR) to promote the establishment of joint research funds.

At the regional level, fora have recently been organized for the purpose, among other things, of identifying regional priorities and improving the partnership between the NARS and the CGIAR. Regional organizations such as CORAF play a leading role in these fora. Some donors, in particular the European Union, are also planning to support these initiatives and use regional organizations to rationalize the allocation of their regional funds.

Finally, at the international level, the CGIAR has completely revised its approach over the last two years. In early 1995 it obtained confirmation of the official support of all its donors for its new course of action (increased stress on the inter-disciplinary approach, an "ecoregional" focus, multi-centre initiatives, etc.). This was known as the Lucerne Declaration. In a parallel development, the European countries have formulated a joint policy with regard to the CGIAR, which is known as the European Initiative. This has meant short-term stabilization of funding for international agricultural research and some programmes can expect to receive additional funding.

Research Programmes

Many discussion meetings have taken place between the various stakeholders in livestock development over the last few years, especially around the establishment of ILRI. The most recent documents include:

- An Assessment of Animal Agriculture in Sub-Saharan Africa (Winrock, 1992)
- Livestock Development in Developing Countries: Development Issues and Research Needs (Richter et al., 1993)
- Strategic Plan for a New CGIAR Global Livestock Research Institution (Rockefeller Foundation, 1994)
- Global Agenda for Livestock Research (Gardiner and Devendra, 1995)
- FAO/ILRI Round Table on Livestock Development Strategies for Low Income Countries (FAO and ILRI, 1995).

Various priorities for livestock research emerge from these documents and may be divided into five major categories: increasing productivity, protecting the environment, safeguarding biodiversity, improving development policies and strengthening national research institutions.

There is also a new trend toward a more precise separation of tasks. Research into animal health, genetics and nutrition, which is of a more strategic nature, would be the responsibility mainly of international organizations in co-operation with research institutes in the industrialized countries. Feed resources, production systems, natural resource management and analysis of development policies, all of which are more ecoregional in nature, would tend to be the responsibility of research institutes in the developing countries.

Proposals for Improvement

Suggestions can be made for organizing research, available resources and programmes so as to improve the scientific environment of livestock research in West and Central Africa.

Organizing Research

The first priority is, of course, for the countries in the region to have in place a strategic plan for agricultural research in which livestock research priorities are clearly defined. On the basis of this document, a more precise division of labour must be worked out in terms of the comparative advantages offered by the various structures (research institutions, universities, NGOs, the private sector, etc.) and the various research teams (to address,

for example, the problem of assigning responsibility for research on integrated crop/livestock systems, natural resources and so on). Universities are often best placed to conduct biotechnological or environment-related research.

In the area of livestock, the situation is complicated by the need to divide responsibilities between agricultural and veterinary faculties and schools, agricultural research institutions and veterinary services. The latter consider that their activities (conducting epidemiological surveys, combating the tsetse fly, etc.) also contribute to research, but that often their role is not recognized. National or foreign funding granted to these various institutions does not always take this situation into account and imbalances at this level can further aggravate difficulties in co-operation.

The next stage is to identify priorities and strengthen co-operation at the regional level. Many regional institutions have come into being since independence and have played or are playing a role that affects the livestock sector (political, economic, research, marketing, extension organizations). There is a need for considerable rationalization of both the number and the mandates of these agencies. As regards research more specifically, mention should be made of CORAF (with its research networks and centres of excellence), the Institut du Sahel (INSAH), CIRDES and ITC.

Research is meaningless, however, if its findings are not made available to producers and adopted by them. At the national level, it is also important to review the classic model of research-extension-user (farmer or livestock producer) and the types of institutional organization that flow from it. This model has rarely produced the expected results and a new, more integrated and producer-centred approach should be envisaged.

Improving Available Resources

Human Resources

The FAO recently published the conclusions of the fifth joint FAO/WHO expert consultation on "veterinary education" (FAO, 1995). Participants in that meeting drew up a series of recommendations on planning responses to needs; privatization; the public sector and public health; and research and the related infrastructure. It would be useful to have a similar picture for all livestock-related activities and not just the veterinary profession.

In West and Central Africa, regional livestock research and development are still heavily dominated by the veterinary profession. It is particularly worrying that younger people have problems finding jobs consistent with their qualifications. In this respect a distinction must be drawn between French- and English-speaking countries. The former have pooled their resources and veterinary training is provided by an interstate school; the latter have traditionally had, or are still struggling to establish, national veterinary faculties.

There is no specific training in livestock production, and veterinary surgeons and animal scientists are trained separately with virtually no communication between the two groups.

It is absolutely vital to build bridges and encourage the training of joint teams of teachers and researchers who can work with national research institutions on national priorities and not just on academic subjects. A review of the promotion criteria for the staff concerned must precede the establishment of such mechanisms.

Another need to be addressed quickly is the training of senior staff in organizing and managing research. Being appointed director of a research station or institute is often the only way for a good researcher to be promoted, although he or she may not necessarily have any interest in the new post or the right skills for it. Training in research organization, planning, monitoring, programme evaluation, and writing of scientific reports or research project proposals is often missing. Following a request from countries in the region to this effect, ISNAR is currently working with the Network of European Agricultural (Tropically and Subtropically Oriented) Universities and Scientific Complexes Related to Agricultural Development (NATURA) on an education programme which will probably receive support from the European Union.

Financial Resources

It is highly unlikely, under current circumstances, that there will be any significant increase in the financial resources available for livestock research at the national or international level. Ways must therefore be found of making better use of existing resources.

Greater transparency in the management of funds allocated to research, combined with a greater degree of accountability of the various stakeholders, should make it possible to maintain or improve results and, at the very least, stabilize available funding. Of course, such efforts cannot be dissociated from those required at the research programming level.

Research Programmes

Livestock research is often criticized as requiring heavy, long-term investment. Moreover, animal production is often thought to have a negative effect on the environment.

The first priority is, therefore, to improve the image of livestock production in the eyes of policy-makers who are currently very sensitive to environmentalists' arguments. A world-wide debate is taking place on this subject. Active participation in this dialogue and dissemination of its conclusions among the region's countries are important.

The second priority is to conduct serious studies into the impact of past and current research. It is necessary to demonstrate that livestock research can have attractive internal rates of return. The participation of socio-economists in these studies is essential. Indeed, this last point prompts the recommendation that multi-disciplinary teamwork should be stepped up. Following the example of ILRI, national teams should now think in terms of the livestock sector as a whole and not just animal health or production.

Within the major categories of livestock research mentioned above, the priority technical themes for West and Central Africa in the years to come will probably be genetic disease resistance, animal feed resources and integrated crop/livestock systems that make optimum use of available land. National and regional expertise in the disciplines related to these different themes should, therefore, be assessed quickly and, where necessary, strengthened.

Conclusion

This brief overview and assessment of the scientific environment of livestock production in West and Central Africa provides no grounds for enthusiasm among the various stakeholders, especially livestock producers. However, the national, regional and international context within which livestock research is developing gives good reason to hope for an improvement in the situation and practical proposals have been made to speed up the process.

The impression drawn from this analysis is that the main obstacle to livestock development in West and Central Africa is probably political and economic rather than scientific and technical in nature. Naturally, the case must be argued more precisely, and this is one of the main objectives of this seminar.

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Organizational and Institutional Aspects of Livestock Production

Jules Abo Soh, Director of Veterinary Services, Ministry of Agriculture and Animal Resources, Abidjan, Côte d'Ivoire

Abstract The paper provides an introduction to and overview of livestock production and policy in the region. Its main foci are the organization of producers, the responsibilities of State ministries, and the need for harmonization of trade policies among coastal and Sahelian countries. After providing background on the geography of the sub-region, its livestock resources and national policies, the author describes, with detailed examples, the organization of production under two headings: traditional extended family groups and groups set up or fostered through outside intervention. He concludes that any effort to support traditional systems demands greater respect for and sensitivity to traditional methods and social structures. As for the more recent associations established by external agents, to be effective they need to function as professional interest groups with clear aims. In both cases, governments should assist production groups, not force or coerce them into specific actions.

The paper next outlines the advantages and disadvantages of two types of ministerial jurisdiction: a single ministry with responsibility for all agricultural activities, versus individual ministries for livestock, cropping, forestry, etc. It also discusses nation-wide and operational functions of ministries and how they can be implemented. In the final section, the author examines trade between the Sahelian countries and coastal states, as well as obstacles to it. He provides concrete suggestions for improving trade within the region, including mechanisms for enhanced dialogue and information sharing within and between the countries involved.

Introduction

Agriculture dominates economic activity in the sub-humid and humid, or Sudanese and Guinean, regions of West and Central sub-Saharan Africa. Livestock production, however, appears to be of only secondary importance. The countries of these regions depend on the international market, particularly the Sahel region, for their animal protein supplies. They began to implement livestock development policies in the 1970s in response to persistent drought in the Sahel, in the hope of eventually being able to meet their own protein needs.

This paper aims to describe the institutional organization of production and identifies two types of groups involved in its development and the institutional framework. It does not examine every form of institutional support for production, research, agricultural extension, training and credit institutions. The paper also examines the need for integration, both within these areas and between them and the Sahelian regions, with a view to securing better co-ordination of foreign trade policies, and formulates proposals for improvements in the areas of production organization, institutional frameworks and transnational co-operation.

General Characteristics of the Sub-Humid and Humid Regions

Geographical Location

The sub-humid and humid regions of West and Central sub-Saharan Africa encompass 18 countries, 12 of which are in West Africa and six in Central Africa (see Table 1). The sub-humid region is a little over half the size of the humid region which is mostly in Central Africa (equatorial region).

The Sub-Humid or Sudanese Region

This region lies between the 8th and 10th parallels. It has a monomodal (or Sudanese) pattern of rainfall, i.e., one rainy season only (June to October) following the dry season. Total rainfall lies between the 1,200 mm and 1,400 mm isohyetal lines. A dry wind from the Sahara, the harmattan, blows from November to February.

From north to south, vegetation consists of savannah, shrub savannah and tree savannah. The growth period for this vegetation varies from 180 days in the north to 270 in the south.

Table 1. *Countries of the sub-humid and humid regions of West and Central sub-Saharan Africa.*

	<i>West Africa</i>	<i>Central Africa</i>
Southern part within the sub-humid region	Burkina Faso Mali Senegal	
Entirely within the sub-humid region	Guinea Bissau	
Within the humid and sub-humid regions	Benin Côte d'Ivoire Ghana Guinea Nigeria Togo	Cameroon Central African Republic
Entirely within the humid region	Liberia Sierra Leone	Congo Gabon Equatorial Guinea Zaire

Humid Region

This ecological area lies between the 5th and 8th parallels. It is known as the Guinean region and has two dry seasons (December to February and July to September) and two rainy seasons (March to July and September to mid-November). Total rainfall lies between the 1,600 mm and 2,200 mm isohyetal lines. Vegetation consists of various types of forest: moist evergreen rain forests and wet evergreen rain forests towards the coast. This is a more populous region, with a greater level of urban development.

Resources

Land

Land is held in inalienable collective ownership. In principle, the ministry has a higher claim on all land. Traditional systems of tenure also exist, varying from one country to another, but they are generally based on the following common principles:

- farmers' enjoyment of usufruct but not ownership
- property rights held by community leaders on the basis of seniority.

The social and legal context is not static, however. Changes are now taking place:

- more widespread buying and selling of land
- the fragmentation of large production units
- an increase in personal ownership and inheritance.

Neither individual farmers nor local communities will be persuaded to change their practices while property rights remain ambiguous.

Livestock Resources

Livestock resources are not spread evenly across all ecological zones. The sub-humid zone produces 80% of the region's cattle and this is the main focus of activity there. Traditional pig and poultry farming is practised in all the countries concerned. Modern production systems are concentrated chiefly around the cities in the humid regions.

The arid region has the highest proportion of ruminants and the lowest ratio of land to livestock. In the more humid areas, less land is reserved for livestock farming but high productivity compensates. Land area per animal increases with humidity but land availability is limited by tsetse fly infestation.

A Major Obstacle to Animal Production

In every ecological region, the most serious obstacle to animal production is the tsetse fly and thus trypanosomiasis. Infestation rules out stable livestock farming across vast tracts of land.

Sectoral Production and Productivity

In the sub-humid and humid regions, the livestock sub-sector's share of farm output varies considerably from one country to another: low in the sub-humid and humid regions of coastal West Africa and the Central African countries, and higher in the vast arid regions. Table 2 shows the relative importance of crop and livestock farming in the economy of each country or group of countries. Table 3 shows the breakdown by region for three categories of livestock, and Table 4 shows the numbers of ruminants by species and ecological region. Across the region, output per head of livestock is very low.

Table 2. *Estimated income per inhabitant and share of crop agriculture and livestock production in GDP in tropical Africa and by country group.*

<i>Region/country</i>	<i>GDP per capita (USD)</i>	<i>Share of crop agriculture (%)</i>	<i>Share of livestock production (%)</i>	<i>GDP from livestock production (US\$ million)</i>
West Africa				
Sahel	186	34.3	32.6	646
Nigeria	466	24.4	11	965
Other countries	428	30.8	5	238
Central Africa				
Zaire	85	21.5	4	21
Other	577	18.1	8.8	103

Source: Jahnke, 1984

Table 3. *Breakdown by region of draught and working animals in tropical Africa.*

<i>Region/country</i>	<i>Cattle ('000)</i>	<i>Equidae ('000)</i>	<i>Camels ('000)</i>	<i>Total ('000)</i>	<i>%</i>
West Africa	2,220	1,877	848	4,945	20.1
Sahel	1,086	1,379	839	3,304	13.4
Nigeria	1,019	475	9	1,503	6.1
Other	115	23	-	138	0.6
Central Africa	63	71	-	134	0.5
Zaire	-	-	-	?	?
Other countries	63	71	-	134	0.5

Source: Jahnke, 1984

Table 4. *Breakdown of ruminants by species and ecological region in tropical Africa.*

<i>Ecological region</i>	<i>Cattle (‘000 head)</i>	<i>Sheep (‘000 head)</i>	<i>Goats (‘000 head)</i>	<i>Ruminants (‘000 TCUs)</i>
Arid	31,462	37,063	48,287	41,697
Semi-arid	45,454	23,071	33,215	37,446
Sub-humid	32,758	14,153	20,266	26,370
Humid	8,814	8,177	11,586	8,148

Source: Jahnke, 1984

Conclusions

Three salient features emerge from this analysis:

- the high concentration of livestock in areas with low environmental potential
- the acute shortage of animal protein in areas which in principle have a high potential for fodder supply
- the important role of non-food products (manure, transport and draught animals) in the sub-humid and semi-arid region.

***Livestock Policies in the Sub-Humid
and Humid Regions***

The economies of all the countries in the ecological regions concerned are based primarily on agriculture. In the decades that followed political independence, the breakdown of agricultural production was as follows:

- in the south, perennials such as coffee, cocoa, banana, coconut palm and oil palm
- in the north, food crops such as rice, maize, yams and sorghum and cash crops such as cotton, in addition to traditional indigenous sedentary livestock production and transnational transhumant cattle production during the dry season.

Over that period, meat requirements were met largely by animal imports from the Sahel countries (Mali, Burkina Faso, Niger and Mauritania for the sub-humid and humid regions of West Africa, and Chad and Sudan for Central Africa).

From 1970 onwards, widespread drought in the Sudan and Sahel regions led to substantial livestock losses, reducing supplies from the Sahel. To make up the shortfall, the coastal countries in the areas affected started importing meat from outside Africa. As the climatic problems persisted, many herds moved down from the Sahel into the north of these countries in search of water and pasture.

In response to the crisis and to guarantee long-term supply, the countries involved opted to put in place general livestock development policies. Some entrusted policy implementation to national public enterprises, others to ministerial agencies. Agriculture in the coastal countries took off over this period with the development of cotton farming in the sub-humid region.

Institutional Organization of Production

Professional Groups

Sociological studies of the institutional organization of livestock production point to two types of groups:

- traditional extended family units, organized and run in accordance with traditions which vary from one country and ethnic group to another
- groups fostered and/or established by state authorities, to some extent on the co-operative model.

In institutional terms, a distinction must be drawn between the two, as the support and advice they require may differ markedly.

Traditional Groups

Groups of this type operate in accordance with established rules. The aim should not be to change but to understand and control those rules. The general objectives defined for livestock development, which can be achieved and built upon via traditional structures, must be identified; any attempt to impose objectives which do not correspond to the needs of these groups would be ineffective and a waste of time.

Let us take the example of cattle production in the densely populated Senufo regions of northern Côte d'Ivoire. The average Senufo farmer raises cattle, sheep, goats, pigs and poultry. In the following paragraphs we will examine the economic and social importance of large ruminants in the production system and the scope for improvement.

From 1972 to 1990, SODEPRA, a public institution in Côte d'Ivoire, promoted small-scale herding by means of a modernization policy designed to increase farmers' knowledge of livestock production through the dissemination of information on a number of technical subjects. The policy, in conjunction with improvements in sanitary conditions, had a positive impact: herd numbers rose markedly. However, there was less willingness to accept other technical changes which required an investment of money or labour, particularly among farmers with only a few head of cattle who are in the majority. To summarize, it would be true to say that so far the initiative by SODEPRA, a state organization, has targeted the herds more than the farmers.

The social and economic role of cattle in Senufo society appears to display a number of unusual features. Most Senufo villages have a herd of cattle, generally kept in one or more reserves outside the village, depending on the distance. The owners tend the animals and use the manure for their crops. Each traditional reserve has one or more owners. One, usually the most powerful, acts as head of the reserve, supervising and monitoring the care of the animals, and employing a herder where that function is not performed by the village children.

Decisions would appear to be made by those recognized by the community as the owners. However, in reality the situation is more complex, in that in traditional Senufo society the management and transfer of property and responsibilities from one generation to another is governed by a system of laws. The principle is that collective production implies a redistribution of income, while individual activity generates personal income. The latter case often arises where the younger generation rejects the traditional hierarchy. A system based on a combination of individual and collective rights will clearly give rise to conflict. Animals in family possession can be sold only in the interests of the group as a whole, which implies the need for a family consensus. The proceeds of the sale of animals can then be used only by the family; individual rights enable freer use of such funds.

The failure to attach due importance to "sociological" factors, which are the real obstacles to a policy of livestock modernization in this part of Côte d'Ivoire, would seem to be at the root of many of the difficulties encountered in fostering the sustainable development of livestock production. We would maintain that detailed knowledge of the socio-economic structure of rural society, different from but complementary to purely statistical data, is vital to improve assistance to the farming community. This approach generally brings to light previously hidden phenomena which offer a rational explanation for the farmers' actions.

The problem of traditional structures is often complex and varies from one country and ethnic group to another. But ignorance of it can only result in a substantial waste of resources. This important factor heightens the need to develop forms of support capable

of tailoring technical and economic advice to the conditions of the target group. It should not be forgotten that in this investigatory and advisory process it is absolutely vital to establish the existing and potential roles of women and young school-leavers. These groups often have very little room for manoeuvre within traditional structures. Yet they frequently have sufficient economic motivation to initiate valuable production and marketing improvements. Women and young people could, for instance, make an important contribution to the traditional poultry and sheep farming sectors.

In view of the primary importance that farmers in the sub-humid and humid regions attach to cropping, any improvements to the livestock system must be considered in relation to crop production. It is no coincidence that draught animals receive special treatment compared with the rest of the herd. Any planned initiative must therefore take account of the additional workload it generates, given the small available work-force and the fact that farmers are already heavily occupied with cropping all year round. In the circumstances, recourse to salaried workers — already widespread — can only increase.

Institutional Groups with Outside Backing

These are groups established and fostered under impetus from outside the community and are often not very effective, depending on the sub-sector.

Under support initiatives aimed at the cattle sub-sector in northern Côte d'Ivoire, a few scattered associations have been set up along co-operative lines to fatten the herds. However, they are not operating successfully, and some are being kept afloat by the public authorities concerned. Other groups have been set up to manage and maintain dams built under the State pastoral development programme. Examination of the way these groups are run shows that they are still at an embryonic stage.

Members are ill-informed about financial transactions effected in the group's name by as few as three or four individuals. Priority issues such as the use of income are not really a matter for discussion by members; instead they are determined by "advice" from the supporting authority which brooks no argument. Far from encouraging initiative and cohesion in the farming community, this strategy maintains a dependency culture — and the long-term dangers of that are well known. Most members can see no personal benefit to be gained, they dissociate themselves from collective initiatives, and end up leaving the groups.

In most countries in the regions concerned, the traditional cattle, sheep and poultry farming sub-sectors have not received any real assistance to set up associations for the purchase of inputs. As a result, farmers have no choice but to buy, as individuals, such items as food supplements for their cattle herds and the building materials required for infrastructure development. This of course entails higher purchase prices and transport costs. The Central African Republic alone has managed to organize systems of this kind among its transhumant livestock farmers. Nor do the livestock farmers have access to co-operative structures for marketing.

These elements of livestock development strategy are absent from the development structures for cattle and small ruminant production. However, for modern poultry production and pig farming, positive initiatives have been taken in some countries.

In Côte d'Ivoire, modern poultry production centres largely on a semi-public structure known as SIPRA, which offers technical support and input supplies and purchases members' produce. Investment, recruitment, training and the running of the farm are the responsibility of the owner.

In practice, the farm's financial risks are shared between SIPRA and the owner, while a farm manager runs the technical operations. The system of partnership between the product buyer, who also supplies inputs, and the investor, backed by a manager and staff, spreads the burden of risk in a sector where the market is extremely unstable. It is an arrangement which leaves little room for amateurism but provides guarantees for real professionals, although in the long run the structure's monopolistic orientation might threaten the balance of power between the farmers and industry.

The relationship between these two groups, however, is positive, with the farmers united in a trade association to counterbalance the industrial partnership of input producers and product purchasers. The support structure of the Ministry of Agriculture and Animal Resources intervenes actively in this balance of power, the overall effect being to assist in managing relations between the two associations.

The livestock farmers' organization in Côte d'Ivoire (UACI) has begun tackling the real problems of poultry farmers. It is calling for technical support in collaboration with the ministry and streamlining of the distribution system through a reduction in the number of middlemen. There would thus seem to be a general will to integrate the entire sector by establishing an association of farmers and industrialists to bring pressure to bear on the market and the public authorities.

The 1989 success in obtaining a suspension of meat and poultry offal imports from non-African countries demonstrated the influence that a large trade association can exercise. Also in 1989, the market for eggs in Côte d'Ivoire was boosted by a television advertising campaign costing 80 million CFA francs in total, financed jointly by the industrial association of input producers and product purchasers and the Ministry of Agriculture and Animal Resources.

Pig farming is quite a recent phenomenon in most of the coastal States and has drawn on co-operative principles from the outset. In Côte d'Ivoire, a quasi-public company, the Société Ivoirienne d'Abattage, de Viande et de Charcuterie (SIVAC, abattoirs' and butchers' association of Côte d'Ivoire), has been set up to control the entire sector, including the support structures. This form of co-operative is certainly promising, but it is important that the farmers remain independent and participate in the running and funding of the sub-sector as a whole.

Fortunately, in most countries in the sub-humid and humid regions concerned, livestock policies established in the context of economic restructuring are systematically accompanied by the promotion of farmers' associations. This institutional structuring of the livestock sector is viewed as essential. Indeed, these groups are being required to take on responsibility as quickly as possible for a variety of tasks which have so far been performed by the new support structures.

The organization of livestock farmers into groups is now, therefore, a part of government strategy and becoming one of the major objectives for livestock development. The areas in which farmers' associations should receive support are

- improved management
- the consolidation of groups to take on livestock marketing, mutual guarantees for loan transactions, and the supply of husbandry- and health-related inputs.

An analysis of the different groups within the various sectors reveals the wide variety of situations and thus the need for flexible and appropriate support:

- It is essential that traditional groups receive recognition and that their way of doing things be analyzed so that improvements they are capable of can be identified without them being "forced" into anything.
- Associations established/supported by external agents should be professional interest groups with clear aims and practices agreed on with the farmers. They should receive assistance, not instructions, for the organization of their activities.

Institutional Framework

Only very few countries in the regions concerned still have separate ministries for crop and livestock farming. The advantages of the dual ministry arrangement are that responsibility for livestock production is given a higher profile at the national level and that it is easier to obtain resources for the implementation of a clearly stated policy.

The drawbacks are, first, a duplication of administrative structures and hence of costs and, second, difficulties in establishing close collaboration between the officials responsible for livestock production and those for crop farming. The second problem could be partly overcome through better regionalization of both ministries, enabling effective fieldwork with shared resources.

In the regions covered by the seminar, most countries have a single ministry responsible for crop farming, livestock production, fisheries, national waters and forests. In such cases, livestock production is a national department within that ministry.

The name of the ministry differs from one country to another. In Côte d'Ivoire and Burkina Faso, it is known as the Ministry of Agriculture and Animal Resources, in Mali the Ministry of Rural Development and the Environment, and in Ghana the Ministry of Agriculture and Food.

These ministries are designed to respond to the changing needs identified in various restructuring studies carried out by external funding institutions, primarily the World Bank.

Having a single ministry offers both advantages and disadvantages. The advantages include

- a reduction in the operating costs of central offices and regional departments, chiefly through a decrease in administrative staff requirements
- improved relations between the various sub-sectors involved, facilitating the integration of crop and livestock farming and even forestry
- integration of forms of assistance for livestock farmers, enabling more effective and homogeneous diversification of export activities.

The drawbacks include

- a serious danger that livestock production could be marginalized, especially in countries where it is not a long-standing national tradition
- non-development of the sector as a result of priority resource allocation to crop farming (since it is easier to reduce appropriations to a department than to a ministry)
- the danger of the ministry becoming unwieldy, with ill-defined responsibilities and uncertain impact.

The last-mentioned drawback can be avoided only if the ministry is effectively regionalized, with each regional department managing its own budget and staff.

Whichever scenario is adopted — separate ministries or a single ministry — certain essential functions must be clearly defined if the institutional framework is to operate smoothly. They can be divided into two main categories:

- *Nation-wide* functions. These are clearly a matter for the central ministry or department. In the area of livestock production, these responsibilities include animal and public health inspections, all legislative and regulatory matters, and the definition of national livestock policy on the basis of information gathered from regional departments and other organizations (extension agencies, laboratories, etc.). Regional departments should provide support for these activities.
- *Operational* functions. In some countries these are the responsibility of regional departments. In others, such as Côte d'Ivoire, these are handled by support agencies under the supervision of ministries or private concerns, such as farmers' associations or private or semi-public integrated trade structures.

These functions should be performed within the framework of legislation and the national policies defined by the ministry.

The tasks of regional departments or ministerial agencies should be land use management and planning in collaboration with provincial and local authorities, R&D, the development of genetically superior breeds, and not only technical but also economic support for the establishment of trade associations. On the subject of support structures, there should be provision in the short term, especially if associations are formed, for the farmers to put up at least part of the necessary funds, to give them an influence over the quality of the service. Private concerns could take on the role of supplying inputs, medicines, small items of equipment and feed supplements, and marketing livestock products. At all events, none of the structures can make an optimum contribution unless it establishes policies for the co-ordinated management of its financial and human resources.

These structures should also be co-ordinated at the regional level. In the interests of efficiency and economy, their regional distribution should be geared to two fundamental principles: meeting the needs of the farmers and limiting duplication of effort in assistance to them. This involves harmonizing the divisions between the spheres of action covered by the various structures, taking account of administrative boundaries. There is also a need for ongoing consultation and collaboration within and between the structures, with a view to ensuring uniform policy implementation wherever possible.

The role of research must be redefined. The ministry responsible for livestock production might identify its needs on the basis of on-farm conditions and devise prioritized research programmes in conjunction with the research ministry. Contractual agreements with State research institutions could form the basis for collaboration on the matter. One option would be to set up a research and development unit at the ministry in charge of livestock farming to co-ordinate research programmes in the farm sector. Research ministry staff could then be seconded to the unit, but it would seem preferable for laboratory research to remain under the authority of the ministry responsible for livestock production.

Plans should also be made for a centre for information on market prices. This could cover both livestock and crops. It would work jointly with the ministry's central and regional departments and would provide a service for both producers and traders.

Harmonized Foreign Trade Policies between the Coastal States of the Ecological Regions Studied and the Sahelian Countries

Macro-economic indicators suggest that livestock farming is a secondary activity in the countries of the ecological regions studied. The reverse is true in the Sahelian States, where livestock accounts for a substantial share of national GDP.

The coastal countries therefore rely largely on non-African countries (meat imports) and the countries of the Sahel (mainly live imports) for their meat supplies. For the countries of the franc zone, the 1994 devaluation of the CFA franc left production more competitive locally and in the Sahel, helping the latter to develop exports and recapture a share of the local meat market from non-African imports. In addition, in 1993, the European ministries cut subsidies for meat exports to Africa; this has stabilized the European market, reducing production and absorbing stocks. Ministries in Africa's livestock and meat exporting (Sahelian) and importing (coastal) countries adapted their foreign trade policies in the light of the move. With these practical measures came the will for closer policy harmonization.

Sahelian Countries

Burkina Faso instituted a policy of dismantling export duties in 1990. The one remaining duty, the statistical tax, was abolished following the devaluation of the CFA franc. The policy has boosted trade and allowed for more effective monitoring of export flows.

However, to export products a trader in Burkina Faso must still:

- obtain a licence to trade, at a cost which varies with the province and is calculated on the basis of turnover
- obtain an animal health certificate of origin (CFAfr 200/head of cattle)
- obtain an export licence (CFAfr 175).

A number of unregulated taxes must also be paid. There are still taxes levied on transit between Mali and Burkina Faso. The Malian government, on the other hand, has opted to simplify export procedures.

Coastal States

In 1994, Côte d'Ivoire lowered its tariff barrier by reducing compensatory levies and customs duties on meat imports from outside Africa. The same year, after the CEAO was disbanded, Côte d'Ivoire introduced a levy on livestock imports from the Sahel, but this was later withdrawn. Animal products from the sub-region thus continue to enjoy preferential conditions in Côte d'Ivoire.

Although Ghana has maintained its high tax on Sahelian livestock, in January 1994 it raised its levy on meat imports, thereby promoting live imports from the Sahel. There can be no doubt that the coastal States have greatly reduced their non-African meat imports since 1993.

Côte d'Ivoire's beef imports fell by 86% between 1993 and 1995, from 900 to less than 150 tonnes a month.

In 1994, registered exports from Burkina Faso to Côte d'Ivoire increased by 39% for cattle and 5% for smaller ruminants. Togo and Benin have also stepped up imports of cattle from Burkina Faso. In 1994, Burkina Faso increased its official live cattle exports to Ghana eightfold and its small ruminant exports 11-fold.

This new economic environment thus promotes regional trade.

Obstacles to the Development of Regional Trade

The beginnings of this regional co-ordination could be jeopardized, however, by a number of factors. In the Sahel and the coastal States alike, certain bottlenecks continue to slow the development of regional trade. These are mainly in the areas of transport, financing and untimely controls.

Transport

Devaluation led to an increase in transport costs. Truck availability fluctuates. Livestock is considered low-profit freight and is dependent on other goods. For example, during the cotton harvest, the negotiated price of a truck may be CFAfr 600,000, but the same truck may be priced at CFAfr 175,000 to 300,000 outside the harvest season.

With the management of the railway operators in disarray, rail is still a far less efficient form of transport than road.

Financing

The financing of the livestock/meat sector is one of the problems which emerged clearly from successive regional consultation exercises with commercial operators, as there is not much support from financial institutions for livestock farming or regional trade (trade credits).

Operators have also emphasized the difficulties encountered in transferring funds due to a lack of co-ordination between banks and long delays, for example.

Untimely Controls

In addition to administrative procedures, exporters face inconvenient police controls throughout the journey. Such annoyances impede the progress of trade.

Suggestions for Supporting the Development of Regional Trade

To ease the flow of trade between regions, improvements are needed in the following two areas:

- marketing and organization of the sub-sector
- regional consultation on policies covering livestock production and foreign trade.

Marketing and Organization

Measures must be taken to ease the flow of trade and improve the organization of the industry. Several meetings have been held at the regional level to seek solutions to the bottlenecks identified. The main recommendations made concern the following points:

Taxation

To put an end to the collection of illegal taxes there must be:

- an information and awareness campaign concerning all the reforms in place
- strengthened procedures for monitoring and checking sanctions within the administration.

Transport

Recommendations focus on the need to:

- facilitate and encourage the establishment of a transnational government exchange for cattle freight services
- adapt trucks and wagons for transporting livestock and return freight.

Financing

To increase the banking system's involvement in financing the sector, it is recommended that:

- consultations between sector professionals and banks be stepped up to restore mutual confidence
- the main obstacles to banking involvement in livestock trading be identified and assessed, as a follow-up to these meetings.

Sector Organization

It is clear that the bottlenecks will disappear once real trade associations are in place to represent the interests of all the operators in the sector. Ministries may promote the establishment of a joint trade organization but must not take on that role themselves. The following recommendations should be considered in this connection:

At the ministerial level:

- identifying all the operators in the sector and giving their representative organizations legal recognition
- setting up a regulatory framework conducive to economic and commercial activity and associations among professionals in the sector
- introducing incentives to improve the organization of professionals.

At the professional level:

- uniting around common interests
- ensuring association and union representation with a view to dialogue with the ministry
- organizing and co-ordinating members' activities at the national and sub-regional level.

At sub-regional level:

- stepping up consultations between public institutions and trade associations in each country to encourage the pooling of experience and strengthen co-operation and partnership between States.

Livestock Production and Foreign Trade Policies

The convergence of foreign trade policies in the sub-region should be intensified and placed in a long-term perspective. This will require regular regional consultation and/or bilateral negotiations on border policies. These meetings should help remove the remaining obstacles and harmonize commercial procedures.

Harmonizing foreign trade policies will have only limited impact unless production activities are boosted sufficiently to provide the regional market with a regular supply of produce in the right quantity, of the right quality and at the right price. Debate is called for at the national and sub-regional level to define ambitious yet realistic policies geared to the needs of the sub-region. For that, up-to-date and reliable information must be available. The ministries must work to improve their statistical tools. It is clearly essential to set up a regional mechanism for collecting, processing, disseminating and also exchanging information, based on a network of national experts in the area of livestock and trade. This should meet the information needs of the various operators in the industry and concentrate on disseminating information.

Conclusion

It is clear from this review of production organization, the institutional framework and co-operation between ministries that the national and regional background to development gives cause for hope. We have formulated proposals in particular on the need for regional co-operation. The main obstacle to this would appear to be essentially political.

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Technical Environment

Traditional Livestock Production Systems in the Humid and Sub-Humid Regions of Sub-Saharan Africa: Key Constraints and Development Potential

*Saydil M. Touré, Centre international de Recherche-développement sur l'Élevage en
Zone subhumide (CIRDES), Bobo-Dioulasso, Burkina Faso*

Abstract Despite the low productivity of traditional animal production systems in the humid and sub-humid zones of sub-Saharan Africa, the potential for development is substantial. It should be studied and acted on in light of the inevitable increase in demand for meat and dairy products in the region. Statistics on livestock production are presented in the paper, along with a brief overview of related traditional production systems, particularly the grazing of livestock on common lands close to villages. Key constraints on the productivity of traditional animal husbandry are described under several headings: disease, nutrition, genetic resources, production systems, socio-cultural and institutional factors, and livestock policy. Production from natural pastures will not be enough to meet future demand; part of the answer to the production challenge lies in mixed farming which combines livestock, crops and agroforestry.

Research and improved technologies (including biotechnology) have a major contribution to make in boosting productivity in an environmentally friendly way, especially in the areas of fodder crops, water supply, and genetic improvement of animals. Good R&D is especially needed to support the trend towards the integration and intensification of combined crop and livestock production. Promising livestock sub-sectors are poultry raising and production of monogastrics such as pigs. Policy measures, especially guaranteed ownership of agricultural lands and a rationalization of animal-product importation, will also go a long way to stimulating sustainable production. Finally, systems research that takes into account not only the production system and animals but also the social and economic context of traditional farmers and consumers, is needed. Computer modelling is a powerful tool to this end.

Introduction

Any study of traditional livestock production systems in the humid and sub-humid regions of sub-Saharan Africa involves reviewing the fairly recent development of animal husbandry in areas where 30 or so years ago there was little farming of domestic ruminants. This report begins with an examination of existing animal production systems and the yields they achieve.

Yields are at present fairly low owing to a variety of constraints that should be analyzed alongside known and prospective means of attaining higher productivity. The land and existing production systems have a development potential that should be studied and identified within the context of increasing demand for meat and dairy products. To this end, we shall attempt to develop models for potentially productive systems that also better protect the environment in a sustainable way.

Livestock Production Systems and Current Yields

Geographical Conditions and Productivity

The sub-humid and humid regions represent 22% and 19% respectively of sub-Saharan Africa's land area. These regions are distributed unevenly across four geopolitical regions, as shown below in Table 1.

The sub-humid and humid regions cover areas of 4.8 million km² and 4.1 million km² respectively.

In equivalent tropical cattle units (TCU), the distribution of the domestic ruminant population is 20% in the sub-humid region and merely 6% in the humid region. In both cases the highest percentage (56%) is in East Africa, against 26% in West Africa, 11% in Southern Africa and 5% in Central Africa (Winrock International, 1992).

These figures suggest that West Africa, and particularly the coastal States, have the greatest development potential.

Production Systems

Pastures in the sub-humid region have long provided reserves for domestic ruminants from the arid and semi-arid regions. In West Africa, there are major transhumant herd movements from north to south during the dry season. My studies of pastoral practices have enabled me to review the situation and draw certain conclusions regarding the use of natural pastures:

Table 1. Description of the humid and sub-humid regions.

<i>Region</i>	<i>Growing season (days)</i>	<i>Rainfall (mm)</i>	<i>Percentage of total area</i>			
			<i>West</i>	<i>Central</i>	<i>East</i>	<i>South</i>
Sub-humid	180 - 270	1,000 - 1,500	16	29	16	39
Humid	> 270	> 1,500	13	76	2	9

Source: Winrock International, 1992

"Because of the failure to switch to intensive meat and milk production methods, results achieved in husbandry have been disappointing. Young weaned bovines do not gain more than 50 kg a year in the transhumant system, so it takes five to six years to produce an animal weighing 250 kg. Weight gain is from 7 to 14 kg a year for cattle and 3 to 6 kg for smaller ruminants. Dairy cows produce 200 to 300 kg of milk in the dry season and 600 to 1,000 kg at best in the rainy season. The pastoral system places substantial constraints on high livestock yield: relatively late development and slow growth, physiological deficiencies that affect production, a variety of health risks and chronic weight loss during the dry season which is barely compensated during the subsequent rains" (Touré, 1991).

Traditional livestock farming methods are still practised, particularly in the sub-humid parts of West Africa. Livestock are grazed on common land on the outskirts of villages, although there have been recent attempts to integrate crop farming with livestock production and introduce more intensive methods. Several typological and system studies have identified constraints and produced productivity estimates. (Unfortunately, discontinuity at the development project level often prevents socio-economic findings from being updated.) One example is SODEPRA's work in northern Côte d'Ivoire, where recent results showed that 65% of farms were involved in sedentary cattle production, classed in a primary "zero level" grouping (Abo Soh, 1987). Typical features of the livestock production system are

- the small number of animals in individual production units
- the grouping of animals in common areas
- tending of the common herd by a salaried herdsman
- owners with no technical expertise
- the scarcity of regulations and measures in respect of herds.

Poor Performance

Various comparative studies of zebu and Baule cattle and their crossbreeds in areas with differing constraints and degrees of technical expertise among farmers reveal the same poor performance trends: advanced age at first parturition, long parturition intervals, low average fertility and a high mortality rate among younger animals (Landais, 1983; Landais, 1985a; Landais, 1985b). In the north of Côte d'Ivoire, for example, the mortality rate is 26% for calves up to one year old, 10% for one- to two-year-olds and 8% thereafter (Itty et al., 1994).

Weight gain in traditional production systems is also low and milk production for consumption is modest.

These conclusions tie in with the findings of a recent comparative study of bovine genotypes in southern Burkina Faso, conducted by CIRDES (the international centre for livestock research and development in the sub-humid regions). These results are presented in Table 2.

Supplying Meat to the Local Population

The raising of smaller ruminants is generally an extensive activity, based in villages or on the outskirts of towns. The animals are highly prized locally for their meat and are used in religious and traditional ceremonies.

Poultry farming, on both an industrial and small scale, is on the increase. Villagers raise chickens and guinea fowl free-range as a sideline to their other agricultural activities. The village producer's investment in terms of both time and money is generally small (INERA, 1995). Traditional hen houses are often unsanitary, although great potential exists for the development of poultry farming of this kind.

We have intentionally left monogastric animals aside in this first section. They are set to become an increasingly important source of meat for local consumption but the constraints involved are less severe in view of the potential for intensive husbandry.

The productivity constraints on domestic ruminant farming require closer investigation.

Table 2. Findings of a study of livestock production systems in Pays Lobi, southern Burkina Faso.

<i>Parameters</i>	<i>Baule</i>	<i>Crossbreed</i>	<i>Zebu</i>
Age at first parturition	52 - 53 months	44 - 47 months	44 - 47 months
Parturition interval	17 - 19 months	14 - 15 months	14 - 15 months
Fertility	45 - 55%	65 - 80%	65 - 80%
Calf weight at 1 month	14 kg	20 kg	25 kg
Weight of adult females	170 kg	230 kg	280 kg
Mortality at 1 year	25%	20%	20%
Numerical increase index	0.40	0.50 - 0.60	0.50 - 0.60
Weight gain index	25 kg	50 - 65 kg	50 - 65 kg
Productivity index per 100 kg	13 kg	24 kg	23 kg

Source: CIRDES

Productivity Constraints

Livestock production in the sub-humid region of West Africa is subject to a great many constraints — pathological, nutritional, genetic, systemic, socio-cultural, institutional and political — which have been described at length in many publications. These factors are summarised in Figure 1 (Touré, 1987).

A recent study by Winrock International provides a good description of the constraints on livestock production and a clear classification of the diseases involved. We need not go into further detail here, except to highlight the case of West Africa's sub-humid region.

Disease Constraints

The first category of diseases consists of epizootic, bacterial and viral diseases which can theoretically be controlled or indeed eliminated by the planned and judicious use of vaccines. In both humid and sub-humid regions, African trypanosomiasis in animals remains a major problem.

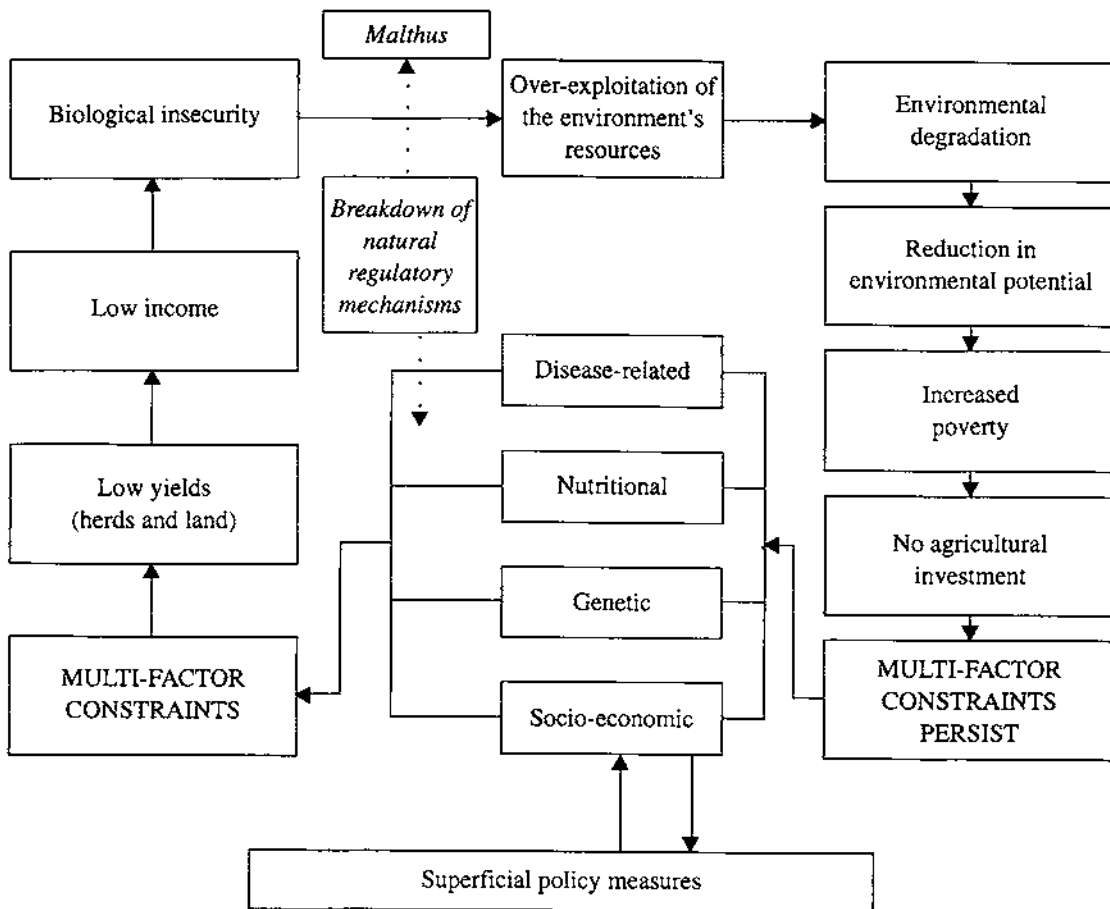


Fig. 1. The interactions among negative factors in traditional livestock production systems.

Other parasitoses, such as helminthiasis and tick-borne diseases, are also present. Dermatophiliasis also causes severe problems. No vaccines have yet been developed for this second group of diseases. However, techniques for diagnosing parasitoses have grown more reliable. More specifically as regards trypanosomiasis, better understanding of the ecology and behaviour of the vector, *Glossina* (tsetse fly), has led to the introduction of several new control methods. These can reduce the tsetse fly population by 90% or more in the space of just a few months. There are also numerous anthelmintics and other antiparasitic products on the market which could make a greater contribution to improving animal health were prices not beyond the means of low-income farmers.

Nutritional Constraints

Nutritional constraints relate to the alternation between periods of relative abundance during the rainy season and periods of food shortage. To make matters worse, soils are poor and often deficient in essential substances and produce inadequate forage, whatever the season. This has considerable repercussions for fertility and reproduction potential. Solutions include rotating ranges by fencing off certain pastures, improving soil quality by fallowing, and integrating crop and livestock farming, all of which increase farm inputs and build up food reserves. The capacity of the sub-humid region in this respect is far from being exhausted. The humid region, however, appears to have reached the limits of its potential for domestic ruminant production. Agribusiness in the villages and on the urban fringes should nevertheless be able to generate by-products suitable for use as feed for intensively farmed monogastric livestock.

Genetic Constraints

Constraints in the area of animal genetic resources are real but should be viewed from the broader perspective of how gene stocks interact with the constraints of the physical environment. There are species which, while not very productive at present, are well adapted to the tropical climate and in some cases have a high degree of tolerance to parasitic diseases. It should be stressed that there has been little research into improving and obtaining highly productive indigenous species suited to their environment. The situation is far better in other geographical regions with humid or sub-humid climates, in Latin America and Asia, for example. It should therefore be possible to improve African genotypes by stepping up research efforts.

Systemic Constraints

Constraints connected to production systems are inherent in pastoralism. Livestock farmers with large herds do manage to make a profit using traditional agropastoral methods, although yields are modest. Small farmers, on the other hand, are reduced to chronic poverty.

Socio-Cultural and Institutional Constraints

Customs and traditions are not always conducive to raising domestic ruminants, which generally are not native to the sub-humid and humid regions. The absence of a land

ownership system discourages investment, and as a result food crop and livestock farming does not progress beyond subsistence level. It therefore digs deep into environmental resources without putting anything back. Land security, in contrast, encourages improvements with a view to securing a lasting income; it goes hand in hand with intensification as a way of obtaining a production surplus.

Owing to a variety of institutional constraints, insufficient assistance is available for livestock production. All too often, support has been limited to vaccinations and the selective treatment of sick animals. Aspects such as feed, environmental and range management, reproduction control and socio-economic guidance are often neglected.

Policy Constraints

Production has often suffered from the lack of a clear policy stance. The importation of livestock products provides an example. Until recently, meat was imported from outside Africa at dumping prices. This occurred at a time when demand from towns represented a potential spur to productivity and ought to have inspired a dynamic policy of domestic production.

Development Potential of Traditional Livestock Production in the Context of Increased Demand and More Open Markets

Population Growth, Increases in Production and Demand

Sub-Saharan Africa is expected to have 900 million inhabitants in the year 2010 and 1.3 thousand million in 2025. Population growth, the faster pace of urbanization and a relative increase in incomes in towns all point to a rise in demand for animal products (meat, milk and eggs). Demand is also likely to be greater in rural areas of sub-Saharan Africa, where the population is predicted to reach 592 million people by the year 2025, an increase of 68% over the present figure (Winrock International, 1992).

In sub-Saharan Africa, total meat production, for all species, looks set to increase from 4.6 million tonnes (estimated figures for 1991/1992) to 9 million tonnes in 2010 (Alexandratos, 1995) and to 11 million tonnes in 2025 (Winrock International, 1992). Growth will be more rapid for monogastric livestock than for ruminants (Alexandratos, 1995).

The sub-humid region, where the bovine offtake rate is 14% and the average carcass weight is 170 kg, should be able to produce 2.5 million tonnes of meat in 2025 (Winrock International, 1992) and 5.6 million tonnes of milk, if annual growth reaches 3.9% for meat and 3.8% for milk. This will nonetheless leave per capita consumption lower than in other parts of the world with the exception of South-East Asia. But the requisite growth in production is not yet visible on the ground, and much remains to be done in that regard.

The potential of the sub-humid region is such that it should be possible to meet these production targets at some time in the future, even though at the farm level they are still a distant prospect. In 1987, the domestic ruminant population in the region was estimated at 37 million cattle, 18 million sheep and 24 million goats, or a total of 0.25 tropical cattle units (TCU) per inhabitant and 16 ha per TCU (Winrock International, 1992). Numerous studies arrive at the same estimate of approximately 4.5 ha per TCU maximum carrying capacity (ILCA, 1993). It would therefore appear that there is still some leeway. But it will take more than natural pastures to make up the shortfall. The answer lies in mixed farming, based on complementary combinations of livestock production, crop growing and agroforestry. Recent scientific and technical advances should enable the introduction of integrated systems of this kind, which will improve productivity in the various agricultural sub-sectors while preserving and indeed enhancing soil quality. Integrated crop/livestock/agroforestry production will yield food surpluses for use in livestock farming. The use of draught animals and organic manuring will raise yield and consequently make more agricultural residues and by-products available for fodder.

Fodder Crops, Watering and Genetic Improvements

As a result of research into fodder crops, forage grasses (*Panicum maximum*, *Andropogon gayanus*, *Zea mays*) and leguminous fodder crops (*Stylosanthes*, *Macroptilium lathyroides*, *Vigna unguiculata* and *Dolichos lablab*) are becoming increasingly widespread. The availability of water and an unstable work-force both represent constraints, however. It should be noted that the Centro Internacional de Agricultura Tropical (CIAT) in Colombia has studied many types of fodder crops which, through adaptive research, could be used more widely in sub-humid sub-Saharan Africa. The International Livestock Research Institute (ILRI) has also, through the former International Livestock Centre for Africa (ILCA), obtained plant collections for introduction, in particular leguminous shrubs and trees as fodder crops.

Another serious problem is water. Animals often have to travel many kilometres to drink. Catchment basins should be used to provide water reservoirs on farms; standard wells and boreholes are required to water animals and assist in the production of fodder crops. Irrigated agriculture also needs to be developed.

Genetic improvements in purebreds and the practice of crossbreeding, particularly for dairy production, have been made possible through newly acquired scientific and technical knowledge. Substantial progress has been made in East Africa, where artificial insemination is common. In West Africa, numerous artificial insemination projects currently under way will allow for the dissemination of improved genes. CIRDES has developed a solar-powered installation for the collection and refrigeration of semen where there is no electricity. This is a significant contribution to the practice of open-nucleus selection. Likewise, as long as prices are reasonable, the application of new biotechnologies will take production levels even higher. The same is true of embryo transfers. The manipulation of micro-organisms in the rumen to ensure more efficient

utilization of fibrous foods and non-protein nitrogen, and the introgression of productivity genes into resistant breeds and vice versa, are also promising areas of research.

The goal is not merely to improve productivity but also to guarantee sustained production in an environment that is protected over the long term and possibly improved. The integration of livestock farming with crop growing will help improve the soil and avoid excessive land clearing (slash-and-burn shifting cultivation).

Specific Sectors

In this context of integration, there are several specific systemic factors to consider, which must complement each other if the growing demand for animal products is to be met.

The Cattle Sector

In beef production it should be remembered that many small farmers give food security priority, keeping breeding cows for milk production and selling the surplus to meet the needs of the family. Those males produced that are not kept for breeding are sold either as draught animals or for slaughter.

The farmer's hands are tied by environmental limitations (Coulibaly, 1992). The production cycle is slow and yields a meagre income. Yield can be improved by appropriate action. An average four-year-old Baule bullock weighs 281 kg and has a commercial yield of 49.4% (Landais, 1983). Zebu cattle reach more than 360 kg under natural conditions, but intensive feeding can improve product quality, although trends are less favourable for small farmers.

Draught animals have a higher market value at the end of the cycle (Coulibaly, 1993). Females can be used for draught, in which case they are better fed and are therefore more productive.

There are benefits to be gained by extending the model of smallholdings run by innovative young farmers, which was piloted in Côte d'Ivoire in the form of "ecofarms" using crossbreeds in an improved environment. Milk production is intensified and surplus males have a higher market value.

Small Ruminants

Surveys of village farm systems show that small ruminants are often part of mixed enterprises that include cattle. In such cases, both are managed in the same way. Lately, however, small ruminant farming has become concentrated in and around urban areas.

Young farmers trying to set up specialized small-ruminant operations sometimes encounter difficulties marketing their products. A good choice of location near large urban agglomerations could solve such problems.

Poultry Farming

Village-based poultry farming is extremely important. Productivity goes up with improved health care and measures to control pests and seasonal stresses. Improved diet increases carcass value. The excellent taste of land races of chicken and guinea fowl is an economic advantage worth preserving. Both intensive and industrial poultry production are subject to established standards which, conscientiously applied, make for high egg and meat production levels. This could help improve supplies to towns. The constraints here concern the shortage of investment capital.

The Pig Sector

Together, traditional and modern pork production methods could soon meet demand, which remains fairly limited.

Suburban and Rural Livestock Farming

Being located on the outskirts of urban areas benefits the sale of products in all sectors. The trend towards production within towns should not be encouraged, however, as livestock operations can be seen as a nuisance and a source of pollution; they should remain in rural and suburban areas.

Policy Measures

Although improved methods favour the development potential of livestock production, it is still important that policy measures be based on, above all else, a better understanding of the concerns of traditional livestock farmers. The imperatives of production to meet growing demand should complement, not replace, the imperatives of security for agropastoral families and communities, who see farming as investing in capital on the hoof.

A concern for productivity and environmental protection will only emerge if family and village production is safeguarded not just by technical means but also by legislative and legal measures. Foremost among the measures required is guaranteed ownership of cultivated and developed land.

In addition, more caution is needed with regard to the importation of poor-quality animal products at dumping prices — a practice tolerated by governments to satisfy urban demand. Livestock farmers invest in their stock and expect a profit in return. The withdrawal of State support and the recouping of assistance costs from farmers' earnings point to a need for greater transparency in international transactions (Reh, 1995). Much remains to be said on this subject, and other participants in the seminar will doubtless take up the issue.

Systems Modelling

“Revolutions” taking place in other parts of the world — in Latin America and continental Asia, for example — could be a model for change in sub-Saharan Africa.

Analysis of the conditions required for change will be achieved through systems modelling aimed at enhancing productivity and economic security while preserving the environment.

Systems Research, Local Knowledge and Practical Applications

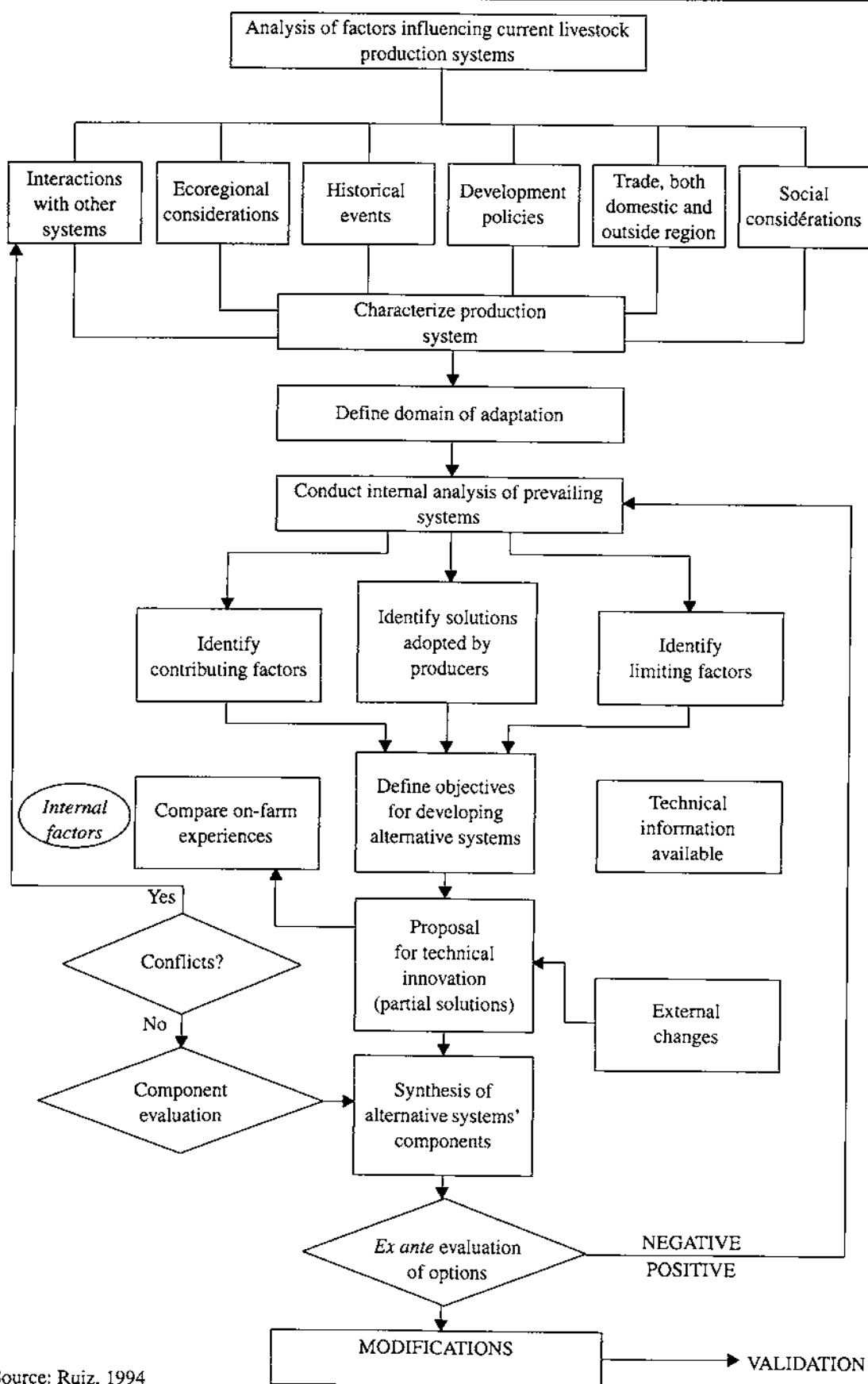
There has been no shortage of systems research into livestock farming in sub-Saharan Africa. It has been largely analytical and has helped quantify basic data and parameters for animal husbandry more precisely. But I am tempted to compare the researchers with entomologists studying relationships in a colony of bees in the wild. What is missing is a rapport between researcher and producer, the understanding of the latter's aspirations that would permit co-operation on developing an acceptable production system. In other words, social needs must be taken into account (Lhoste, 1994).

Systems analysis should be followed up with an improvement plan whereby the system is redesigned with the help of the main actors in the sector, starting with the agropastoralists themselves. The planned improvements need to be modelled and, based on the systems analysis, experiments that aim to optimize conditions should be carried out. All too often, unfortunately, this aspect of research is neglected and the result is yet another esoteric publication on production systems.

I would venture to adopt and recommend the methodological chart (Ruiz, 1994) shown as Figure 2. The chart takes account of both the exogenous factors and endogenous constraints relevant to an understanding of the system that is to be modified. System modifications can normally be made through a variety of technical options, but the scope of the change will often be dictated by the financial resources available. Technology "packages" are not always acceptable and that is why *ex ante* assessments are so important. Computer technology allows for a range of options to be simulated and modelled. Naturally, however, the changes introduced must take into account not only the farm and livestock directly concerned, but also the sector as a whole and the potential economic consequences for producers and consumers alike.

Future Prospects

Economic conditions appear to have improved. The liberalization of markets for agricultural produce and currency devaluations, both measures strongly recommended elsewhere (Williams, 1993) and recently introduced in the CFA franc region, should have a positive influence on production. Price incentives cannot be achieved without a reduction in dependence on imports of all kinds. The onus is on the R&D sector to put forward solutions and production techniques geared to local resources.



Source: Ruiz, 1994

Fig. 2. Steps in formulating alternative systems.

R&D is needed to support the trend towards the integration and intensification of crop and livestock farming. Wint and Bourn rightly stress that if the human population continues to grow, as is almost certain, and uninhabited areas are increasingly placed under cultivation, the interface between crop growing and cattle farming is bound to expand. It is also likely that increased cultivation will provide accessible sources of cattle fodder, thereby reducing recourse to high-risk strategies involving long-distance transhumance (Wint and Bourn, 1994).

The trend toward intensive land use in the sub-humid regions calls for R&D support. CIRDES is well placed to play an important role in coordinating research into livestock production in the sub-humid region, in collaboration with partners working in this area (Winrock International, 1992; Haan, 1992).

Conclusion

"*Res non verbal!*" ("Deeds, not words!") is the motto of a training institute in Burkina Faso. I believe it could also be our motto for this seminar. There is much talk of systems improvements, but little is translated into real development.

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Dairy Development in West Africa: Current Status and Issues Concerning Further Development

J.W. Smith,¹ K. Agyemang,¹ Z. Hailu,¹ M. Jabbar,² A. Larbi,¹ and P. Osuji,²

International Livestock Research Institute (ILRI)

¹ILRI, Ibadan, Nigeria ²ILRI, Addis Ababa, Ethiopia

Abstract Dairy production in several communities of West Africa is an integral part of household economies, as in other regions of sub-Saharan Africa. But its integration into existing farming systems is less obvious in the region than elsewhere on the continent. Several factors strongly suggest that the peri-urban areas of West Africa could become major milk and meat producers in the very near future. Recent macro-economic shifts in several West African countries, population growth, urbanization and the changing socio-economic circumstances of producers and consumers all point in this direction. Increased production would be achieved principally through efficient use of resources in the mixed crop-livestock farming systems. This paper reviews the current status of dairy development in West Africa in the context of overall agricultural development, provides justification for further development and indicates priority areas for research to support the dairy sub-sector.

Introduction and Background Data

Livestock in Sub-Saharan African Agriculture

The livestock sub-sector accounts for 25% of agricultural gross domestic product (GDP) in sub-Saharan Africa (SSA). This share may be as high as 35% if the value of draught power and manure is included (Winrock, 1992). The importance of dairying in the economy of sub-Saharan Africa can be gauged from the fact that milk accounted for 16% of the total value of all food products coming from livestock in this region, estimated at US\$18.3 thousand million in 1986 (FAO, 1986). A more recent appraisal of the situation puts milk's share in livestock products at 20-25% (Winrock, 1992).

Despite this significant contribution to GDP and milk's cherished value as food by a large proportion of the population, all the available statistics show that sub-Saharan Africa has failed to attain self-sufficiency in dairy production. According to Brokken and Seyoum (1992), overall self-sufficiency around the mid-1980s was estimated to be about 80% with considerable cross-country variations. The region has, therefore, depended on dairy imports to bridge the gap between demand and supply.

In an analysis of dairy imports into sub-Saharan Africa during the period 1970-1985, von Massow (1985) made the following observations:

- There was not a single country in sub-Saharan Africa that did not commercially import dairy products.
- During the 10-year period starting around mid-1970, not a single SSA country could maintain or even increase its level of dairy consumption per capita without increasing its dairy imports.
- Imports made up 50% or more of total domestic consumption in 24 of 45 SSA countries.
- For all countries in the region with less than US\$350 GNP per capita in 1981 except Mali, dairy products accounted for more than 10% of the agricultural imports bill.
- Typical livestock countries such as Somalia, Mauritania, Botswana and Burkina Faso were among the 12 countries that imported the most dairy products per head of population.

The World Bank (1989) has estimated that meat and milk production needs to grow by 4% per year to meet escalating demand resulting from rapid population growth and modest increases in incomes. The current growth rate, however, lags far behind that figure.

Imports of milk and dairy products into SSA, mainly from European Union countries, rose from \$113 million in 1970 to \$707 million in 1981. Additional dairy food aid shipments amounted to \$140 million in 1981 (von Massow, 1985).

Livestock in West Africa

The situation in West Africa is even more daunting as three of the five biggest importers, accounting for over 50% of imports, are found in the sub-region. Nigeria alone accounted for 31% while, taken together, Cote d'Ivoire, Senegal, Somalia and Angola accounted for another 22%.

Furthermore, trends in human population growth, dairy production and imports suggest a bleaker outlook in West Africa than the other sub-regions. While human population has been growing at an annual rate of over 3%, growth in total dairy output has only been 2%. As for dairy imports, they grew at nearly 11% per annum over the period 1974-76 to 1983-85. For 1983-85, an estimated 1.356 million tonnes per annum (liquid milk equivalent) of dairy products valued at \$266 million was imported into the sub-region. It is currently estimated that the milk consumption level of 26.7 kg per person per year in West Africa is only about half the continental average and that imports account for about half of the consumption.

Within the West African sub-region, both the size and structure of demand that gave rise to these imports differed for the drier and moister zones (Seyoum, 1989). For example, in 1983-85 the moister countries in the sub-region imported more than twice the volume of dairy products as the drier countries. Moreover, while net dairy imports accounted for an average 62% of total dairy consumption in the moister areas, the value for drier areas was 28%. The corresponding values for 1985-87 were 46% and 29%. Although the per capita consumption of dairy products in drier areas was nearly four times the levels recorded for the moister areas, the estimated growth rate for that consumption was similar in the two areas (2%), which suggests that milk consumption has gained more importance in moister areas (Seyoum, 1989). This observation is in agreement with figures from FAO (1976a, 1976b, 1985a and 1985b) which put the growth rate of aggregate dairy consumption at 4% and 6% for drier and moister areas respectively. These differences can be partially attributed to differences in overall human population and urban population growth rates between the drier (2.6%, 4%) and moister areas (3.2%, 6%).

The major causal factors identified for increased aggregate demand for dairy products and their imports are changes in income, consumer prices and population growth. Thus it is postulated that the expected increase in human population in SSA (more than doubling by the year 2025), rising incomes in certain areas and lower prices for milk products on the international market will push up demand for these products. The theory of comparative advantage and the benefits of international trade have been called on to justify the view that dairy products should continue to be imported into SSA as long as international market prices remain depressed. However, von Massow (1985) lists three economic and political factors that must be considered in addition to the above-mentioned trade theories:

- Export earnings in most African countries are not sufficient to cover their import requirements.
- Dairy imports, particularly those that serve as raw materials for re-combination into liquid milk, are distributed mainly in large cities and thus benefit only urban consumers.
- Continued imports are a disincentive to local production.

Despite their reduced export earnings and foreign exchange problems, SSA countries continued to import dairy products because of decreases in real import prices and over-valued national currencies. However, the implementation of structural adjustment programmes in most SSA countries since the early 1980s has resulted in massive currency devaluations, making imports very expensive in terms of local currencies and, in most cases, curtailing dairy imports drastically.

The case of Nigeria illustrates this trend. Nigeria's dairy imports increased from 190,100 tonnes (liquid milk equivalent) in 1973 to 995,000 tonnes in 1982; by 1980 dairy imports

had become the single most important item among Nigeria's imports (FMA, 1981; Jansen, 1992). With the series of devaluations in the 1980s, the cost of imported ingredients increased, in local currency terms, by a factor of 8 to 10. This led to a drastic decline in volume of imports, reaching an all-time low of 164,000 tonnes in 1986.

Thus, economic considerations alone amply justify the development of indigenous dairy production in some SSA countries and in West African ones in particular. Such development is further justified by the fact that, whereas over 20% of the world's cattle population is in Africa, only a little more than 3% of the world's cow milk is produced there (Walshe et al, 1992).

Milking for human consumption is a long tradition in many communities in SSA. However, its integration into crop husbandry is more recent, occasioned by the settlement of pastoralists who take up crop farming. Called agro-pastoralism, this practice is expanding rapidly in West Africa's sub-humid zone and the drier parts of its humid zone. It also appears to be occurring in both traditional and non-traditional cattle areas.

Recent surveys in Southern Nigeria (Mohamed, 1990; Jabbar, 1993) show, for example, that crop-cattle farming is emerging from two directions. The dominant line is that of nomadic Fulani pastoralists becoming sedentary pastoralists and eventually agro-pastoralists. A minor but perceptible line is that of traditional crop farmers becoming mixed farmers by purchasing cattle, hiring Fulani herdsmen for initial management, then taking up management themselves after gaining experience. Much of this integration is happening in peri-urban areas where surplus milk and other dairy products are exchanged with the urban population (Waters-Bayer, 1988). A rather new but expanding phenomenon seen in and around large towns and cities in the sub-region is the investment in cattle production by both active and retired civil servants in the so-called backyard or compound cattle ranching system (Agyemang and Dogoo, 1992).

These developments point to new opportunities for significantly increasing the indigenous aggregate milk supply with the emergence of new crop-livestock systems and the intensification of existing ones. The potential for increased earnings from the livestock components of crop-livestock systems was demonstrated by Debrah and Sissoko (1990). They calculated the net cash income from cropping in Banamba zone of Mali to be 14% compared with 73% from livestock sales, with milk sales constituting the largest single item. Cash from livestock sales, in addition to being used to meet miscellaneous family obligations, was also reported to have been used to pay hired labour in both livestock and crop production and to buy or repair farm equipment. Thus, the developmental role of dairying in the context of crop-livestock systems cannot be over-emphasized. Furthermore, the potential positive impact on the environment of the dairy sub-sector in crop-livestock systems, arising from efficient use of resources including labour and feeds could be large.

Previous Dairy Development Efforts

It is widely recognized that past failures in fostering effective dairy development in much of SSA stemmed from the lack of an integrated approach to solving the sub-sector's problems. As the success story of Kenya vividly shows, favourable public policy on marketing, pricing, importation of dairy products and provision of inputs (including technology) and services are important preconditions for small-holder dairy development.

Although technical research on dairy production in West Africa dates back to the 1940s and 1950s (Foster, 1960; Hill, 1956), most studies were based on exotic cattle and indigenous breeds reared on research stations or university farms. That research agenda was closely linked to a dairy development strategy based on large-scale State or parastatal dairy projects. These projects imported large numbers of exotic cattle as well as the physical infrastructure and technological packages used in the mostly temperate environments of the exporting countries. But the high-producing temperate genotypes could not be successfully managed in the humid tropics without substantial modification, at prohibitive cost, of the environment (feeding, health, nutrition, etc.). Thus, with few exceptions, these projects eventually failed.

Simultaneously, a similar strategy was adopted for processing and marketing dairy products. Large industrial dairy plants (for processing milk, cheese and butter) were imported and commissioned in selected urban centres of many countries. It was expected that these plants would collect and process farmers' milk and market the resulting products locally. However, perhaps as a consequence of poor rural infrastructure (roads, electricity and so on) and the high transport costs associated with lower milk volume than expected, these plants were mostly unable to satisfy their objectives. To continue operating, they resorted to reconstituting milk from skim milk powder and butter oil which were available on the international market or through food aid at much lower prices than local fresh milk. Despite such measures, the vast majority of these plants have either closed or are operating at only a fraction of their capacity.

It is now generally accepted that an alternative dairy development strategy is needed. It must ensure congruence between policies and development objectives, between processing and marketing means and institutional capacity, and between the technological alternatives and the indigenous resource base (Smith and Larbi, 1991).

In West Africa the most appropriate entry point for expanding milk production seems to be the large number of limited-resource, crop-livestock farmers who rely mostly on traditional management practices to produce their milk. By adopting new but appropriate technologies, their farms could evolve into highly productive crop-dairy enterprises. Initial increases in milk volume will likely be consumed fresh or in a semi-processed state. Hence the need for small-scale, farm-based dairy processing alternatives that could be used until the milk supply expands sufficiently and or until market demand indicates larger-scale industrial processing.

Research on indigenous breeds and on processing technologies in the context of traditional farming systems is rather recent and ILCA has been in the forefront in these areas (see Otchere, 1986; Agyemang et al., 1991). The findings of this research and from research in other agro-climatic zones in West Africa (e.g., Pullan, 1979; Pullan and Grindle, 1980) identify several production constraints. These relate to feed quality and seasonal availability of feed, internal and external parasitism, poor reproductive performance, calf morbidity and mortality and management-related lapses (e.g., uncontrolled breeding) that hinder genotypes from producing near their potential.

Development Potential from Dairying

Potential of the Ecozones

A major assessment of animal agriculture in sub-Saharan Africa has predicted rapid intensification of agriculture and development of crop-livestock farming. The prediction is based on projected high population growth rates, a high rate of urbanization and consequent changes in food production, marketing and consumption patterns. The sub-humid zone and the moister part of the semi-arid zone of West Africa have been identified as the higher-potential areas for crop-livestock farming. Arid and humid zones have been identified as second-priority areas (Winrock, 1992).

Several authors have postulated population pressure as the prime mover of agricultural intensification and development of crop-livestock farming (Boserup, 1965, 1981; Ruthenberg, 1980; Pingali et al., 1987; McIntire et al., 1992). Market access, presence of cash crops, dominance of cereals in the cropping pattern, and relative prices have been mentioned as additional factors fostering crop-livestock interaction in specific situations (Smith et al., 1993; McIntire et al., 1992; de Wilde, 1967).

If these criteria are applied to judge the potential for crop-livestock development in the humid and sub-humid zones, there are good reasons to be optimistic. Firstly, although these zones are generally sparsely settled, in parts of West Africa and around major cities population densities are high compared with those in the drier zones. Most major cities are located in the humid zone and they are expected to grow rapidly with migration from within and outside the zone. Population pressure in other zones may also stimulate migration into rural areas in the humid zone.

Secondly, the humid zone is better endowed than other zones with regard to two major dimensions of market access: size and communication links between producers and consumers. This is due to the presence of big cities that are well-connected with rural areas. Several times more animal (and in some cases crop) products are consumed in this zone than are produced, and the size of the market will expand rapidly, as indicated earlier.

Thirdly, although cereals may not immediately become dominant in the cropping systems, their importance is steadily increasing. As agriculture is commercialized and consumer income increases, the importance of cereals will grow and there is likely to be a move towards producing cereals as sole crops. Cereal crop residues and agro-industrial by-products linked to cereal production offer important avenues for increased crop-livestock interaction. Thus, with the already established trend toward intensified and mixed crop-livestock farming in the semi-arid and sub-humid zones and the above-postulated scenario for some parts of the humid zones, the stage is set for wider development in West Africa if all the contributory factors can be properly harnessed.

There is no evidence that rain forest is cleared to expand livestock production per se. However, forest is regularly cleared to expand crop production. Cattle may then move in, particularly trypanotolerant breeds in the beginning. Unless constrained by external forces, this trend is likely to expand. It is therefore essential to develop controlled, integrated land-use systems for sustainable crop and livestock development. In the absence of such systems, tsetse control and crop-cattle production in the more fragile areas should be actively discouraged.

Crop-livestock farming is evolving and will presumably become the dominant system in the derived savannah and sub-humid zones. Research and development strategies should, therefore, be aimed at "supporting, accelerating and helping to direct the natural forces of intensification of agriculture and the evolution and maturation of mixed crop-livestock farming systems that will make agriculture more productive and sustainable, while at the same time improving the social and economic conditions of people" (Winrock, 1992). It is envisaged that such a strategy would adopt a resource management approach using land as the most critical resource.

Potential Role of Crop-Livestock (Dairy) Systems in Development

Small-holder crop-livestock (dairy) systems may take several forms. At one end of the scale may lie systems in which crops and cattle are raised by the same household. Cattle are grazed mainly on natural pastures, crop residues are fed to animals, and manure from night kraaling is applied to crops. At the other end of the scale may lie systems in which crops and dairy cattle are raised as specialized commercial enterprises based on commercial inputs. On-farm interaction between crops and cattle may be minimal. Fully integrated and functionally related crop-dairy systems may lie somewhere in between.

In West Africa, nomadic cattle rearing is still the predominant system and crop-cattle systems are only now evolving. The degree of integration is higher in the drier semi-arid zone and gradually declines as one moves to the wetter sub-humid zone. Specialized systems are yet to emerge. Productivity is lower at the bottom end of the scale of integration. Therefore, improving crop-dairy systems implies an upward movement along the scale of integration.

Improved crop-dairy systems may contribute to West African development in three ways: supplying more food for the domestic population, earning or saving foreign exchange and generating farm income and employment.

Increased Food Supply

Adequate amounts of balanced and nutritious food are a primary indicator of quality of life, human welfare and development. Animals are an important source of food, particularly of high-quality protein, minerals, vitamins and micro-nutrients. Animal protein plays an important role in human nutrition beyond the provision of protein per se. This is because it contains amino acids that are essential to human health but deficient in cereals. The consumption of even small amounts of animal products corrects amino acid deficiencies in cereal-based diets, permitting more of the total protein to be used (Winrock, 1992).

Judged by their comparatively low level and share of protein derived from livestock, West African diets may be considered poorer than those in the other regions of SSA. Milk and beef consumption in West Africa is significantly lower than in Eastern and Southern Africa. Total meat consumption is also lower. Moreover, contribution of imports to milk, meat and beef consumption is significantly higher in West Africa. In the recent past, per capita milk consumption has declined despite increased imports. Consumption of meat marginally increased and that of beef marginally decreased in the face of declining imports. Most of the imported products are consumed in the wetter regions, particularly in the urban areas.

More recent figures indicate a further deterioration in the consumption of these products in West Africa. Projections to 2025 indicate that, without substantial increases in output, SSA in general and West Africa in particular will face severe shortages of these products. Improved crop-dairy systems could help improve nutrition through increased supply of milk, meat and staple food crops. It should be noted that 20-40% of a dairy enterprise's income typically comes from beef (male calves and culled cows). Increased domestic production will also cut dependence on imports.

Improved crop-dairy systems could also contribute indirectly to nutritional quality by keeping prices down through increased production. Most low-income people in West Africa suffer more from energy deficiency than protein deficiency. It is also known that people consume more animal protein as incomes rise. If increased production were to keep prices low, it might be possible for people at relatively low income levels to consume more animal protein. Since animal products also supply significant amounts of energy, the energy-protein deficiency could be simultaneously overcome (Lipton, 1988). At the same time, lower food prices would likely foster greater political stability.

Finally, better crop-dairy systems could also provide a better cushion against poor crops or herd losses due to natural calamities and epidemics.

Earning or Saving Foreign Exchange

In 1985-87, West Africa accounted for 51%, 34% and 47% of the value of milk, meat and beef imported into SSA. The value of milk imports was \$235 million and that of meat \$63.2 million of which \$50.6 million was for beef. Nigeria, Côte d'Ivoire and Senegal were the major importers.

Importation meant that valuable resources were diverted from investment in domestic production into current consumption. The failure of domestic producers to keep pace with growing demand further increased imports. Other factors such as subsidies by exporting countries and over-valued exchange rates in the importing countries have accelerated importation. But recent trends already indicate that, with changes in policies in both exporting and importing countries, a high level of imports and import-based consumption cannot be sustained by most African countries. Improved crop-dairy production systems may help reverse the situation by increasing output and saving or earning foreign exchange.

Increased Income and Employment

The cash-generating potential of dairy enterprises in West Africa may foster greater investment in both crop and livestock enterprises in the form of seeds, fertilizers, pesticides, drugs and feeds, thus enhancing production and income. Increased crop income may also be invested in animal production (Brumby, 1986). There is evidence that livestock provide a dominant part of the cash income and gross margin of crop-livestock farmers (Gryseels, 1988; ILCA, 1987; Debrah and Sissoko, 1990) and that gross margins of crop-livestock (dairy) farmers are higher than that for crop farmers (Gittinger et al., 1990; Okoruwa, 1993). Higher income from more integrated and intensified systems also imply higher productive employment.

Specialized dairying at the farm level is labour intensive, with labour typically accounting for over 40% of total costs in small-holder systems (Walshe et al., 1992). It was estimated that each 6 to 10 kg per day of additional milk produced in India added one person-day for animal feeding and care. Data from the Dairy Development Programme in Kenya indicate small-holder production on the order of 25 kg of milk per person-day. If 300 working days per year is considered full-time employment, each 7,500 kg increase in milk production will require the full employment of one person. Recent data show the current (1988) consumption level for dairy products to be 11.22 million tonnes (Winrock, 1992) and the growth in demand to be 4-5%. Thus, a production level of 560 million kg per year is required to meet the growth in demand. This would increase employment in sub-Saharan Africa by nearly 70,000.

In West Africa, where the dominant milk production systems are less intensive than those in India or Kenya and use mostly traditional management practices, the employment content will likely be much lower. Even so, the absolute numbers of these crop-livestock (dairy) enterprises suggest considerable importance for rural employment. As these enterprises evolve into more intensive crop-dairy or even specialized dairy operations, their employment capacity will appreciably expand.

At the processing level the choice of technology will have a major impact on the level and type of employment generated. Small-scale rural processing is labour intensive and processing/marketing systems require one person per 50 to 100 kg handled. These tasks are handled almost exclusively by women. Expansion of milk production, at least initially, is therefore expected to place heavy demands on women's labour if appropriate processing alternatives are not simultaneously developed. However, women are likely to derive considerable financial and social benefits. Incomes from milk and from processed products are usually controlled by different family members: women handle on-farm processing and receive income from sales while men control income from fresh milk.

Development Issues and Research Priorities

Policies, Institutions and Markets

It is generally believed that inappropriate policies, markets and institutions have contributed to the poor state of agriculture, including the dairy sector, in West Africa. Some of the policy-related problems are as follows:

- Agriculture was subjected to negative protection through over-valued exchange rates, heavy taxation of production inputs and liberal importation of consumer goods.
- Food pricing policies favouring consumers at the expense of the producer were pursued.
- There was widespread government intervention in production and marketing through State enterprises protected by subsidies, thus discouraging competition. Public investment in these enterprises was often made without due attention to social profitability.
- Technologies inappropriate to the prevailing production systems were promoted through government policy.
- Credit rationing and administrative regulation and bottlenecks discouraged private investment.

Together such policies discouraged the adoption of new or better production technologies, increased imports for consumption and transferred income from producers to consumers, mainly in the urban areas. They also stimulated rural-to-urban migration, thereby making the adoption and use of labour-intensive technologies difficult, and discouraged the development of land tenure security and a land market.

With the introduction of structural adjustment programmes, some of these inappropriate policies and institutions are disappearing. But the net effects of these changes are still unclear. Thus, research to improve understanding of macro-economic policies, local markets and institutions, and their impact on small-holder producers, lenders and

consumers is important. The social, economic and technical effects of various policy options and policy changes also need to be quantified.

Intensification of Agriculture

"The pattern of rapid population increase in sub-Saharan Africa — expanding rural population subsisting on a fixed land base and growing urban population creating markets for agricultural products — will inexorably lead to intensification of agriculture" (Winrock, 1992).

Intensification involves the use of more labour, more inputs such as fertilizer and chemicals, and improved technology such as better genetic stock and power sources. Many authors have described population pressure and market access as the main forces fostering agricultural intensification and crop-livestock interactions.

McIntire et al. (1992) have characterized the role of livestock in intensification of African agriculture as an evolutionary process. The pattern can be summarized as follows:

- As population grows, crop land expands, fallow periods are shortened and pasture land shrinks. External inputs are needed to maintain fertility. Farmers paddock animals on crop land or collect and use manure and graze-crop residues.
- With increasing population pressure, production is increased through more intensive technology. This includes heavier applications of manure and fertilizer. There is a shift from paddocking of animals to a system of collection, processing and application of manure.
- Herders become settled, begin growing crops and increasingly use crop residues.
- Grazing of pastures is further reduced, crop residues are harvested and preserved as feed, and manure is used more intensively.
- Labour is replaced by animal traction and mechanization which become economical because of the greater intensity of land use. Farmers grow legumes and forages to improve soil fertility, crop yields and livestock productivity.

Transhumant pastoralism made cattle production viable in the ecological stratification of West Africa and it is still the dominant system of cattle production in the region. Crop-livestock interactions and integration are evolving, a process that is slightly more advanced in the drier regions. However, there are indications that the linear evolution of crop-livestock interactions postulated by McIntire et al. (1992) may not always hold for West Africa.

If chemical fertilizer becomes cheap and readily available, the initial interaction between nomadic herders and settled crop growers through paddocking (manuring) and crop

residue grazing could end. The chances of this happening are greater if market access also improves, better crop varieties become available and herders are pushed away from more intensively cropped areas in an attempt to prevent crop damage and conflicts. Intensification of crop production could then advance without cattle, particularly without manure. Crop farmers may adopt animal traction at some stage, but traction and the sale value (cash income) of the fattened animal may be the primary motives for keeping cattle. Manure may be considered a secondary benefit for intensive crop or vegetable production near the household.

High-level intensification requires crop-livestock integration within the same production unit; mere interaction is not enough. The need for manure and traction may not be strong driving forces for integration in the sub-humid zone, particularly for crop farmers, if cheap substitutes are available. The prospects of higher cash income may be a stronger motive for intensification through crop-livestock integration. A crop-dairy system satisfies this condition because of the regular cash-generating potential of dairying.

It is generally recognized that pastoral and agro-pastoral systems are efficient but their productivity and offtake rate for milk and meat are low. For these and other reasons, such systems cannot serve the needs of vast urban markets; a more intensive and integrated crop-dairy system is required. Depending on the degree of intensification and crop-dairy integration, more efficient use could be made of on-farm resources. Crop residues could significantly contribute to the feed budget of animals at critical times, thus enhancing milk production. Cattle manure could help to maintain the level of soil organic matter, water-holding and cation-exchange capacity, and nutrients required for crop production. Thus, the potential for attaining efficient and sustainable production from crop-livestock (dairy) systems is considerable.

Technological Issues

Feeding and Nutrition

Nutritional factors are a severe constraint on increasing milk production in sub-Saharan Africa. In most cases, they are more important than the animals' genetic potential for producing milk (Walshe et al., 1992). Production could generally be increased if either the quantity of the feed or its quality could be improved.

In West Africa, natural pastures are the primary feed sources for cattle. However, the production response of cattle, particularly those reared for milk, is constrained by inadequate forage supply accentuated by acute seasonal shortages and large annual fluctuations (Winrock, 1992). The magnitude of the feed supply problem from natural pastures, in terms of both quantity and quality, varies across ecozones as a function of season and rainfall.

The nutrition available from natural pastures is usually not sufficient to sustain satisfactory production and health even under optimal management and stocking rates. This is because the grasses grow rapidly during the rains and then, as they quickly become fibrous with high lignin content, their digestibility declines. Consequently, milk yields of cattle raised on natural pastures alone rarely exceed 3 to 4 kg per cow per day (Walshe et al., 1992). During the rainy season animals usually have a surfeit of forage,

though of low quality; during the dry season both quantity and quality are severely restricted. Crop residues and, to a lesser extent, agro-industrial by-products are relied upon to ensure survival until the next rainy season. The importance of such residues and by-products to meet the demands of enhanced herd productivity cannot be over-emphasized. The use of the latter as well as cultivated forages could be stimulated under appropriate milk pricing policies.

There are, however, knowledge gaps about how to budget potential feed resources over time to maximize their use efficiencies in various production systems (cut and carry, grazing, etc.) and among cattle in various physiological states. Many technical questions arise in the attempt to take advantage of feed resources for greater productivity of milk herds. Here are a few examples:

- What is the production potential for milk of indigenous pastures of the sub-humid ecozone?
- How or when should crop residues be employed to derive maximum benefit from their use as strategic supplements?
- Under conditions of nutrient insufficiency should preference be given to feeding the lactating cow rather than the replacement heifer?
- Would favouring the heifer be compensated by a younger age at first calving and hence higher aggregate lifetime production? Or would the benefits be greater from the incremental increase in milk production by favouring the lactating cow?

Breeds and Breed Selection for Milk Production

The cattle breeds found in the sub-humid zone of West Africa are diverse. Whereas the Baoulé, N'Dama and Zebu occur in similar proportions in Côte d'Ivoire, the Shorthorn predominates in Ghana. In Nigeria, the Zebu, of which the Bunaji are the most numerous, dominates. Only a few exotic breeds are found in the sub-region, usually in specialized production systems such as university farms and research stations. However, cross-bred cattle such as Friesian x Bunaji, produced from such stations and at commercial farms, are finding their way into small-holder production systems. In addition several cross-breeding programmes involving indigenous trypanotolerant cattle, notably the N'Dama, Baoulé and the West African Shorthorn with Zebus, are proceeding in the sub-region.

The Bunaji has traditionally been considered the indigenous breed with the most dairy potential. Annual lactation yields of 1,000 - 2,400 kg per cow have been reported from research stations (Hill, 1956; Foster, 1960). Otchere (1986) provided an estimate of 442 kg per cow during a six-month lactation period for agro-pastoralist herds in Central Nigeria. Where the N'Dama breed has been kept purely for beef, as on ranches, milk offtake for human consumption has been negligible. Where N'Dama has been kept as a multipurpose breed, average milk offtake in excess of 400 kg per lactation has been recorded (Agyemang et al., 1991).

These and other results illustrate the opportunities for selecting genotypes for the different production systems and feed resource endowments of the various ecozones across West Africa. For example, closer to towns, where agro-industrial by-products can be used for supplementary feeding, genotypes with higher milk potential (e.g., indigenous/exotic cross-breeds) may be desirable for cut-and-carry systems. But genotypes of lower potential may be indicated deeper in the milk-supply hinterland where extensive grazing of indigenous pastures offers the best means of exploiting available feed resources.

It is thus clear that, across West Africa, strategies for using animal genetic resources to expand milk production need to be flexible. They should be based on matching genetic potential for milk with the feed resource endowments of ecozones so as to improve genotype and feed supply simultaneously. This measured approach to dairy development could benefit from the use of geographic information systems (GIS) based on variables such as market potential, animal genetic resources and their potential, and descriptions of feed resources and crop-livestock production systems.

Animal Health and Reproduction

In West Africa, as in the rest of the tropics, many diseases afflict cattle. Mortality and morbidity rates are often high.

ILRI is attempting to control some of the most important diseases. But some are not currently being investigated and their effects may be exacerbated under intensive production systems. Such diseases are known to undermine cattle production and productivity but their economic effects on the performance of enterprises are often unknown.

Growth rates of calves are curtailed by helminthiasis and cattle of all ages die of ectoparasitosis, for example. De Jode (1989) found mortality of 30.5% among White Fulani; 24.2% for White Fulani x N'Dama crosses and 2.25% for pure N'Dama calves. Worms and diarrhoea were mentioned as reasons for calf mortality by 86% and 60% of farmers in two studies. Mohammed (1990) found calf and adult mortality of 23.1% and 6.4% for wet and dry seasons respectively. Diarrhoea, worms and sand eating (geophagia) were mentioned as major reasons for calf mortality by 94%, 86% and 50% of farmers in three villages in south-western Nigeria.

Calf mortality and morbidity rates remain high in West Africa, with negative economic consequences for producers. Finding alternative calf-rearing strategies to reduce mortality and promote earlier weaning will be important for dairy development among farmers with limited resources. Strategies used in more industrialized countries are unfortunately too expensive for West Africa, so local resources such as agro-industrial by-products and grass or grass/legume mixtures should be considered.

The negative effects of disease on intensification are not restricted to calves, of course. Adults are also affected and depressed milk production is a major consequence. Intensive and more frequent milking expected in peri-urban dairy systems, together with inadequate nutrition, are likely to cause weight loss and affect reproductive performance.

These two problems may not be caused by pathogenic diseases alone. Nutritional diseases and complexes between pathogenic and nutritional disorders are also known to be debilitating. Expanding milk production and productivity of dairy cattle cannot be successfully pursued without adequate attention to these constraints.

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Livestock/Environment Interactions in Humid and Sub-Humid Africa: Underlying Causes and Policy Recommendations¹

***Henning Steinfeld, Animal Production and Health Division, UN Food and Agriculture
Organization, Rome, Italy***

Abstract Livestock production has been widely criticized as being damaging to the environment. The paper attempts to shed light on key interactions between livestock and the environment, focussing on overgrazing, deforestation, threats to wildlife and biodiversity, disposal of waste (from manure production and meat processing), methane production, demand for feed concentrate, and crop-livestock links. It examines these interactions for three main types of animal production: grassland-based systems, mixed farming systems, and land-detached systems such as intensive pig and poultry operations. The paper concludes that none of the systems is environmentally unfriendly in itself. However, the most beneficial livestock-environment interactions are seen in mixed farming systems and the most negative in land-detached systems. Grassland-based (pastoral) systems are mostly environmentally balanced, but the equilibrium is threatened by demographic pressure. Livestock policies can be used to correct market failures, that is, animal production situations where the value of a resource is not reflected in its price and where the costs of degradation are not met by the polluter or degrader. The paper identifies several types of policy intervention — institutional reform, infrastructure development, markets and pricing, regulation, and information and extension — and suggests which environmental problems might respond positively to them.

Introduction

In recent years, there has been growing criticism that livestock production has major negative effects on the natural environment. A study co-ordinated by FAO and the World Bank is now attempting to assess objectively the interactions between the two. Some preliminary analysis can now be made and conclusions drawn.

This paper assesses the major positive and negative interactions between livestock production and natural resources in the context of sub-humid and humid Africa. For the

¹Apart from the author of this presentation, this study is co-ordinated by Dr Cornelis de Haan of the World Bank and by Dr Harvey Blackburn of USAID. In addition to FAO, the World Bank and USAID, contributors to the study are Denmark, the European Union, France, Germany, the Netherlands, and the United Kingdom. Consultants include CIRAD-EMVT, France; IFC and GMS, United States; IAC, Netherlands; NRI, United Kingdom; Universities of Gießen and Saarbrücken, Germany; and Drs Sere and Cunningham as individual consultants. Dr Steinfeld's paper was presented to the seminar by Dr J.C. Lambert, also of FAO's Animal Production and Health Division.

main production systems of the region, the state of the natural resource base is described. The main pressures on it are outlined, with the distinction being made between those attributable to livestock production, and those due to other factors.

Finally, social responses in the form of changing values, environmental laws and policies, the effectiveness of their enforcement and their impact, and possible improved technological and policy options are discussed.

Figure 1 is a conceptual framework developed by OECD (1993) showing interactions between human activities and the environment. For our purposes, the state of natural resources is affected by pressures from livestock production, which in turn are driven by population pressures and human aspirations.

Deterioration of natural resources creates feedback and provokes a societal response in the form of decisions or actions. This response can be of an institutional, technological or policy nature. Technological change is often induced by policy changes insofar as incentives or regulations alter the relative scarcity of production factors, stimulating innovations that respond to the changed set of factor prices.

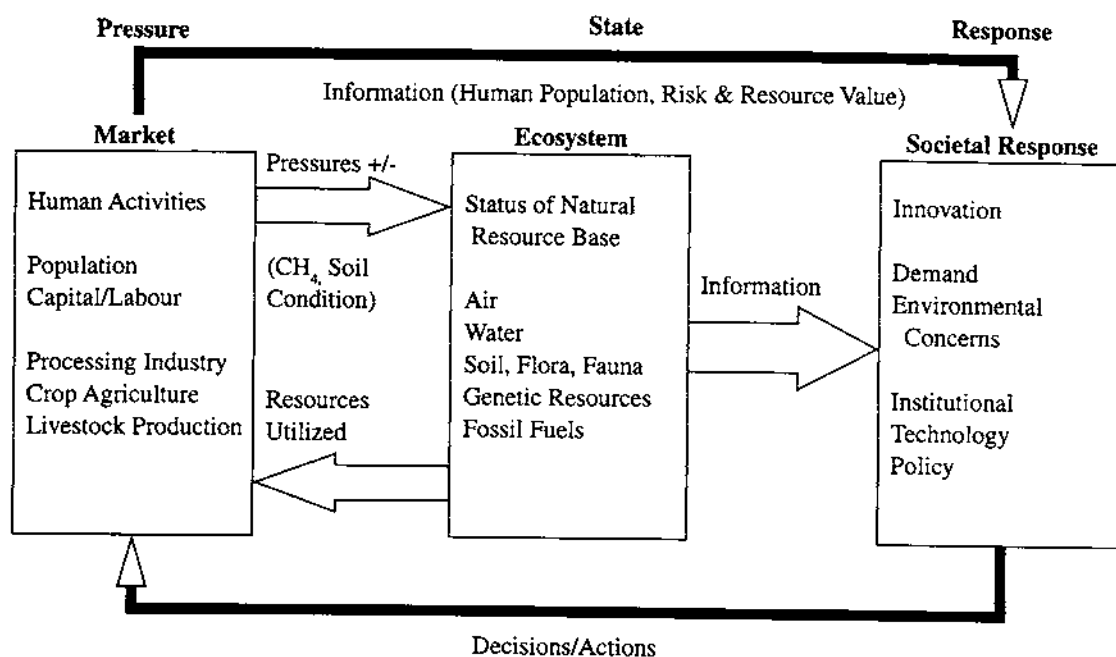


Fig. 1. Global/local pressure-state-response framework for livestock systems.

Interactions with the environment are diverse. Some are positive, some are negative. Some may be valued in one context but be considered an environmental burden in another. Some environmental effects are reversible, others irreversible. Livestock may be at the beginning of the cause-and-effect chain, the end, or somewhere in between. Thus, there are direct and indirect effects. *Direct effects* of livestock production on natural resources involve impact on land (grazing, trampling, manuring/waste depositing), on water (depletion, pollution), on the atmosphere (methane emissions) and on genetic resources (biodiversity). *Indirect effects* have to do with feed requirements and conversion efficiency. The expansion or intensification of arable lands, for example, can partly be attributed to increasing demand for animal feed concentrates. This creates competition for potential food commodities. At the same time, livestock production entails losses in nutrient conversion. Indirect positive effects result from the use of animals for traction and manure for fertilization. The use of pastures in crop rotations and nitrogen-fixing forage crops are further examples of indirect effects of livestock production on the environment.

Compared with other regions of the world, the humid and sub-humid zones of sub-Saharan Africa have been traditionally protected to a great extent by the incidence of diseases. In particular, trypanosomiasis limited not only livestock production but human settlements. But road construction and immigration from drier areas led to the destruction of the habitat of the carriers African sleeping sickness, in turn threatening the habitat of wildlife tolerant to the disease. There has thus been growing concern over the environmental impact of population growth and urbanization in these areas.

Livestock Production Systems

Livestock systems have evolved in response to scarcities of production factors (land, water, labour, capital, and feed) and to development opportunities (demand for livestock products). Where grazing land was abundant, production systems took a different technological course compared with where it was scarce. In very general terms, three major production systems can be distinguished: grassland-based systems, mixed farming systems and land-detached systems.

Grassland-Based Systems

Grazing is the main feed resource in such systems although some isolated interaction with cropping may occur. The main environmental concerns relate to livestock interactions with grassland resources, forests and wildlife. As most of the grazing in sub-humid and humid sub-Saharan Africa is usually on common or open-access lands, there are inherent risks of this resource being over-exploited, with the environmental effects being shouldered by the community. In agro-ecological terms, it is useful to distinguish between lowland and highland systems since ecosystems and agricultural potential differ markedly.

Mixed Farming Systems

Crop and livestock production is integrated to varying degrees and there are generally interactions with grazing, forests and wildlife. Most of these systems are environmentally benign or neutral. They usually help recycle and direct nutrient flows and, in some instances, save fossil fuel by providing animal traction. The same agro-ecological distinction between lowland and highland zones is appropriate.

Land-Detached Systems

In such systems, livestock production, typically the raising of pigs or poultry, is separated from feed production and waste disposal. This type of production is on the rise as incomes and urbanization increase. In terms of energy and nutrient flows, these are open systems and present ample opportunity to burden the environment. They depend on feed, energy and other inputs from outside — that is, on inputs not generated by the system itself. And because of the large concentration of animals in one site or region, the waste produced by land-detached systems also poses a considerable environmental threat. In some cases, particularly in urban and peri-urban environments, groundwater and soils have become contaminated with nitrates, phosphates and heavy metals — all of which can also threaten human health. Because of the multiple interfaces with their surroundings, these systems run the risk of externalizing environmental costs if not properly controlled.

As can be seen from Table 1, mixed farming systems dominate meat production, with 57% of the total, followed by grassland-based systems with 37%. Land-detached systems, at only 6%, are still relatively unimportant.

Table 1. Overview of main production systems and quantities produced in sub-humid and humid sub-Saharan Africa.

<i>Type of livestock production</i>	<i>'000 tons</i>				
	<i>Land-detached system</i>	<i>Grassland-based system (lowlands)</i>	<i>Grassland-based system (highlands)</i>	<i>Mixed farming systems (lowlands)</i>	<i>Mixed farming systems (highlands)</i>
Beef and veal		358	263	398	178
Sheep and goats		42	54	217	106
Pork	35	42	35	249	9
Poultry meat	112	63	59	225	49
Total	147	505	411	1,089	342

Source: Multi-donor livestock/environment study (Sere and Steinfeld, 1996)

Conflicts between Livestock and the Environment

In very general terms, livestock is pulled out of equilibrium with the environment because of market forces and overall economic development. In humid and sub-humid Africa, the human population is growing by 3% per annum, urbanization by 3.5% to 4%, gross agricultural production by 2.5%, and *per capita* income by 1% to 2% (estimates based on FAO information, 1995). Livestock production follows this trend and, because of the high elasticity of demand, often exceeds the growth rates of agriculture and population. In addition, because of its intermediate position, livestock production is complex and policy measures are difficult to target. Thus, conflicts with the environment are apparent in many locations and elicit heavy criticism. Let us now take a closer look at the underlying causes.

Overgrazing and Resulting Degradation

The negative effects of excessive livestock grazing include soil compaction and erosion, decreased soil fertility and water infiltration. Pressure from grazing also eliminates perennial herbaceous plants which are difficult to regenerate. Heavy grazing in open savannas, especially in Central Africa, has led to the disappearance of many palatable species, replaced by herbaceous plants. This leads to encroachment of shrubs and bushes, where bush fires are a common phenomenon. A closed canopy cannot develop and open grassland follows. While the overall biomass production may not decrease, the diversity of plants and animals under such circumstances is much reduced. In this way, livestock grazing, if not properly managed, contributes to degradation.

Compared with semi-arid areas, the threat of long-term degradation in sub-humid and humid areas is not as serious. This is because of historical presence of disease which prevents the introduction of large-scale livestock-only operations. Instead, livestock production follows in the wake of population and cropping pressure on these areas. In such circumstances, overgrazing of sub-humid and humid secondary vegetation is often associated with shortened fallow periods for cropland. At the root of the problem is the issue of unregulated access to grazing land and uncontrolled land use in general.

Deforestation

Unlike the situation in parts of Latin America, it is not livestock production but the growing of crops, especially plantation species such as oil palm and rubber, that has been directly linked to deforestation in sub-Saharan Africa. Very little forest is cleared for the purpose of livestock production *per se* since disease undermines the profitability of such undertakings. Instead, forest is cleared to provide additional land for crops, subsequently opening a window for livestock production to sustain agricultural production in these areas.

Deforestation means a decline of the natural resource base, particularly loss of biodiversity and soil degradation in humid environments. The key factors behind deforestation are land tenure systems and policies that favour the clearing of forests. Livestock do play a role in that they often are a means to establish title to land. Furthermore, livestock are grazed on previously forested land which, after a few years of exploitative cropping, has become less productive.

Of Africa's total forested area of 527.6 million ha, 408.3 million ha, or more than three-quarters, are located in the sub-humid and humid zones (FAO, 1993). The average annual deforestation rate was 0.7% from 1981-90. It has been slightly lower for the tropical rain forest zone (0.5%) and higher for the moist deciduous zones and highland zones (0.9 and 0.8%) (FAO, 1993).

Biodiversity

The control of livestock disease vectors such as ticks and tsetse flies has resulted in the release of large quantities of insecticides and acaricides into the natural environment. Dipping or spraying cattle with organo-chlorines against ticks has been common practice, and used dipping liquid has often been discharged into surface waters, harming the fauna. While it is difficult to quantify these effects, it can be assumed that they are significant at the local level.

Wildlife is threatened by the conversion of forests and other biologically rich areas into grazing land. Tsetse clearing in sub-Saharan Africa potentially falls into this category of environmental problem. But the effects of livestock production on wildlife and biodiversity are perhaps most seriously felt through the use of land for feed production. This entails expansion and intensification of cropped area with commensurate increased use of natural resources and potentially polluting inputs.

Livestock production also results in a loss of domestic animal diversity. In developed countries, the sector is dominated by a small number of breeds. Intense selection and widespread use of artificial insemination narrow the genetic base, particularly in the case of dairy cattle. Many traditional breeds no longer compete effectively in mainstream agriculture. The commercial drive for efficiency and standardization of production environments makes previous breeding criteria such as adaptation to harsh environments or disease resilience less relevant (Cunningham, 1995).

This process is also observed in developing countries, at varying scales and speeds, with the notable exception of remote marginal areas. It is estimated that one-third of the present genetic resource base may become extinct in the coming two or three decades. The indigenous genetic base is being eroded without full knowledge of the potential value of these breeds. This is particularly true in cases where commercialization in mixed farming systems creates pressure to introduce exotic breeds at the expense of traditional

ones. In land-detached systems, production is based on a small number of selected breeds, usually using hybrids from specialized breeding units. In grazing systems, the danger of genetic erosion is more or less insignificant since breeds still need to be adapted to disease and climatic stresses.

Waste

Intensive, mostly land-detached production systems have developed or are quickly developing around urban centres. Their location takes advantage of good infrastructure and markets. Such systems produce food efficiently at low prices and usually at controlled quality. But they also produce massive amounts of animal waste, creating disposal problems that affect water and soil and lead to acidification of the environment. The economies of scale enjoyed by these large livestock production units leave a big enough profit margin to enable producers to cope with the enforcement of regulations.

In addition to the threat from manure, waste from animal processing facilities is another area of concern. In most of sub-humid and humid Africa, poor waste utilization and treatment, especially by slaughter houses, have created environmental problems. (The problem is less serious in the case of tannery and dairy operations.) The main resource polluted is water. Apart from the environmental considerations, such pollution poses a serious public health risk.

Technologies are available to address the waste problem. For manure, the focus is on management and improving feed utilization. For waste from processing, the emphasis is on by-product utilization and waste water treatment.

Feed Concentrate Demand

In the humid and sub-humid zones of sub-Saharan Africa, the demand for feed concentrates is, together with South Asia, the lowest in the world. Only 1%, or 10.5 million tons, of the world's total concentrate use occurs in the area. The demand for concentrates results in expansion and intensification of cropped areas and indirectly has an environmental impact on soil, water and energy use. More than two-thirds of the nutrients are lost in livestock production, with wide variations between ruminants and monogastrics.

Compared with the situation in developed countries, the share of cereals in concentrate feed is still very low. The composition of feed concentrates is about 20% roots and tubers, 15% oilcakes, 45% brans, and 20% cereals. This reflects the food-deficit situation on the African continent, which together with low animal productivity does not allow for the profitable use of cereals in animal nutrition.

In sub-Saharan Africa, land-detached systems account for only 10% of feed concentrate use and such concentrates can be assumed to be their only feed resource. The bulk of the

rest is used in land-based systems, both mixed farming and grassland-based, where feed concentrates balance otherwise deficient diets or compensate for seasonal variations. While the use of concentrates in land-detached systems allows for unparalleled efficiencies in terms of feed conversion, these systems are least efficient in terms of fossil energy conversion. Cheap energy is the main facilitator for the surge of landless systems. However, it remains to be established whether the economic efficiency of these systems could be maintained if all "externalities" — effects on the environment outside the production unit — were appropriately costed.

The main way to limit the negative externalities of feed concentrate use, and of land-detached production in particular, is to improve feed conversion efficiencies through better animal feed, nutrition and health, as well as better animal husbandry in general. It can be assumed that large quantities of feed concentrates would be saved if the productivity gap between sub-Saharan Africa's intensive livestock systems and those of, say, OECD member countries could be closed. Since these systems are fully commercialized and the introduction of technology is not usually constrained by capital availability, this process is already under way in many countries. It is important, however, to underline that policy distortions — such as support to producers through feed concentrate subsidies or support to consumers through livestock product subsidies — undermine productivity advances and have negative environmental effects.

Another approach to limiting externalities is proper targeting of land use and ensuring the use of environmentally friendly cropping techniques. Different crops exert different stresses on the environment and so do different cultivation methods. If pursued through "command and control", this approach is unlikely to succeed in sub-Saharan Africa because of weak institutions. It is more likely that the use of extension and training would have the desired impact.

Methane

In ruminant animals, fermentation in the rumen produces relatively large methane emissions per unit of feed energy consumed. Methane has a high capacity to absorb infrared radiation. Because of this and other chemical and radioactive properties, it is a major contributor to global warming. Its role in the greenhouse effect is believed to be second only to that of carbon dioxide (EPA, 1992).

Low-quality feeds, such as untreated straw and poor rangeland vegetation, have low levels of digestibility and result in high emissions per unit of feed intake. Frequently, around 6% of gross energy is converted to methane in the rumen. Methane emissions are comparatively high when animal productivity is low since a higher share of total feed intake goes for body maintenance.

For the whole of sub-Saharan Africa, methane emission from ruminant enteric fermentation have been estimated by IFC at 7.8 million tons per year which is about 10.8% of total global emissions from that source. Table 2 gives an overview.

Table 2. *Meat production and ruminant methane emissions in sub-Saharan Africa and the world (based on 1991-93 average).*

	<i>Sub-Saharan Africa</i>	<i>World</i>
Meat production (all species)	4.6 million tons	180.1 million tons
Share of total meat production (all species)	2.6%	100%
Methane emissions from ruminants	7.8 million tons	71.9 million tons
Share of total methane emissions from ruminants	10.8%	100.0%

Note: Based on EPA study, 1995.

Because of low-quality feed and low animal productivity, sub-Saharan Africa makes a disproportionately large contribution to methane emissions. As shown in Table 2, its share of world emissions is four times higher than its share of meat production.

All technologies that improve livestock productivity also reduce methane emissions per unit of output (a "win-win" situation). Improvements in animal productivity mean that a greater portion of feed energy is directed towards the production of useful products (milk, meat, draft power, offspring), so that methane emissions per unit of product are reduced. Increases in animal productivity also lead to reductions in the herd size needed to meet a given production target. In humid and sub-humid sub-Saharan Africa, significant productivity increases and subsequent reductions in methane emissions can be obtained through improved basic livestock management.

Methane is also emitted from anaerobic fermentation of animal manure. This kind of manure management is typical of intensive pig and dairy operations. Because of the limited importance of such operations in humid and sub-humid Africa, methane emissions related to such fermentation is of little significance.

Crop/Livestock Interactions

By definition, most of these interactions are found in mixed farming systems. The key environmental features are the recycling of nutrients and organic matter within the production system, the use of animals for traction, and the use of nitrogen-fixing fodder crops. Interactions between crops and livestock also tend to conserve a wide variety of plants and animals. Mixed farming systems can therefore have largely positive effects as they maintain and improve soil structure and fertility, save non-renewable resources such as fossil fuel and fertilizer, and protect agricultural genetic diversity. Where inorganic fertilizer is expensive or difficult to procure, the recycling of nutrients is particularly important. The synergy between inorganic and organic fertilizer enhances overall farm productivity and it can reasonably be argued that intensification of farming systems in most cases requires the presence of livestock. Livestock are not, of course, net producers of nutrients but they do allow for:

- spatial and temporal allocation of nutrients, at given levels of manure supply, from areas of lower returns from cropping to those with higher returns
- acceleration of nutrient turnover in the production cycle
- reduction of nutrient losses within the cycle compared with agricultural production without livestock.

In some parts of humid and sub-humid Africa, livestock also provide power to till the soil. However, the practice has not been widely adopted because of the presence of trypanosomiasis and because bush fallow agriculture, which predominates in this zone, is not well adapted to animal traction. (Johnsson et al., 1994). Where it does exist, animal power raises crop productivity and allows for area expansion, reducing fossil fuel consumption and the use of other natural resources. In other cases, ruminant livestock increase range productivity by stopping weeds and bush from encroaching on pastures. Furthermore, livestock give farmers incentive to cultivate nitrogen-fixing forage crops and to maintain crop rotations that sustain long-term productivity of agricultural land.

In many mixed farming systems, livestock function as a buffer. They balance the demands for labour, food and cash while reducing overall farming risks through diversification and through the capital that they represent. It is possible that environmental damage would be much greater if livestock were absent from these systems.

There are factors, however, that lead to a separation of crops and livestock. First, continuing mechanization with subsidized fuel or machinery puts mixed farming at a disadvantage. Second, price support for fertilizer undermines the profitability of using animal manure.

Policies

Policies to reduce the detrimental effects of livestock on the environment and to enhance their beneficial effects alter existing factor scarcities and induce innovation. For example, taxing feed concentrates may lead to a push for higher rates of feed conversion or to a shift to more land-based production. Policies need to correct market failures, i.e., situations where the perceived value of a natural resource is not reflected in its price, and the costs incurred are not borne by the polluter or the degrader. Policies are directed to internalize these externalities to protect public goods and future generations.

Implicit valuations of environmental impacts reflect social valuations which, in turn, depend on income levels and willingness to pay for environmental benefits. To put it more strongly: it is the willingness to pay that turns the environment into a "good" and physical interactions into either "costs" or "benefits". This willingness depends to a large extent on available income but also on information and public awareness.

Not all interactions between livestock and the environment are externalities. Externalities occur outside production system boundaries and point to market failures, i.e., the inability to reflect these effects in commodity prices.

Externalities may be negative (a damage or cost to society) or positive (a benefit). Three types can be distinguished (compare Proops et al., 1994):

- Public good externalities, such as methane causing global warming. These are extremely difficult to internalize especially when they are global in nature.
- Open access externalities, such as the degradation of land due to overgrazing in the absence of regulations. These are easier to internalize, for example, through the assignment of property rights.
- Inter-temporal externalities, where costs and benefits, such as animal genetic or wildlife resources, accrue to future generations. Lowering the discount rate or taxing the use of a resource (such as fossil energy) are ways to internalize environmental costs.

These types of externalities may have local, national or international dimensions. The challenge is to devise instruments to internalize these externalities, i.e. to apply the "polluter pays" principle.

None of the described production systems is environmentally unfriendly *per se*. They vary, however, in their capacity to absorb changing challenges through changes in production intensity. It can be concluded that production systems vary considerably in their impact on the environment. Most beneficial effects are in mixed farming systems, whereas land-detached systems face a range of environmental problems, mostly related to waste and resource use. Pastoral systems are mostly environmentally balanced, but this equilibrium is endangered by persistent demographic pressure. Within production systems, intensity of production is a major factor determining the nature of livestock/environment interactions.

Internalizing the environmental costs and benefits of livestock production as a means of encouraging efficient and sustainable use of natural resources remains a widely accepted principle. Policy instruments to internalize environmental effects fall into four broad categories:

- basic institutional reform, such as changing property rights
- regulatory action (the "stick", or "command and control" approaches)

- incentives (the “carrot”, or reliance on market forces)
- information, including training and extension.

In addition, infrastructure is another policy instrument (although often not regarded as such) for influencing environmental effects. Market development helps drain off slaughter stock from overgrazed areas, for example, and road development in tropical rain forest zones induces farming and subsequent livestock encroachment. The following matrix attempts to summarize policy options addressing major conflicts between livestock production and the environment.

Conclusion

An overview of the interactions between livestock production systems and major areas of environmental concern is given in Table 4. It shows the strength of the interaction and may indicate areas for correcting market failures through policies.

Table 3. Applicability of policy instruments by environmental concern.

<i>Area of environmental-concern</i>	<i>Policy Instrument</i>				
	<i>Institutional reform</i>	<i>Infrastructure development</i>	<i>Markets and pricing</i>	<i>Command/control (regulations)</i>	<i>Information, extension</i>
Overgrazing	•••	••	••	•	•
Deforestation	•••	•••	•	••	•
Wildlife	•••	•••		••	
Waste (manure and processing)	•	•	••	•••	••
Methane			•	•	•••
Feed concentrate demand			•••	•	•••
Crop/livestock interactions	•	•	•••		••

Note: Number of bullets suggests relative potential of policy instruments for addressing environmental concerns.

Livestock/environment interactions can be beneficial as in most mixed farming systems. Or they can be damaging as is frequently the case in grazing systems and even more so in land-detached systems. All these systems have resource requirements the price of which is often degradation. The challenge is to design policies that create a framework conducive to more environmentally friendly production techniques. The major obstacle for doing so is valuation of the environment.

At low levels of income, the environment as an amenity or as a future resource base is valued differently than at high levels of income. At low levels, priorities are clearly set for food, education and basic material welfare. Only when these basic needs are met do individuals and societies value environmental goods more highly. Europe, for example, has lost much forest land and wildlife in the course of development. This is not to say that sub-humid and humid Africa will follow such a route. It is clear that environmental concern and valuation are a function of income. Financial transfers will be needed to support the design of schemes to protect biodiversity, be it wildlife or domestic animals.

Table 4. Summary of interactions between livestock production systems and areas of concern in humid and sub-humid Africa.

<i>Area of environment-al concern</i>	<i>Land-detached system</i>	<i>Grassland-based system (lowlands)</i>	<i>Grassland-based system (highlands)</i>	<i>Mixed farming systems (lowlands)</i>	<i>Mixed farming systems (highlands)</i>
Range utilization	-	•	••	•	••
Forest utilization	•• ¹	•••	•	••	•
Waste manure	•••	⊕	⊕⊕	⊕⊕⊕	⊕⊕⊕
Waste from processing	•••	•	•	••	••
Methane	•	•••	••	•••	••
Livestock genetics	•••	⊕⊕	•⊕	⊕⊕	•⊕⊕
Wildlife biodiversity	•• ¹	•	••	••	•
Feed concentrate demand	•••	•	•	•	••
Inputs to cropping	••⊕	⊕	⊕	⊕⊕	⊕⊕⊕

Note: Number of symbols indicates strength of interaction

• = Negative interaction; ⊕ = Positive interaction; ¹ Indirect effect

Internalizing environmental externalities changes the relative abundance of production factors and therefore their prices. This in turn affects technology use and development. Policies, then, can steer technological change in a direction that lessens environmental damage caused by livestock production. However, unilateral implementation of such policies in one country may put national producers at a disadvantage vis-à-vis foreign competitors. Another problem is that the economic valuation of environmental externalities is still in its infancy (for a review see Munasinghe, 1993). (The same applies to the formulation of policies that try to direct technological change towards less damaging modes of production.) The valuation problem relates to the uncertainty associated with costing some of the most important environmental resources such as biodiversity and, hence, the impossibility of internalizing these costs in market prices.

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The Organization of Livestock Support Services

***Aphonse Kota-Guinza, Director of the Fonds Interprofessionnel de Développement de
l'Elevage, Central African Republic***

Abstract In many African countries it is not feasible for governments to provide a full range of services to the entire livestock sector. Over the medium term, the only feasible solution seems to be to transfer certain responsibilities to professional associations and private service providers. This can free up State agencies to concentrate on policy and other cross-sector issues such as public health and training.

The paper briefly discusses the roles of the four main types of actors in the livestock sector: the State, producers, service providers and outside donors. In moving to a new set of dynamics among these interdependent groups (one in which public agencies are relieved of many operational functions), the greatest difficulty lies in managing what will be a long and difficult transition period. The new arrangements will place greater responsibility on livestock producers themselves for developing and financing their activities. They will also require the development of novel professional structures that ensure good service to rural communities while allowing professionals such as veterinarians to make a decent living. In the area of financing, better collaboration among donors and participation in sectoral planning would improve the effectiveness of outside assistance. The paper ends with a brief examination of the organization of livestock services in the Central African Republic, particularly an innovative national mechanism for co-ordinating technical and financial assistance to the sector.

Introduction

For several decades it has been clear that, without outside aid, many national governments are not in a position to ensure the development of the livestock sector or even to guarantee minimum standards of public veterinary health and food hygiene.

In these circumstances, it is no longer feasible for public agencies to introduce, at the request of farmers, support measures aimed at promoting productivity gains for certain species or activities. In the case of small ruminants, pigs, poultry and rabbits, for example, government officers often have little expertise. Similarly, some types of enterprises at varying levels of intensiveness, such as milk production, may be new to government personnel.

In any case, the majority of such support measures have to date been implemented not by State agencies but, of necessity, through other mechanisms, chiefly "projects" whose continuity is rarely guaranteed. The only viable medium-term solution seems to be to transfer activities of this kind to professional bodies (livestock producers' organizations) and their agents (salaried or free-lance service providers). The result is a twin-track system whereby the State takes responsibility for general-interest and public health measures and leaves all other activities to livestock farmers and their agents.

The success of privatization of veterinary services depends on whether private-sector veterinarians can make a decent living. The feasibility of developing a rural market for veterinary assistance remains uncertain, even in areas covered by development projects. A full range of service opportunities will undoubtedly need to be exploited: veterinary medicine and surgery, health certifications, food hygiene inspections, veterinary pharmacies and so on.

The term "privatization" should not evoke the specter of mass layoffs and the marginalization of veterinary services. Instead it should be seen in terms of the development of a legislative and functional framework for the liberalization of professional activities and the protection of those joining the profession.

Outside Assistance

Outside assistance to the livestock sector is often disorganized and lacks coherence. It could be used more effectively by increasing the co-ordination capacity of livestock services. The involvement of donors and synergy of their efforts would be greatly enhanced if these organizations participated in planning through closer dialogue and integrated their support efforts within the resulting framework.

Financial Mechanisms

In the current macroeconomic climate it would be unrealistic to expect a steady flow of government funds to support the livestock sector and its new orientation. Basic changes in the sector, such as privatization, can be financed only by the establishment of "livestock development funds", paid for by reallocating revenue from various charges levied throughout the sector:

- various inspection charges
- taxes on imports of animal products, as part of moderate protection measures
- counterpart funds from the sale of animal product-based food aid (milk powder).

The Case of the Central African Republic

We now briefly examine the case of the Central African Republic as an illustration of certain practical issues, in particular the problems involved in establishing professional structures.

Over the past 23 years, the country has developed its own specific approach and unique expertise in this field. Its method of organizing livestock farmers via the distribution of veterinary inputs — from the basic community level (GIP) to local associations (FELGIP)

and national structures (formerly ANEC, now the FNEC) — has found its way into numerous development policies and has been put into practice in other African countries after being suitably adapted, of course, to local conditions and constraints. Other professional organizations have also been set up, including the national association of Central African butchers (ANBC) and the Central African association of cattle traders (ACCB). Although they have not yet reached the same level of maturity as the FNEC, in the medium term these associations will doubtless make a vital contribution to the development of the sector.

During the current phase of the country's livestock production and range management development project (PDEGP), thinking and action on the issue of institutional organization has advanced and deepened. In particular, a genuinely novel structure, FIDE, has been created. FIDE is the interprofessional fund for the development of livestock farming. Administered by an interprofessional co-ordination committee (CIC), FIDE is responsible for the technical and financial co-ordination of all external aid initiatives in the livestock sector. It also manages the State's contribution, which is financed from tax revenue (health visit charges, market levies, etc.) on certain sub-sectors.

The privatization of veterinary services in the Central African Republic is still in its infancy. While in the cities the provision of health care for pets such as cats, dogs and parrots is sufficiently profitable, in livestock farming areas it remains, as in many countries, very difficult for a private veterinarian to make a decent living.

Processing and Preserving Animal Products

J. Henriksen, J.C. Lambert and G. Heinz, Meat and Dairy Service, Animal Production and Health Division, United Nations Food and Agriculture Organization (FAO), Rome, Italy

Abstract The contribution of livestock production to food output in developing countries is growing faster than that of cereals. Developing countries now produce almost half the world's meat supply. The rise in output has been less dramatic for milk, which accounted for 33% of world supply in 1994.

While the consumption of livestock products is declining in the developed world, demand looks set to rise steadily in the developing nations, owing to rapid population growth and income improvements in many countries. Yet, despite the general increase in production in most developing countries, the diet of the average consumer still contains only a low proportion of animal products.

Within traditional marketing systems in developing countries, meat and milk are typically sold direct in their raw, fresh, unprocessed state. The absence of a cold chain is detrimental to the preservation of these highly perishable products. Milk is often hard to find in urban areas, owing to transport difficulties, and meat is frequently unavailable in rural areas as slaughter takes place in the towns.

Processing prior to marketing generates value added which can more than double the worth of the primary product. Collective action enables producers to take full advantage of opportunities for economic growth as well as personal and social development.

Introduction

The contribution of livestock production to overall food output in developing countries is increasing more quickly than that of cereals. Meat production rose from 30 million tonnes in 1970 to 69 million tonnes in 1990, and is expected to reach 105 million tonnes by the year 2000. Developing countries now account for half the world's meat production. Milk production has increased less dramatically, but has nonetheless risen by 40% over the last 15 years and now accounts for 33% of world output.

Whereas the consumption of livestock products in the developed world has reached saturation point, demand in developing countries is growing steadily. This is mainly the result of rapid population growth, particularly in urban areas where incomes are also rising. In contrast to the situation in the developed countries, where livestock products are currently seen as a source of health problems, increased consumption in the developing nations is expected to bring about marked improvements in health. Milk, meat and fish provide essential amino acids, minerals, vitamins and calories in concentrated form. Animal products are particularly important for young children, pregnant women, and mothers during breast-feeding. But per capita consumption of meat and milk remains very

low in developing countries, again as a result of population growth and also because prices in many countries are high.

The traditional market practice is to sell meat and milk unprocessed a few hours after slaughter or production. This system is common where there is no cold chain to preserve such highly perishable products. Meat is frequently unavailable in rural areas as the abattoirs are in the towns, and fresh milk often cannot be found in urban areas because of the problems involved in transporting it over long distances from production areas.

The preservation of animal products is becoming increasingly important. Meat and milk must be seen as raw materials and given appropriate treatment to extend their shelf life. We will discuss the two products separately, since, although the principles of preservation are identical, the techniques used differ.

Meat Processing

Traditional Methods

Drying, with or without salting, is a traditional method used throughout Africa to lower the water content of meat. The technique has been known for centuries and is believed to be the oldest method of preservation. It is relatively straightforward: the meat is sliced into thin strips and dried outside in the sun. The water content decreases quickly enough to check bacterial contamination. With certain improvements, this traditional method can generate considerable gains in value added, while the product remains affordable for a large section of the population. Part of an FAO project in Chad is focused on improving traditional meat-drying techniques.

Another traditional aspect of the processing of slaughter animals is the method of butchering used. After slaughter and the removal of the gut, the animals are quartered and transported together with the offal to the point of sale, with no hygiene precautions. In this system, the sale is almost entirely in favour of the buyer, as the seller has no means of assessing the weight and quality of his goods. The meat is then processed under deplorable conditions of hygiene, the result being that many parts of the carcass are lost or undervalued.

Advantages of Food Technology

Processing allows meat to be sorted into prime cuts and by-products. Food technology makes it possible to find market outlets for meat by-products, which are classified as such on the basis of taste, smell or texture but in fact have nutritional value. The cost price of some meats can be reduced by the use of extenders, without detriment to the nutritional value of the product. This practice also has the advantage of lowering the biological activity due to water content, thereby prolonging shelf life.

Future Prospects

The UN Food and Agriculture Organization is currently making efforts in this area, demonstrating that rural communities can in fact build hygienic, efficient abattoirs geared to their needs and resources. FAO has perfected a small-scale abattoir, composed of various optional modules, to meet the specific requirements of individual communities. Modular abattoirs have already been installed in about 10 countries. They allow for substantial increases in the income of small producers, improve the quality of their goods and integrate all aspects of production and distribution.

Milk Processing

Variety of Practices

Water is the main constituent of milk. Its activity within the milk is therefore important and rapid processing is required to prevent bacterial growth. The main problems here are the quality of the milk produced on the farm, its immediate preservation using appropriate methods, collection, processing into various dairy products and distribution to consumers.

Processing technology makes it possible to improve the quality and shelf life of milk thereby increasing food safety. Practices vary according to production system and geography, but may be summarized as follows:

- direct sale from the farm
- on-farm processing to extend shelf life
- transportation to a collection point
- collection direct from the farm
- pooling of milk by village co-operatives
- village processing and marketing units
- dairies located close to urban centres.

The level of technological sophistication depends largely on local conditions. Although many technologies and systems exist, a significant proportion of the milk produced in the humid and sub-humid regions of sub-Saharan Africa is lost or not turned to profit. This is due to a lack of know-how and appropriate means of preserving the milk properly and finding profitable outlets.

There are many ways to process milk that is surplus to family requirements. As circumstances vary greatly from one country, region and sector to another, there can be no stock solution. For every region in which milk production requires a profitable outlet, a model must be found to enable families, livestock producers' groups, associations and

co-operatives to obtain a fair return from their labours. We therefore propose to illustrate a variety of methods for making milk production more profitable, using specific examples for each of the production systems in a given socio-economic sector.

On-Farm Processing

The example is that of a project for improving *tchoukou* cheese in Niger. This is a traditional cheese made by women and sold in villages in the area. First a study of the technical manufacturing parameters for year-round milk supplies was carried out in a livestock production centre in the region. The second step was to test the proposed improvements among the cheese makers and supply adapted equipment to improve the hygienic quality of the cheese as well as its presentation and preservation. The establishment of an association proved a key factor in building up sales, by ensuring a regular and highly profitable outlet for the cheese. It did not take long for the *tchoukou* makers to recognize the economic benefits of the new system: rather than offering cheeses at the roadside (with no guaranteed sales volume) for 100 CFA francs a piece, each made with 1.5 litres of milk, they now earn (without having to go anywhere) 125 CFA francs per cheese, each made with one litre of milk. In other words, their selling price for milk has risen from under 70 CFA francs to 125 CFA francs.

Transportation to a Collection Point

In developed countries, refrigeration is common practice, stopping milk from rapidly going sour because of microbial and enzymatic activity. However, in many regions of the developing world, collecting milk, transporting it (with journey times of no more than three hours) and refrigerating it to 4 degrees C are considered complicated and costly operations. The wide geographic dispersion of farmers producing small quantities of milk, poor road networks and fuel shortages continue to make milk collection the weakest link in the chain from producer to consumer.

For this reason, the work programme of FAO's dairy development group has focused on two areas: research into means of slowing down the fermentation of milk during transport prior to refrigeration; and the implementation of milk collection systems to suit conditions in given production regions.

Immediate refrigeration of milk is often impracticable. However, an alternative method developed by the FAO is available to reduce the multiplication of bacteria in milk. By activating the enzyme lactoperoxidase, which is naturally present in milk, the duration of safe transportation without refrigeration can be extended by two to three hours. This new method is a significant asset, as many producers can now send their milk to a collection point where the peroxidase is activated; the milk is then transported to a refrigeration centre. A number of trials are under way.

Milk Collection Centres

Managing a collection centre requires a degree of competence. The centre is where milk is refrigerated, but more importantly it is the point at which absolute trust between the

milk producer and the organization (association, grouping, co-operative or private company) buying the milk must be established. Milk is paid for by volume (a lactometer can detect whether the milk has been watered down) and quality (an acidimeter detects excessive acidity); as a result, transactions are often not understood by the producer.

The following principles have emerged from the FAO's milk collection aid projects:

- Milk must be paid for regularly, on a set date.
- The basic price of milk should not be subject to seasonal variations.
- The centre must be managed collectively.

In Africa, where population density is not as high as in Asia and the difference between peak and low production is less, collection centres must be highly flexible. This may mean, for example, using a large number of small milk refrigeration tanks rather than one large tank, despite the economic advantages of the latter option, and diversifying product range. A fairly simple manual device beside the milk refrigeration tank enabling fresh milk to be sold packaged in plastic bags represents a profitable outlet and substantial value added. An example of this system, in Uganda, revealed a market among urban consumers in the capital, Kampala, for cold, fresh milk, not pasteurized but packaged and thus protected from adulteration with polluted water.

Milk Processing at the Village Level

The second weak link in the chain between milk producer and consumer is pasteurization, which extends shelf life and ensures a safe finished product. Numerous projects setting up milk processing units at the village level have demonstrated that it is economically possible to pasteurize and process milk into safe and nutritious dairy products for the city market.

When milk production is too distant from the market for daily milk supplies to be possible, small rural cheese production centres should be set up. Model units have been established in Cameroon, Mauritania, Morocco and Peru. In Morocco and Peru, goat's milk is made into cheese; in Mauritania, camel's milk has been used for the first time to make a fresh cheese that will keep; and in Cameroon, a pressed cheese made with cow's milk has found an outlet in the capital, one day's journey away.

The manufacture of mozzarella-type cheeses requires the least investment in equipment, as no pasteurization is involved; after acidification, the cheese undergoes heat treatment by immersion in hot water, which gives it a fairly long shelf life. This process was developed for a women's co-operative in northern Tanzania.

Small Peri-Urban Dairies

Small dairies manufacturing fresh products should be located not too far from large

towns. The experience acquired by FAO's milk development group in setting up numerous small dairies has established the following principles:

- A mini-dairy, like a cheese-making unit, requires simple, flexible, low-capacity equipment.
- The choice of fuel for heating and cooling should take account of environmental constraints.
- The product range must be sufficiently broad to respond to market changes.

Bobo-Dioulasso dairy in Burkina Faso is a prime example of a small dairy located close to a consumer centre. It receives 1,000 litres of milk a day and is profitable because it sells products with large profit margins, such as yoghurt and butter.

Industrial dairies on the outskirts of towns are the ultimate in technological complexity for the supply of milk to the city. For many years, large-scale industrial activity using state-of-the-art technology was the rule in developing countries. However, in view of the vast costs involved and State withdrawal from production activities, these large dairies are now gradually being replaced by smaller plants, using equipment more economically geared to the average-consumer market of large towns. The most economical peri-urban dairies are those with a capacity of 10,000 to 30,000 litres of milk a day which can be operated by two teams. The main concern of such dairies is to reduce the industrial element as much as possible by using low-cost packaging and developing a network of depots in the capital to reduce distribution costs and retail mark-ups.

Conclusion

Imports from industrialized countries are widely used to offset shortages of locally produced milk in large urban centres. Until now, conditions on the world milk and dairy product market have favoured trade of this kind. First, the industrialized countries need outlets for the structural surpluses congesting their own markets. Export subsidies have facilitated access to markets where milk and dairy products are in short supply. (It is worth noting that New Zealand has strengthened its position on the world market for milk and dairy products apparently without resorting to the perverse mechanism of subsidies.) Second, many countries welcome these products — especially milk powder — as they go some way to solving the chronic food and nutritional problems that are all too common in the developing world. Furthermore, these highly subsidized products are marketed at moderate prices compatible with low local incomes.

But this process would seem to be reaching its limit. The industrialized countries as a whole are bringing their milk production and costly surpluses under control. As for the

developing countries, rising imports of milk and dairy products remain too much of a drain on their balance of trade already weakened by a decline in export revenue. Logically, the world market for milk and dairy products must shrink, and the consequence will be higher prices as supply from industrialized countries decreases.

The only possible reaction to this new situation is to encourage dairy and meat production based on existing herds of cattle, sheep, goats and even camels, to replace imports with local products wherever profitable production is possible.

The cost of milk production in a number of developing countries is already quite close to that of the developed countries. The difference lies in collection, processing and distribution costs. Following the model of the dairy sector in the developed countries has been the downfall of many a dairy development project in the developing world. The high cost of modern milk collection methods, the excessive size of large dairy product plants on the outskirts of capital cities and the use of expensive packaging make dairy products inaccessible to all but a very small section of the population.

Reducing international aid in the form of milk powder and loans to semi-public dairy plants is working in favour of the emergence of a small, private dairy industry. This must be protected from imports of subsidized dairy products and supported by credits and training in management and dairy technology. By conducting studies and setting up small dairy units, FAO supports developing countries in fostering a dynamic and profitable dairy sector that can link milk-producing areas with large urban centres.

Institutional Environment

A Strategic View of Public and Private Initiatives in Livestock Development

Pierre Ackah Angniman, Direction de l'Appui aux Organisations professionnelles agricoles, Agence nationale de l'Appui au Développement rural, Côte d'Ivoire.

Abstract The difficult economic situation facing the countries of Africa's humid and sub-humid tropics demands a new vision and strategy for the livestock sub-sector's long-term development. This should accommodate a more practical division of responsibilities among participating groups, in both the public and private sectors. This is already happening as many governments progressively disengage from some traditional roles, especially production.

Future development of the sub-sector depends on several factors: land management approaches that reconcile the needs of livestock producers with those of farmers; wide availability of animal health services; an improved production environment, especially through technical knowledge; more effective extension; better marketing and processing; and adequate financing. In looking at possible ways to share tasks among the State, its parastatal organizations and agencies, private companies, and individual producers, it is useful to recognize three types of essential functions: those arising from state jurisdiction and competence; operational functions; and production. State disengagement from certain operational and production functions in favour of greater private involvement does not mean governments are abandoning the livestock sub-sector. Indeed, governments will likely continue to play a key role, especially in policy incentives and programming. They will also need to lead the way in introducing new services or operations which could eventually be taken over by the private sector but for which no models currently exist. The challenge for public policy is to promote a smooth and gentle transition to the new structure.

Foreword

In the summary of a study titled "Preparing for the Future in West Africa: Looking towards 2020", the authors describe the changes expected over the next 30 years, namely:

- rapid demographic growth and integration with the harsh reality of international markets
- economies in which meeting basic needs is still a major concern
- adaptation of economies to cope with urban growth
- gradual integration of agriculture into the market system
- reinforcement of the complementary roles of the urban and rural environments.

All humid and sub-humid African countries are likely to experience a similar pattern of long-term change.

This paper presents a strategic view of public and private initiatives in livestock development and attempts to answer three questions:

- What should the role of the State be in promoting livestock production in the sub-region?
- What roles can the various stakeholders (private sector, farmers' organizations, NGOs, etc.) play?
- What policy measures should be taken to enable all involved to make an optimum contribution to livestock development?

Introduction

The importance of livestock production in the national economies of the sub-region varies from one country to another. However, the sector is potentially important in all the countries inasmuch as the agricultural sector as a whole is the main source of employment and still accounts for a dominant share of GDP.

Livestock production in the area has political, strategic, economic and environmental importance. Further development of livestock production in the sub-region would help to increase national income, improve the balance of payments, provide a more balanced diet for the population, and diversify and increase producers' income.

The situation varies from country to country depending on the economic and technical environment: type of livestock, production levels, production systems, inputs, marketing and processing of products.

Since independence, policies adopted by countries in the region to promote livestock production have usually been based on a voluntarist strategy with a tendency toward top-down administration. The sector has developed in close association with traditional government services (ministries of livestock production, livestock production departments, veterinary services departments, etc.), development agencies (support, marketing, etc.) and projects funded partly by external donors.

Thanks to foreign aid, which was abundant for about two decades, it has been possible to pursue a livestock development policy based on State subsidies. But now, against a background of acute economic and financial crisis in the countries of the sub-region, a new strategic vision and a new division of responsibility between the various stakeholders in livestock development are essential. Without them, countries will be unable to grasp

all the opportunities that monetary adjustment and renewed competitiveness of certain types of production can offer.

The Livestock Sector

Production Systems

Cattle production systems in the sub-region are both sedentary and transhumant, and generally extensive in nature. Dairy production is mostly traditional. New production systems, particularly in the dairy sector, are being set up around major cities such as Bamako and Dakar. Ranches and livestock stations also exist in various countries. Integrated crop and livestock systems involve mainly combinations of draught oxen with cotton growing; this practice is expanding markedly in some areas on the fringes of the Sahel, helping to extend the cultivated area.

A variety of sheep and goat production systems also exist. There are both traditional and improved systems of sheep-rearing, whereas goats are reared only in the traditional manner.

As for pigs, production systems are both traditional and modern.

Not much is known about traditional poultry production systems, although there is lively regional trade. Modern poultry-farming methods are gaining ground in some countries, concentrated around large towns.

New forms of production (bee-keeping and sericulture) are springing up in the modern sector.

In some countries, wild animals are being raised in extensive production systems. This is a way of exploiting natural resources in areas of the sub-region which do not lend themselves to traditional livestock production or crops, while helping to protect the environment.

Production Conditions

Problems in animal health and disease control have not yet been fully overcome.

With regard to land-use management, development of crop-livestock systems (the co-existence of agricultural and animal production concerns on the same piece of land) carries risks owing to the absence in most countries of secure land tenure for livestock producers.

Feeding for large and small ruminants is centred on natural pasture and fallow land. The use of artificial grazing remains marginal, while agricultural by-products are used mainly in modern poultry and pig-rearing systems.

Cattle, sheep, goat, pig and poultry genetic resources are local, except in the case of some modern production systems (dairy production, pig and sheep production), which rely on imported resources.

Producer groups are well developed in some Sahelian regions, but remain marginal in many countries. Marketing is conducted through the traditional channels, with only poultry and pig production relying on modern systems.

Institutional Framework

The institutional framework is of the traditional type with a ministerial department and various agencies responsible for extension, production and marketing.

Research in the sector has remained rudimentary, and its structures and programmes have not always met the needs of beneficiaries and users. Applying research findings to development activities has not always been a major political concern.

Training is provided by a number of institutions of higher education, secondary schools and training centres. People are trained mainly for employment within the public sector, which is currently unable to take them on. Vocational training for livestock producers does exist, but there are not enough centres. In many countries, there are serious shortcomings in the training of extension staff.

Although credit is an important element in livestock development for setting up new farms, it is generally still a luxury for producers in many countries. A cursory glance at the position of livestock production in the sub-region reveals the following essential conditions for its development:

- managing land use and the conflicts between crop and livestock farmers, as well as the institutional environment (land tenure regulations, pastoral codes) and traditional environment (traditional chiefs)
- establishing, sustaining and optimizing animal health services
- improving production conditions, especially by promoting knowledge of production systems and how to apply them on the farm, the effect of production factors (feed, inputs) and the role of producer organizations
- ensuring appropriate agricultural extension based on generating innovations and removing constraints (R&D), and a system of disseminating technical advances
- marketing and processing animal products through national and sub-regional networks, imports, competition, infrastructure and equipment
- funding programmes through subsidies, credit, projects and external donors.

Livestock Development Prospects and New Strategic Approaches

The combined effects of economic crisis and the drying up of external resources have led governments to formulate new livestock development strategies based on a policy of disengaging from all production, supply and distribution functions. This new strategic approach aims to increase national production with a view to meeting national needs more effectively and stepping up animal product exports. Only by taking the following factors into account at various levels can this aim be achieved:

- making animal products affordable to consumers
- increasing and diversifying producer income
- developing regional environmental potential
- reducing operational costs at the State level.

Essential Functions

The new strategies adopted by various countries have led to institutional restructuring and a new division of responsibilities between the State, its operational units, the private sector and operators in the livestock sector. At this level, three types of functions must be distinguished:

- the role of the State
- operational functions
- production.

The Role of the State

Functions linked to the State's sphere of competence and its executive role include policy definition, legislative and administrative regulation, disease control (public disease-prevention programmes and veterinary health) and training.

The State must apply itself to drawing up rational, coherent policies for developing the livestock sector, especially in the following fields:

- *Animal health.* This includes contagious disease control, health monitoring, cost recovery, and the involvement of private service providers (veterinary surgeons, technicians and livestock workers) in public disease-prevention programmes.

- *Agricultural and agro-industrial by-products.* Use of these is vital at certain times of the year (dry season) and essential to more intensive livestock production and to improving modern poultry and pig-rearing.
- *Land-use management.* Policies in this area are needed to secure the position of livestock production in the rural environment and to ensure better co-existence of crop and livestock production (transhumant system) or mixed farming systems. There are many stakeholders here, including local government departments and authorities and producer groups.
- *Credit.* This is needed for agriculture in general and the livestock sector in particular.
- *Business development.* Young modern farmers need help in setting up businesses. This means tackling land tenure, credit and technical issues.
- *Genetic improvement.* This needs to be based on local genetic resources and should keep sight of field and research needs.

Regulation in various fields — particularly the control of officially recognized contagious diseases, veterinary medicine, food hygiene and land-use management — must always leave room for the controlled transfer of State functions to the private sector (e.g., health visits) and for initiatives taken by livestock producer groups.

Operational Functions

Operational functions fall within the jurisdiction of regional State services (ministries), State agencies or parastatals, professional producer groups and NGOs. These functions are connected with land-use management and planning, extension and dissemination of technical advances and the structuring of professional groups. It should be pointed out that in the long term, even at this level, priority should be given to encouraging beneficiaries to seek independent funding or contribute to programme funding.

In this respect, attention must be given to two essential concepts:

- Until now, the State has not merely been regulating but also intervening directly. This means that gentle ways must be found to help government agents understand and accept their new role which is to “have things done” rather than “do” them.
- The State must formulate a coherent policy governing the intervention of the various operators. This policy must aim to minimize the perverse effects of choosing operators on the basis of funding available to projects supported by foreign aid.

Production

Production functions, sale of inputs (drugs, production equipment, feed, etc.) and marketing of animal produce must be left to the private sector and livestock producer groups. There is always a strong temptation for government agents to reproduce their own models in order to ensure their survival. While bearing in mind that production, input supply and marketing functions should be left to private enterprise, the necessary steps must be taken to avoid chaos and prepare professional organizations to take over. By way of illustration, it could be mentioned that:

- It took 10 years to phase out subsidies for veterinary drugs in Côte d'Ivoire.
- The idea of setting up private veterinary surgeons in rural practice has been spreading since 1985.
- Cost recovery in vaccination programmes and the involvement of private agents in public disease-prevention programmes no longer shock anyone.

Disengagement of the State does not mean abandonment by the State. By altering the way it operates, the State can leave more initiative to producers and their professional organizations, to regional government and local groups, and to companies and agencies set up to implement State-designed programmes with participation from professionals in the sector. Meanwhile, the State retains its role in providing incentives and financial resources to support policies and programmes. It still has a predominant role in initiating, implementing and promoting certain operations for which no other models yet exist but which could be taken over in future by the private sector if profitability is guaranteed.

Conclusion

To be better prepared for the challenges of the next 30 years, any strategic view of livestock development must be based on a policy of gradual State disengagement from the functions of production, supply and distribution and a gradual transfer of them to the private sector, producers and their professional organizations. This transfer of powers must be accompanied by institutional restructuring of the agricultural sector and division of responsibility between the State and other stakeholders along three main lines:

- the State's executive functions
- operational functions
- functions to be left to private initiative.

Given that governments have often been involved at the operational level, it would seem useful to effect a smooth transition so as to ensure the success of new livestock development policies.

Training Needs for Improved Livestock Production in Africa: The Role of Universities

A.A. Ilemobade, Federal University of Technology, Akure, Nigeria

Abstract The need for improved training in livestock production and health to meet the challenge of growing human population, disease constraints and the lowered productivity of indigenous livestock was well emphasized at an FAO expert consultation held in Copenhagen in 1974. The panel concluded that lack of experienced senior research staff was a major limitation on the development of training programmes in the livestock sub-sector. Despite the recommendations made to improve the situation, little has changed in the past two decades. The reasons are many: economic recession, devaluation of national currencies, poor implementation of otherwise good policies, rapid increase in human population and social and political instability. How, then, can training needs be met at minimal cost to ensure improved livestock production and productivity?

The paper examines the types of training available in higher institutions in the humid and sub-humid zones of sub-Saharan Africa, as well as the relevance of such training for implementing programmes in livestock production. The paper also identifies future training components required for a holistic approach to livestock production at the undergraduate and post-graduate levels. These would include training in the following areas: data collection, storage and retrieval; extension services that are farmer-driven rather than government-driven; post-harvest technology, food processing and storage; equipment standardization and maintenance; and entrepreneurship.

While suggestions have been made to improve and expand training in livestock production, improvements can only occur and be sustained in a stable socio-political environment where policy-makers are willing to deal with the population issue.

Introduction

The UN Food and Agriculture Organization, at a 1974 conference in Copenhagen, concluded that the major limitations on the development of livestock research training programmes in the developing countries were "the lack of experienced senior research staff, equipment and facilities for large-scale livestock experimentation; a poorly developed private sector that is unable to offer opportunities for practical experimentation and data collection; and inadequate liaison between university institutions and Ministries of Agriculture which often have better facilities for livestock production." Among the recommendations to improve the situation were the provision of facilities for training research workers "in their own environment" and the strengthening of existing national and regional research institutions by the FAO and bilateral organizations.

In response to these suggestions some significant steps were taken, leading to what has been described appropriately as "growth without development." The booming livestock industry of the late 1970s and early 1980s declined because of the economic recession and social and political instability. These factors, in turn, led to the formation of the World Bank's "panacea", the Structural Adjustment Programme (SAP). SAP is apparently being abandoned because of the problems of implementing it in Africa.

Since 1974, many senior research staff have been trained. However, because of an inadequate reward system and salary structure, many have left or are leaving to seek greener pastures in Europe and North America and many of those remaining have pursued new interests. Equipment and facilities built in the early 1980s have broken down for lack of maintenance and spare parts. The eldorado promised by large-scale investment in livestock farming by the private sector has all but evaporated.

Because of high population growth — running between 2.5 and 3% per year — coupled with growing economic difficulties, the situation is probably worse now than in 1974. What, then, is needed in the way of training to increase livestock production? Before responding, it is necessary to identify the types of training available in this area and the types of institutions that offer it.

Types of Training

Four types of training can be identified:

- diploma training at the sub-professional level
- degree training at the professional level
- post-graduate degree and diploma training
- specialized and short-term training.

Training at the Sub-Professional Level

In Nigeria, for instance, and probably in most anglophone and francophone sub-Saharan Africa, there are two types of sub-professional training. One leads to an Ordinary National Diploma (OND) or Animal Technician Certificate, the other to a Higher National Diploma (HND) Certificate.

In the first category, candidates must have completed secondary school and satisfied certain course requirements, including English language, chemistry and biology via the Senior School Certificate Examination, to be admitted into the programme. The instruction lasts two years and successful candidates are required to spend at least one year in the field before being accepted into the two-year Higher National Diploma programme. The effectiveness of the training in both cases depends on the availability of

appropriately trained personnel, well-equipped classrooms and laboratories, and opportunities on government and private farms for practical experimentation. Courses offered include basic anatomy, physiology and biochemistry of domestic animals, statistics, animal reproduction and genetics, principles of animal nutrition, pasture agronomy and disease control.

Some candidates who successfully complete the OND and HND programmes are admitted to universities, based on their performance, to study for a professional degree in veterinary medicine.

Training at the Professional Level

Universities have traditionally had three main roles:

- to assist, through training, with programmes for human resource development
- to advance the frontiers of knowledge by searching for truth and discovering, storing, and disseminating knowledge
- to interact with the community and act as a social critic.

While improvement in livestock production requires all three components, the extent to which each is needed depends on the level of agricultural development in a given country in the humid and sub-humid zones of sub-Saharan Africa. As for the countries under consideration, it is relevant to identify veterinary institutions concerned with training in the livestock sector (see Table 1). In addition, it should be noted that virtually all faculties of agriculture in these zones train livestock specialists.

Training in Nigerian universities normally lasts six years after successful completion of the Senior Secondary School Certificate. While training tends to be more academic in the first four years, the last two years are more clinical and field-oriented.

Historically, the pattern has been to adopt, with some modifications, the veterinary curricula used in industrialized countries in order to conform with international academic standards. However, it has become increasingly clear that to achieve the best results without sacrificing international standards, curricula must be based on local conditions and on the level and direction of livestock development in a given country or zone. A major weakness in the formulation and implementation of curricula for livestock training in higher institutions is the inadequate attention paid to the stage of development of local animal agriculture.

Table 1. Veterinary faculties in the humid and sub-humid zones of sub-Saharan Africa.

<i>Name of Institution</i>	<i>Country</i>	<i>Year Programme Established</i>
University of Nigeria, Nsukka, Faculty of Veterinary Medicine	Nigeria	1981
Ahmadu Bello University, Zaria, Faculty of Veterinary Medicine	Nigeria	1965
University of Ibadan, Faculty of Veterinary Medicine	Nigeria	1963
University of Maiduguri, Faculty of Veterinary Medicine	Nigeria	1980
Usmanu Dan Fodiyo University, Faculty of Veterinary Medicine	Nigeria	1980
University of Dakar, Ecole Inter-Etats des Sciences Médecines Vétérinaires, Campus Universitaire	Senegal	1968
University of Zaïre, Faculté de Médecine Vétérinaire	Zaire	1971

At present, most veterinary and livestock training in higher institutions includes, to varying degrees, the following components:

- animal health
- public health
- animal production, breeding and genetics
- animal nutrition, feeds and feeding
- extension services
- food processing and storage
- rural economy

- agro-pastoralism
- fisheries and wildlife
- livestock economics.

However, a number of subjects particularly important in a holistic approach to livestock training are either absent or treated superficially. Courses that should be included to redress this training imbalance include

- entrepreneurship training for livestock production
- basic techniques in information management related to data collection, storage and retrieval
- appropriate extension techniques for making services farmer- rather than government-driven
- basic training in equipment standardization and maintenance
- training in post-harvest technology, food processing and storage.

Training, then, should enable graduate veterinarians to carry out the full spectrum of their professional duties as current conditions require. But provision should also be made to ensure that training anticipates and accommodates future developments in the ever-changing landscape of the livestock industry.

Post-Graduate Degree and Diploma Training

Many African countries, especially in the humid and sub-humid zones, depend on institutions in industrialized countries for the post-graduate training of their staff. But if such training is to be relevant, it should be provided locally with support from the international agricultural research centres such as the International Livestock Research Institute (ILRI). At the FAO regional conference for Africa in 1984 it was suggested that African institutions of higher learning form a network to reduce training costs and ensure the relevancy of instruction. Unfortunately this recommendation has not been pursued with the vigour that it deserves. The Association of African Universities (AAU), with headquarters in Accra, Ghana, tried to implement a similar programme, but its success was limited by the availability of funds.

There is a need for more post-graduate training and for financial support by international organizations and institutions in developed countries. However, and this needs emphasizing, most students sent to developed countries for post-graduate degrees do not return to their home countries after completing their programmes. This has caused a setback in the development of national human resources.

Table 2 shows the numbers of veterinarians and animal health assistants in 18 African countries in 1982 and 1992. While the number of veterinarians in countries of the humid and sub-humid zones of sub-Saharan Africa generally tripled between 1982 and 1992, the status of the livestock sub-sector has improved very little. Part of this can be attributed to the economic downswing suffered by most countries. This seriously affected the livestock industry and left many veterinarians languishing in paid government positions, with little or nothing to do. Many veterinarians have either migrated to developed countries in search of better pay and job satisfaction or pursued other interests within the national economy. Those in the private sector found themselves looking for jobs because of the collapse of the large-scale livestock production industry.

Table 2. Number of veterinarians and animal health assistants in countries of the humid and sub-humid zones of sub-Saharan Africa, 1982 and 1992.

Country	Veterinarians		Animal health assistants	
	1982	1992	1982	1992
Benin	35	NA*	NA	NA
Burkina Faso	31	93	NA	183
Cameroon	50	152	NA	45
Central African Republic	17	NA	236	NA
Congo	27	NA	375	NA
Côte d'Ivoire	45	119	275	396
Equatorial Guinea	1	NA	NA	NA
Gabon	2	NA	NA	NA
The Gambia	6	NA	NA	NA
Guinea	38	176	194	477
Guinea Bissau	2	15	NA	16
Liberia	13	NA	20	NA
Mali	76	NA	380	NA
Nigeria	1,000	2,528	1,200	6,506
Senegal	50	171	110	311
Sierra Leone	16	21	13	13
Togo	49	NA	39	NA
Zaire	650	890	NA	710

* Not available

Source: Data compiled from FAO/WHO/OIE Animal Health Year Books, 1983 and 1993.

In light of this unfortunate situation, policy-makers and implementers should be able to redefine the types of post-graduate programmes most relevant to developing, improving and sustaining the livestock industry.

Short-Term and Specialization Training

The majority of countries in the humid and sub-humid zones of sub-Saharan Africa have developed facilities for short courses (one week to three months) to continue the training of their veterinarians in specific areas related to their work. Unfortunately, these facilities are now under-utilized. Short-term programmes need to be re-activated and facilities revamped.

Specialization needs to be encouraged, especially in view of the fast pace at which knowledge is being transmitted today.

Liaison between Universities and Ministries of Agriculture

This is one of the weakest links in our training programmes. Because of lack of funds, ministries of agriculture have neither the equipment and facilities nor for the motivated staff required to establish meaningful links with other institutions as a means of enhancing training. For training to be relevant, ministries of agriculture must revitalize their extension services. This is an area in which assistance from international organizations and bilateral and multilateral agencies could make a significant contribution. Universities must develop meaningful relationships with ministries of agriculture to provide an enabling environment so that students can benefit fully from their training.

Stable Governments, Stable Policies

Government instability has often resulted in shifting policies and, frequently, in the inefficient implementation of otherwise good policies. This results not only in low levels of agricultural production but also, in some cases, in an actual decrease in production leading, in turn, to massive imports of food and animal protein to avert famine. This situation is usually a recipe for currency devaluation, low Gross National Product and poverty; indeed, this has been the case in most of the countries of the humid and sub-humid zone.

Greater investment in agriculture, livestock and training is needed to reverse the trend. Stable government is a prerequisite to tackling such problems and to ensuring that agricultural production keeps ahead of increases in the human population. Otherwise, firm action will be needed to control population growth.

International and Regional Institutions: Their Place and Role in Livestock Development

W.N. Masiga, Inter African Bureau for Animal Resources (IBAR-OAU)

Abstract More than 20 regional and international organizations are involved in livestock development in Africa. The paper organizes these into five categories: international technical organizations with a global mandate, research institutions with a global mandate, research institutions with an African or regional mandate, sectorial organizations that enjoy direct links with political organizations on the continent, and organizations with a wide mandate of which livestock development is only a part. The overall impact of these bodies has been substantial, particularly that of FAO, OIE, and the larger research institutions. However, even successful projects implemented by such organizations face problems of longer-term funding and therefore of sustainability. As for sectorial and sub-regional organizations, their achievements have often been less positive than hoped for. Regional and international organizations face several major constraints. Among these are their sheer number (leading to heavy competition for limited funding), lack of coordination among them (resulting, for example, in duplication of effort), and the tendency of governments to shift the burden of national-project implementation onto the shoulders of sub-regional organizations. The paper advises organizations to avoid an "ivory tower" approach and to ensure that projects are mission-oriented, grounded in local and national aspirations. It also recommends they maintain the capacity to train local people and that they promote strong collaboration with national agricultural research systems (NARS).

Introduction

The establishment of a large number of international and regional institutions in Africa suggests a very simple underlying principle: an institution is created to solve an identified problem and later, when it is solved, the institution perpetuates itself until its funds dry up.

In sub-Saharan Africa there are more than 100 such institutions. They serve mandates as diverse as transportation, communication, finance, sports and culture.

The activities of more than 20 of these institutions are directly related to livestock development. The livestock-carrying capacity in most of sub-Saharan Africa is now at its maximum; therefore, the food-production and security needs of the increasing population can no longer be satisfied by increasing the absolute numbers of animals. Rather, individual animal productivity must be increased. The role of these institutions in livestock development relates directly to three main constraints on productivity in sub-Saharan Africa: disease, poor nutrition and under-utilization of the genetic potential of indigenous livestock.

The Institutions

While it is outside the scope of this paper to name and describe all the institutions working in the area of African livestock development, they can be classified according to their sponsoring organizations, their development or research programmes, or the breadth of their geographical focus.

The best known *international organizations with a global mandate* are the United Nations FAO, whose mandate covers the full range of food and agriculture, and the International Office of Epizootics (OIE), concerned with all aspects of epizootic diseases.

Among those *research institutions with a global mandate* is the International Livestock Research Institute (ILRI). It was created by the merger of the International Laboratory for Research on Animal Diseases (ILRAD) and the International Livestock Centre for Africa (ILCA). ILRI does research on both animal production and health. It is most valued for its work on the economy of animal production systems, trypanosomiasis, East Coast Fever (ECF), and dairy and small ruminant production. A second actor in this category is the Department of Livestock and Tropical Veterinary Medicine (EMVT) of France's Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD). It carries out research on agro-pastoralism, nutrition, zootechnology and animal diseases.

A third category is *research institutions with an African or regional mandate*, three of which we take note of here. The International Trypanotolerance Center (ITC) specializes in research on trypanosomiasis and trypanotolerance. The Centre International de Recherche-Développement sur l'Élevage en Zone Subhumide (CIRDES), initially a research centre focusing on tsetse fly and trypanosomiasis, now encompasses other fields such as agro-pastoralism and zootechnology. As well, it coordinates regional rural development with emphasis on tsetse and trypanosomiasis control. The Conférence des Responsables de la Recherche Agronomique Africains (CORAF) does not conduct research per se but is listed here because it organizes training, meetings and seminars which unite national and European research institutes.

Sectorial organizations with "autonomous" status are institutes that enjoy direct links with political organizations in Africa at the continental or regional level. Examples are the Inter African Bureau for Animal Resources (IBAR) of the Organization of African Unity (OAU), the Institut du Sahel (INSAH) of the Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (CILSS), and the Communauté Économique du Bétail et de la Viande (CEBV).

Last, there are several *organizations with wide mandates that encompass livestock development*. Examples of these are CILSS, the Commission du Bassin du Lac Tchad (CBLT), and the Communauté Économique de l'Afrique de l'Ouest (CEAO).

Funding

Both core funding and funding to cover operational costs for specific projects are crucial to the success of any programme, institute or organization.

It is often argued that sophisticated research is best carried out in developed countries because results are achieved more quickly and with fewer constraints than in developing countries. However, African institutes normally deal with African problems that are not of primary importance to developed countries. Therefore, funding is only assured for research carried out in Africa. The location of these institutes in Africa assures eligibility for money from governments or organizations that manage special funds for the developing world. Such donors and lenders include the World Bank, the African Development Bank, the European Development Fund under the Lomé Convention, and the United Nations Development Programme.

It is important to note that bilateral donors fund these research institutes because they have always given priority to African livestock-development projects. A consortium of donors has also funded these institutes for many years. What can we say now about the impact of such funding?

Impact

The impact of the international organizations is probably most evident in the work of the FAO, which always stresses that it is not a donor organization and depends heavily on donors for funding its technical co-operation projects outside its regular budget.

Generally, donors prefer not to take over projects abandoned by other donors because of their suspicion of a hidden agenda and belief that a successful project will always survive. Technical co-operation projects, which are used as tools for urgent intervention for a limited period, face the problem of sustainability. The FAO, however, has created the Emergency Prevention System (EMPRESS) which mobilizes emergency funds within days. This is probably the organization's most notable recent achievement. No other international agency or donor has developed a system of comparable efficiency.

The OIE's impact can be attributed primarily to its successful co-operation with virtually all global livestock-development organizations. This positive influence is seen in the support it has provided to the OAU/IBAR for the PARC project. This support concerns the formulation of regulations related to the declaration of freedom from rinderpest, assistance in the process of privatizing the veterinary profession, and interest in assuring standard rules for drug importation and distribution and, in the near future, for sanitary matters. The fact that almost all African states are also OIE members makes for good co-ordination and harmonization at the continental level.

The impact of large research institutions, especially in the area of vector-borne diseases, is evident. In most instances, their mandates cover basic and applied research. The contributions of these institutes would have been even greater had they put more emphasis on adaptive research.

“Autonomous” sectorial organizations, because they are linked directly to political organizations, should have had the greatest impact on the formulation and implementation of livestock policy. Unfortunately, most of these have been rather dormant. OAU/IBAR, however, has had an impact, particularly through its PARC project. Its most notable achievement has been to influence decision makers, thereby promoting a shift towards liberalization and privatization of the veterinary profession and a restructuring of the livestock sector as a whole. The introduction of “cost recovery for services rendered” was an important step towards sustainability of services and has helped reduce dependency on donors.

The impact of other organizations is more difficult to assess and opinions about their efficiency and impact differ, particularly in the case of sub-regional bodies. Some have improved the information flows between member countries and have become a forum for designing development programmes. The formulation and dissemination of legislative models by CEBV to harmonize veterinary laws and regulations exemplifies their prompt response to regional needs. Nevertheless, there is a general sense that the impact of the sub-regional organizations is far less positive than it should be.

Major Constraints

Three major constraints undermine the effectiveness of regional and international organizations working in Africa's livestock sector. First, and most notable, is their sheer number. In the 1970s and 1980s they multiplied, resulting in a sharp rise in competition for funds. In turn, this led to some institutes being inadequately financed. A number of them, mainly sub-regional organizations, were paralyzed by this.

Second, insufficient co-ordination among organizations has always led to duplication of effort and, again, competition for funding. Donors have contributed to the confusion by sometimes financing the same projects in the same country or region.

Third, governments have tended to view sub-regional organizations as implementing agencies for national projects. In this way, they side-step their responsibilities for such development work.

Possible Solutions

The following suggestions may enhance the future performance of some institutions:

- The “ivory tower” approach should be avoided. Activities should be mission-oriented and projects formulated at the grass roots so that they take national aspirations and plans into account.
- Collaboration between the international or regional organizations and national agricultural research systems working in the same areas should be promoted at all costs. Communication between institutions to promote common planning, exchange of information, and, where necessary, joint implementation of projects should always be borne in mind. The Nairobi Cluster, involving a number of research institutions that meet informally to exchange results and general information, best illustrates this kind of collaboration.
- All regional and sub-regional organizations should maintain the capacity to train local people both on the job and in formal programs.

Evaluation

Evaluation of international and regional institutions is needed to assess their impact and to help re-orient programmes and projects when necessary. At the same time, the future roles and financial needs of these organizations need to be defined. The development of an inter-organizational network to improve collaboration between experts and to harmonize programmes is essential.

System-Wide and Ecoregional Initiatives: The Contribution of the International Livestock Research Institute

***S. Ehui, J. Smith and P. Gardiner, International Livestock Research Institute (ILRI),
Addis Ababa, Ethiopia***

Abstract The World Bank has estimated that production of animal products in sub-Saharan Africa needs to increase by 4% per year to ensure an adequate supply of animal protein for the region's growing population and eliminate imports. This goal implies a target production of 19 million tonnes of meat and 43 million tonnes of milk for the year 2025. Such increases can only be achieved with appropriate research and development policies.

So-called "system-wide" and "ecoregional" initiatives have been identified as mechanisms for conducting research within ecoregions but with a global perspective. They are meant to achieve economies of scale in research, maximize the use of spillovers, reduce transaction costs and facilitate advances in knowledge.

In its report on the medium-term allocation of the CGIAR for 1994-98, the Technical Advisory Committee (TAC) proposed a Systemwide Livestock Initiative (SLI). TAC identified ILRI as the convening centre with an organizing and facilitating role. In partnership with other institutions, ILRI is to develop proposals and carry out joint programmes.

The SLI presents a framework for new research to develop unifying principles that build on, interpret and extend the results from individual ecoregional studies involving farming systems. Through collaboration with ecoregional research consortia, the SLI will carry out a global feed research agenda based on ecoregional studies to develop research outputs broadly applicable across regions.

Using a competitive research grant approach, mediated by an external scientific review panel under an independent chairperson, ILRI and its partners have reached consensus on recommendations for funding in 1996. Three ecoregional proposals for improving production and use of livestock feed are to be supported – in Latin America, in West Asia and North Africa, and in the East African Highlands. Planning workshops are expected to take place during 1996 to develop proposals to be submitted for competition in 1997.

Introduction

Livestock products (food and fiber) account for about 25% of the total value of the agricultural gross domestic product (GDP) of sub-Saharan Africa (SSA). Livestock contribute to the welfare of the region's farmers in different ways: (1) livestock products improve the nutritional status of both farm and urban families; (2) sales of live animals, meat, milk, eggs and fiber are often the major sources of income for farmers in SSA; (3)

livestock are living banks for farmers, providing flexible financial reserves for periods of economic stress and a buffer against crop failure; and (4) livestock play a critical role in agricultural intensification by providing draft power and manure for fertilizer and fuel. The value of power and manure from the farm raises the contribution of livestock to the total value of agriculture in SSA from 25% to about 35%.

Driven by human population, rural-urban migration and income growth, demand for livestock products in SSA is increasing steadily. The region's human population is expected to increase from the present 500 million to nearly 1300 million people by 2025. Urbanization is also increasing rapidly. Currently, 145 million people are urban dwellers, but by 2025 more than 700 million will be living in cities and towns, raising the projected proportion of urban dwellers from 29 to 54%. Urbanization will force the commercialization of agriculture and increase the demand for foods of animal origin. If livestock production does not increase, it is projected that SSA will have to import about 7 million tonnes of meat and 11 million tonnes of milk annually to meet this demand. At current prices these imports will cost about \$16,000 million a year which is likely to be prohibitive.

The World Bank has estimated that production of animal products in SSA will have to increase by 4% per year to ensure an adequate supply of animal protein for the region's growing population and thus eliminate imports. This goal implies a target production for the year 2025 of 19 million tonnes of meat and 43 million tonnes of milk. Such increases can only be achieved with the aid of development policies.

Research can dramatically demonstrate what is achievable, thereby encouraging development. But the full potential of research to assist in livestock development will be exploited only if it is properly conceived within the overall agricultural development strategy. System-wide and ecoregional research initiatives have been identified as mechanisms by which international and national research centres can implement joint local research programmes of global relevance. This paper discusses the contribution of the International Livestock Research Institute (ILRI) to the development of system-wide and ecoregional livestock initiatives.

ILRI was established on January 1, 1995. It is the newest of the international agricultural research centers supported by the CGIAR. It combines the resources of the former International Livestock Centre for Africa (ILCA) and the International Laboratory for Research on Animal Diseases (ILRAD). It also capitalizes on the major strengths in animal health and animal production research which had been pursued separately by these two centres. Unlike its predecessor centres, ILRI has a global mandate. It has four goals:

- to improve animal performance by overcoming identified constraints on animal productivity through technological research and conservation of genetic diversity amongst livestock populations

- to improve and maintain the long-term productivity of the major livestock and crop-livestock production systems typical of developing regions
- to improve the technical and economic performance of the livestock sector in these regions so as to ensure the appropriate translation of production systems improvement into increased food security and economic welfare
- to improve the development, transfer and use of technology by national programmes and client farmers in the agricultural systems of these regions.

These goals are the framework for developing ILRI's new programme and they apply to the improvement of animal agriculture globally. However, the combination of strategic (e.g., biotechnological), applied and adaptive research will vary according to the problem, production system or region in question. A globalization of research through ecoregional initiatives and links to other programmes is central to ILRI's strategy and to recommendations of other recent reviews of livestock in developing regions.

Concepts of System-Wide and Ecoregional Initiatives in the CGIAR

In its report on the medium-term allocation for 1994-98, the Technical Advisory Committee of the CGIAR made two types of recommendations on funding: centre-specific funding and programme funding for particular CGIAR system-wide and ecoregional initiatives. System-wide initiatives were proposed for programmes on genetic resources, livestock, and water management as well as for a number of ecoregional programmes. For each of these proposed initiatives, TAC had identified a convening centre to play a facilitating role and, in partnership with collaborating institutions, to develop proposals for joint research programmes.

TAC envisages system-wide initiatives that would:

- make a conscious effort to globalize methodologies used in local studies to ensure comparability of results across ecoregions and of specific themes or problems within given ecosystems
- involve locally relevant research within ecoregions, but with a global perspective, in such a way as to a) take advantage of economies of scale in research, b) maximize the use of spillovers, c) reduce transaction costs in doing research, and d) facilitate effective advances in knowledge
- be multi-sectoral and multi-disciplinary in nature and scope, to incorporate the different sectors and disciplines across the system.

A system-wide livestock initiative, then, should be explicitly linked to ecoregional activities, to the work of crop centres, and to policy issues studied by such centres as the International Food Policy Research Institute (IFPRI). Both system-wide and ecoregional initiatives would consist of collaboration between two or more centres and other parties as appropriate, addressing issues of high priority to the CGIAR system.

Ecoregional proposals should seek to resolve priority issues, explore the roles of all partners in contributing to outputs at the global, ecoregional and local levels, and to highlight expected externalities, often in natural resource management.

System-wide proposals submitted to TAC include:

- the Genetic Resource Initiative
- the Systemwide Livestock Initiative
- the system-wide Initiative on Water Management Research
- Property Rights, Community Organization and Resource Management
- Agricultural and Water Policy to Sustain the Resource Base and Productivity Growth in Fertile Lands
- Establishment and Upkeep of the Global Data Base on National Agricultural Research and Analysis of Policy Implications.

Ecoregional initiatives submitted for sub-Saharan Africa include:

- Sustainable Natural Resources Management Options to Assess Land Degradation in the Desert Margins of Sub-Saharan Africa
- Ecoregional Program for the Warm Humid and Subhumid Tropics of Sub-Saharan Africa
- Inland Valley Consortium: An Ecoregional Program for the Warm Humid and Subhumid Tropics of Sub-Saharan Africa
- African Highlands Initiative.

The Systemwide Livestock Initiative

The SLI presents a concept for new research to develop unifying principles that build on, interpret and extend the results of individual ecoregional studies involving farming

systems. Through collaboration with ecoregional research consortia, the SLI will superimpose a global feed resource agenda on ecoregional studies to develop research outputs that can be broadly applied across regions.

Using a competitive approach, ILRI has built consensus on recommendations for funding in 1996. It is recommended that three ecoregional proposals for improving production and use of livestock feeds be supported — in Latin America, in West Asia and North Africa, and in the East African Highlands. The initiative evolved in tandem with ILRI's own development of global priorities. ILRI convened the first meeting of the Inter-Centre Livestock Program Group (IC-LPG) in Nairobi in May 1995 to lay out rules for working groups and for review of research proposals.

Eight proposals were submitted to the CGIAR-led consortia. These were subjected to a "competitive grants" screening process involving external peer review. These proposals were as follows:

- improved legume-based feeding systems for small-holder, dual-purpose cattle production in tropical Latin America (CIAT-led consortium)
- production and utilization of multi-purpose fodder shrubs in West Asia and North Africa (ICARDA-led consortium)
- utilization of forage legume biodiversity for dairy production and natural resource management in the East and Central African Highlands (ICRAF/ILRI-led consortium)
- improvement of production and utilization of feed resources in crop-livestock production systems in Asia (ICRISAT-led consortium)
- improvement of the nutritive value of crop residues and their efficient utilization (ICARDA-led consortium)
- improving livestock productivity through a more efficient and sustainable use of feed resources in the High Andes (CIP-led consortium)
- improving livestock feed resources and nutrient management in the drylands of West Africa (ICRISAT-led consortium)
- improving crop-livestock systems in the savannah zone of West Africa through integration of herbaceous, woody and dual-purpose (grain) legumes (IITA-led consortium).

The external panel was made up of representatives from developing and developed countries working in international organizations, national agricultural research systems,

academic institutions and consultancy firms. Criteria and sample questions were organized around the headings of scientific and technical quality, conformity with CGIAR regional and global priorities, inputs and outputs, dissemination, and future development research potential. The IC-LPG agreed by consensus that three proposals — the first three listed above, led by CIAT, ICARDA and ICRAF/ILRI — would be recommended for funding in 1996 following minor modification of the proposals and the budgets as per reviewers' comments.

The IC-LPG considered that the current proposals should be supported on scientific merit. It did not give consideration to regional coverage nor did it apportion available funds amongst the proposals submitted.

Several consortia proposed research on the production and use of forages, residues and by-products from food and/or cash cropping systems and related natural resource management research. Although it was suggested that digestibility and nutritive parameters of crop residues (e.g., straws and stovers) might be improved through specific breeding programmes and other technologies, the scientific reviewers were split on the overall feasibility of improving both grain and residue qualities. However, the relevance of such research is potentially very wide. The IC-LPG therefore recommended that in 1996 SLI funds be used to stage a research planning workshop.

Involving national and international sources of expertise (including all relevant CGIAR centres), the workshop will address this crop-livestock interface with particular emphasis on the use of feed resources from cropping systems and on related natural resource management questions. The subject of the workshop is of trans-regional relevance and is expected to be a key element in the formulation of future proposals for improving livestock feeds.

ILRI Global Livestock Agenda

To fulfil its global mandate, ILRI has been holding consultations with potential partners and clients in different developing regions. Putting together an agreed global agenda for livestock research will support the development of appropriate research programmes by all those concerned with livestock improvement around the world. ILRI stages these consultations to support institutional planning and to establish links with partner organizations. This helps to identify the comparative advantage of each institute in addressing wider CGIAR initiatives in agriculture and to determine how advice and assistance might best be formulated to aid the projects and programmes of other international and regional agencies.

To start this process ILRI held a global consultation in January 1995 at its headquarters in Nairobi. The meeting drew together senior representatives of livestock research and development programmes in Asia, sub-Saharan Africa, North Africa and the Middle East,

Latin America and the Caribbean. These experts compared and contrasted general requirements for livestock research in these regions. The objectives of the consultation were to

- identify priority requirements for improved livestock productivity and development of sustainable production systems in the developing regions
- identify cross-regional priorities, major constraints, researchable areas and issues in livestock production most likely to bring distinct benefits and impacts
- assist with planning of future regional research workshops and with identifying participants.

Sub-Saharan Africa was viewed as comprising arid, semi-arid, sub-humid and humid zones. The group identified seven major areas for consideration for research (although the priority varied with the severity of the constraint on livestock production systems in different zones):

- *Feed Production and Utilization.* For the three most humid zones, this theme is recognized as a major research priority.
- *Animal Health.* This is of particular importance in the humid zones of SSA. The group suggested broader based animal health research to include the relative costs of vector-borne diseases and internal parasites, plus the use of epidemiological tools for wider, integrated health management.
- *Systems Analysis.* All regions would benefit from unifying the research portfolio through the use of simulation models and geographical information systems and from rationalizing research on individual production system constraints.
- *Natural Resource Management.* This is of critical importance to the semi-arid regions where research in quantifying soil-plant-livestock dynamics was given highest priority.
- *Conservation and Biodiversity.* All regions would benefit from better characterization and conservation of both animal and forage genetic resources.
- *Animal Genetics.* The potential of indigenous species in all regions to contribute to improved productivity through inherent disease resistance and other environmental adaptations was considered important. ILRI was expected to contribute substantially to this research.

- *Policy and Socio-Economic Issues.* Such issues are considered under-researched in SSA. There is great potential for contributions by international institutions.

The first considerations of what livestock research is needed in different regions concurred on the widespread importance of improving livestock feed resources and their utilization.

Another fundamental change in the approach taken by the international research centres is their move towards ecoregionality, i.e., looking at the agricultural requirements of areas linked by climate, geography and other similar biophysical constraints. CGIAR centers have been given new responsibilities for developing coherent research programmes for improving agriculture in the ecoregions where they are located. ILRI therefore formulated its consultation series within this ecoregional framework and has contacted both CGIAR and other centres resident in the relevant regions to participate in the deliberations.

ILRI has completed three regional consultations (two in Asia and one in the Latin America and Caribbean region). ILRI plans to hold one for the West Asia and North Africa region during 1996. Because of the large human and livestock populations in Asia and the integration of many livestock species into the farming systems of the regions, the planning documents for ILRI viewed Asia as the first major challenge for the institute.

The South-East Asia consultation (hosted by the International Rice Research Institute) brought together representatives of national and international programmes for agriculture and livestock improvement with donors interested in livestock issues and the broader development of South-East Asia. It placed livestock requirements within a framework of overall agricultural development and helped international and national institutes to define potential entry points for research on livestock.

The participants identified the priority agro-ecological zones and, within each, priority production systems in which livestock research was required. For the ASEAN (Association of South East Asian Nations) region, the basic focus was on the upland and lowland rainfed agro-ecological zones. Among the production systems, rice/buffalo and rice/cattle (beef and dairy), maize/buffalo and cattle systems, and the integration of ruminants with plantation crops (coconut, oil palm and rubber) were prominent. The highest priority research areas were feeding and nutrition, genetic improvement, methodology for crop-animal interactions and the promotion and adoption of appropriate technologies.

Among the countries, there was general consensus on the need for adequate funding for livestock research, training, institutional strengthening and germ-plasm conservation and use.

Conclusions

In sub-Saharan Africa, the greatest need for livestock research is to improve productivity. Research can demonstrate what is achievable, thereby encouraging development. Investment in livestock research should be increased and perhaps the direction of research in SSA should be changed.

System-wide and ecoregional initiatives provide a platform where national, regional and international research organizations can join together to address local or regional research problems that also have global significance. They also permit these organizations to take advantage of economies of scale.

ILRI was identified as the convening center for the development of the System-wide Livestock Initiative. Out of eight proposals three were recommended for funding. It is expected that this innovation process will help national and international research institutions implement system-wide co-operation to increase the contribution of livestock to agriculture. The success of these initiatives depends on donor commitment. A sustained level of funding, which supplements the centers' funding, will be essential.

Issues and Recommendations

Working Group Reports: Issues and Recommendations

Introduction

The constraints on livestock production in West and Central Africa are well known. Perhaps less well understood is the great potential with which the region is blessed: human knowledge and skill, plus physical capital in the form of land and indigenous breeds of livestock.

Given the rapid growth of the human population and shifting demand for food, it is essential that this African potential be harnessed without delay. But a prerequisite to any widespread progress is the presence of a sound policy environment in the 18 countries of our region. It is essential that policies and regulations — for research, education, production, commerce, health and so on — balance the interests and needs of consumers, producers and others with a stake in the livestock sector.

Three working groups were formed during the Abidjan seminar. Each was assigned to discuss and examine in detail one of three themes:

- the economic, policy and scientific environment of the livestock sector
- the technical environment
- the institutional environment.

The papers that were delivered in plenary earlier in the week, along with the questions, answers, comments and issues raised following each paper, served as the “raw material” for each working group.

The better part of a day was devoted to working group discussions and the formulation of recommendations. The chairperson and rapporteur of each group continued their work and report writing while other participants went on a livestock field trip. Each working group later met to review and comment on the documents prepared by the rapporteurs and chairpersons.

The final reports of the working groups were presented in plenary by their respective rapporteurs on the final day of the workshop and briefly discussed before adoption.

The recommendations, numbered and highlighted below in italic type, cover a range of activities and issues of direct concern to all involved in the livestock sector of the humid and sub-humid zones of West and Central Africa. These actors include government policy makers, research institutes, public- and private-sector service providers, donor agencies, regional organizations and producers and consumers of meat and dairy products.

Table 1 is an index giving recommendation numbers alphabetically by subject or production sub-sector. Table 2 lists recommendation numbers by target group, i.e., intended implementing agent. The tables are meant only as a rough guide to steer readers to those recommendations that may interest them. Many recommendations are listed under several activity/sub-sector headings or several target groups; and the table categories are not necessarily mutually exclusive.

It is the sincere wish of the seminar participants that their deliberations and recommendations, presented below, attract the attention of West and Central African policy-makers, donor organizations and others with a major stake in the livestock sector. With their assistance, livestock production will fulfil its great potential in the region, especially as a provider of food and income security, in the rest of this decade and into the next century.

Table 1. Recommendation numbers by subject or sub-sector.

Subject or Sub-Sector (Alphabetically)	Recommendation Number
Cattle/Dairy	2.8 - 2.20, 2.39, 2.40
Consultation / Coordination	2.19, 3.1, 3.3, 3.4, 3.5, 3.7
Diversification	2.6, 2.37, 2.38, 2.40
Environment / Natural Resource Management	2.3, 2.5, 2.6, 2.8, 2.10, 2.35
Feed/Water	2.3, 2.8, 2.9, 2.11, 2.17, 2.23, 2.24, 2.28
Funding/Credit	1.6, 1.8, 3.6
Genetic Improvement	2.4, 2.13, 2.14, 2.22, 2.27
Health/Veterinary Services	1.6, 2.2, 2.8, 2.10 - 2.12, 2.22 - 2.25, 2.33
Information	1.2, 2.7, 2.30, 2.40, 3.4
Intensification	2.16, 2.17, 2.24
Manure	2.6, 2.35
Marketing	1.3, 2.24, 2.29, 2.38, 2.40, 2.44
Micro-Livestock	2.34
Mixed Production (Crop/Livestock & Livestock/Livestock)	2.6, 2.16, 2.18, 2.31, 2.32, 2.35, 2.38
Pastures/Plant Resources	2.8, 2.33
Peri-Urban Production	2.5, 2.14, 2.39
Pigs	2.25 - 2.31
Poultry	2.23, 2.24, 2.31
Preservation	2.7, 2.39-2.42
Privatization	1.6, 3.1
Processing	2.7, 2.29, 2.38 - 2.41, 2.43
Professional Organizations	2.19, 3.1
Quality/Quality Control	2.4, 2.11, 2.16 2.42
Relevance of Development Activities	2.1, 2.19
Research/Extension/ Technology Transfer	1.7, 2.3, 2.6, 2.7, 2.13, 2.15, 2.16, 2.18, 2.26, 2.32, 2.40, 2.41, 2.43, 3.5 - 3.7
Small Ruminants	2.21, 2.22
Traction	2.16, 2.18, 2.36
Traditional Production	2.26, 2.41
Trade/Pricing	1.4, 1.5
Training	1.6, 3.2
Transhumance	2.8
Wild Species	2.33
Women	2.21

Table 2. Recommendation numbers by target group.

Target Group	Recommendation Number
Policy-makers and Regulators (ministers and senior government officials)	1.1 - 1.8, 2.1, 2.2, 2.5, 2.6, 2.8 - 2.13, 2.19 - 2.25, 2.29, 2.30, 2.40, 2.44, 3.1, 3.6
Public-Sector Service Providers (e.g., extension and other ministerial departments and agencies)	2.2, 2.3, 2.6, 2.7, 2.9, 2.10, 2.11, 2.15, 2.16, 2.18 - 2.36, 2.40 - 2.42, 2.44, 3.1, 3.2
Livestock Producers	2.5, 2.16, 2.17, 2.20, 2.21, 2.23, 2.26 - 2.29, 2.32, 2.37-2.39, 2.42, 2.43
Professional Associations (e.g., of producers or veterinarians)	2.6, 2.14 - 2.16, 2.19 - 2.21, 2.23, 2.26, 2.27, 2.28, 2.29, 2.31 - 2.38, 2.40, 2.42, 2.43, 2.44
Financial Institutions	1.8, 2.1, 2.39, 2.43
Private-Sector Service Providers (e.g., feed or equipment suppliers)	2.1, 2.12, 2.15, 2.16, 2.18, 2.20, 2.21, 2.23, 2.24, 2.26, 2.27, 2.28, 2.39, 2.41, 2.43
National Agricultural Research Systems	1.2, 1.7, 2.1, 2.3 - 2.5, 2.7, 2.11, 2.13, 2.15, 2.16, 2.18, 2.20, 2.26, 2.27, 2.30 - 2.35, 2.41, 3.2, 3.3, 3.7
Training Institutions (e.g., university departments/faculties of veterinary medicine, animal sciences, etc.)	3.2
International Research Centres, particularly ILRI	2.1, 2.5, 2.15, 2.16, 2.18, 2.20, 3.3, 3.5, 3.7
International Donor/Technical Agencies	2.1, 2.15, 2.16, 2.18, 2.20, 3.2, 3.3, 3.4, 3.7
Regional Organizations	1.2, 1.5, 2.1, 2.2, 2.4, 2.15, 2.20, 3.2, 3.4, 3.6

Report of Working Group 1: Economic, Political and Scientific Environment

Chairperson: W.N. Masiga, OAU-IBAR, Kenya

Rapporteur: Vitor Picao, University of Reading, U.K.

Issues and Discussion

The discussion following the paper by Andrew James on socio-economic issues focussed on two key subjects: the role of government in market regulation, import policy and public health legislation; and the need for a better understanding of existing livestock systems so that acceptable and appropriate development policies can be designed.

Governments should play a role in balancing markets in the interests of both producers and consumers. Public intervention is normally justified on equity grounds, but care should be taken to ensure that measures are enforceable and that costs are kept low.

A major challenge faced by the livestock industry is the ever-increasing demand for animal products. The industry is not keeping pace with demand and it responds to market signals only over the long term.

Population growth creates pressure to intensify and commercialize production. Such changes may be inevitable. However, non-monetary values must be taken into account in economic analysis. This requires methods of assigning money equivalents to social factors and other non-traded benefits.

It is widely accepted that lack of data on livestock production systems leads to inappropriate policies. Work by the International Trypanotolerance Centre (ITC) in The Gambia, however, has helped improve production in tse-tse infested areas through the promotion of local trypanotolerant breeds. ITC data has shed light on the importance of such animals relative to exotic breeds. But, overall, there is a serious lack of reliable livestock information in the region. This hurdle needs to be overcome through development of standard methods of collecting national and regional data that allow for cross-country comparisons.

The paper by Christian Hoste, on the scientific environment of the livestock sub-sector, prompted much discussion. A number of problems facing research seem to be common to institutions throughout the region. In particular, national research programmes are heavily dependent on donor funding, which cannot be sustained over the long term. Funding per scientist has also been shrinking. This is linked to the substantial growth in

Trade and Prices

The trend toward liberalization of international trade is well-established and African states are adapting to this new environment. However, world markets in livestock products are currently distorted by subsidized exports, and some regulation of imports is required to prevent the destruction of national production. Tariffs should be used where necessary. *(1.4) Target prices should be established at a level that balances the interests of producers and consumers.*

Important intra-regional trade in livestock and livestock products exists, and should be further developed to the advantage of both exporting and importing countries. *(1.5) A regional body should be identified or created to monitor and promote trade in livestock and livestock products between countries of the region.*

Livestock Services

(1.6) Governments should revise their policies on the delivery and financing of livestock services. (See also recommendation 3.1 below.) Most services can be delivered more efficiently by the private sector. However, in many countries the private sector has yet to be established and its development will be a long-term process requiring legislation, the creation of regulatory bodies, and the provision of training and credit.

Some services should continue to be financed by government, even where they are delivered by the private sector. These include compulsory programmes for the control of major epidemic and zoonotic diseases, where complete coverage is essential for success, and cost recovery is likely to cost more than the revenue generated.

Livestock owners should, in general, meet the cost of other services. There may be a case for subsidies to promote the adoption of new techniques, but these should be regarded as temporary.

Government services should be developed to supervise and regulate the activities of the private sector.

Research and Extension

(1.7) Countries should develop, with full participation of all actors, particularly farmers, research strategies and master plans consistent with agricultural and livestock development objectives. The required numbers and types of researchers should be assessed by each country. All components of the national agricultural research system, i.e. government research departments, universities, NGOs and private organizations, should play an active role in identifying research priorities and conducting research.

It should be a priority to improve skills in agricultural research management.

Studies on the impact of research programmes should be conducted so as to improve the planning of future research and to justify resource allocations. There is a need for better integration of national research and extension services, with more emphasis on farmer participation, on-farm demonstration and adaptive research activities.

Regional priorities should be formulated as soon as possible, and regional co-operation strengthened.

Credit

Lack of access to credit is often cited as a constraint on the development of livestock production. (1.8) *Governments and financial institutions should implement credit systems tailored to the specific needs of the livestock sector.*

Report of Working Group 2: Technical Environment

Chairperson: Didier Richard, CIRAD-EMVT, France

Rapporteur: Etienne Enguele Guele, SODEPA, Cameroon

Issues and Discussion

The group conducted an in-depth analysis, sub-sector by sub-sector, of animal production in our zone. This was done on the basis of the five presentations on the technical environment and the discussions that ensued in plenary. These papers covered several key topics: traditional livestock production systems, peri-urban systems, interactions between livestock and the environment, the organization of support services, and the processing and preservation of animal products.

The analysis of the livestock sector's technical environment revealed a great diversity of production systems in the humid and sub-humid zones of sub-Saharan Africa. It also showed that the level of livestock development varies widely from one country to another in the region.

Current knowledge of traditional livestock production systems indicates low levels of productivity for all species. This stems mainly from problems of animal health and nutrition. For cattle, parasitic diseases are a major constraint; in the case of small ruminants, fowl and pigs, infectious diseases are responsible for major losses.

Food intake is often inadequate and limits the gain of animals raised in extensive production systems. Where climatic conditions allow for high fodder production, the fodder is of poor nutritional quality and its availability depends on anthropogenic factors that may limit its use. Such fodder production varies markedly with the season and influences animal production levels, which already experience wide variation throughout the year.

Food resources in the form of by-products are important, but the use of such inputs continues to be limited in some instances by distribution and price constraints.

The introduction of semi-intensive and intensive production systems shows, however, that there is potential for high-level production in the sub-humid and humid zones. In particular, local breeds of ruminants, which are well-adapted to these environments, demonstrate high productivity under good feeding and sanitary conditions. This major production potential should help to respond to growing demand for the highly nutritional

protein needed by the people of these regions. It requires control over the complete production cycle (e.g., for monogastrics), or over part of this cycle, at a particular stage of the animal's development (fattening). In some situations, the use of exotic breeds should be considered.

Another way to boost the quantity of available animal products is to improve traditional processing and preservation methods or adopt new ones. Various methods have shown the value of popularizing appropriate technologies (for processing milk, for example) which lead to a high proportion of the raw material being made available as consumer products.

The evolution of livestock production should take into account the impact of husbandry practices on the environment, a key factor in the sustainability of resources in the coming decades. Livestock *can* be produced in a healthy symbiosis with the environment. For ruminants, this will require efforts in the area of natural resource management and optimal use of other feed resources. For intensified production systems, it will mean paying attention to environmental effects so that surroundings remain conducive to human activity.

Ensuring that producers are organized seems essential to the livestock sub-sector's development and to its proper integration within overall national agricultural production. It is also necessary for conservation of natural resources. Other countries provide clear examples of producers' ability to organize themselves and of the advantages of group action in the areas of input supply and marketing of processed or partially processed products. The technical constraints faced by these organizations should be better known and widely publicized among producers and national and regional services concerned with livestock development.

The recommendations that follow are divided into two parts. We begin with seven major ones that apply generally to livestock production in the humid and sub-humid zones of West and Central Africa. Following these are a second set of technical recommendations, for specific livestock sub-sectors and activities, aimed at producers and governments in the region. These are based on the constraints and potential that the working group identified for each livestock sub-sector.

Recommendations for Livestock Production in General

(2.1) Any improvement measures should be in accordance with the agricultural production system to which they are being applied. They should correspond to technical and economic elements specific to each livestock sub-sector.

(2.2) Significant and sustained measures, some of them at the regional level, should be undertaken in the area of health.

(2.3) Optimizing feed resources is of prime importance and will require extension efforts for rationalizing the use of both natural resources and by-products.

(2.4) The implementation of national plans for improving the quality and quantity of various animal species should lead to the formulation of genetic improvement plans adapted to local production conditions and monitored by selected organizations.

(2.5) Measures taken to develop the livestock sub-sector should pay attention to the environment as a whole, both to ensure the sustainability of natural resources and to keep peri-urban pollution in check.

(2.6) Combined production of crops and livestock should be promoted as a way of diversifying farm production and ensuring better use of animal manure for soil improvement.

(2.7) Improvements in methods of processing and preserving animal products should be accompanied by better dissemination of new or improved technologies.

Technical Analysis and Recommendations by Sub-Sector

Cattle

The constraints on cattle production are numerous and varied in nature. They include

- systemic constraints: predominance of traditional production systems with all their weaknesses
- biological constraints: numerous parasitic, bacterial and viral diseases
- institutional constraints
- genetic constraints: lack of sexual precocity of animals
- administrative and financial constraints: inadequate investment
- social and cultural constraints
- lack of organization in the cattle sub-sector, which stifles development of the producer who is at one end of the production chain

The cattle sub-sector's potential is very high but still untapped:

- Plant resources and agro-industrial by-products that can be used as animal feed are seasonally abundant.
- Existing cattle herds are well adapted to the ecology but their continuing low output means that local supply cannot meet demand. Rapid urbanization and the growth of urban incomes is stimulating demand for animal products, requiring heavy imports from outside the region.

- There is an encouraging trend toward intensification in peri-urban areas. Intensive production units are being set up with the aid of agro-industrial by-products and other agricultural residue as feed. These units, which employ paid workers and are run professionally, are constantly seeking innovative, profit-making ventures.

Recommendations for the cattle sub-sector are as follows:

(2.8) Increase control of the physical environment through

- *improved, long-term management of plant resources, with special attention to seasonal transhumance, a problem that each affected country should deal with, taking into account local socio-economic constraints*
- *implementation of local plans for developing pasture lands and water supply*
- *introduction of policies on land use, control of cattle movements at borders, and standardization of health regulations.*

(2.9) Take stock of available agro-industrial by-products and implement a policy at the sub-regional level on the use of by-products as livestock feed.

(2.10) Control bovine trypanosomiasis and other parasitic diseases by taking environmental factors into account.

(2.11) Make an inventory of veterinary laboratories that do diagnostic work, produce vaccines, or do analysis and quality control of animal feed; ensure specialization and regionalization of such facilities.

(2.12) Manufacture and package drugs.

(2.13) Develop local genetic resources via a national and regional plan for cattle breeding, based on modern production systems.

(2.14) Set up dairy projects in both livestock production areas and peri-urban areas based on the use of improved local cattle breeds.

(2.15) Encourage transfer of appropriate technology.

(2.16) Encourage increases in the number and quality of cattle in the sub-region by gradually modernizing traditional production methods and by setting up a modern semi-intensive and intensive livestock sector; and encourage livestock-crop combinations through the use of animal traction.

(2.17) Shorten the production cycle for beef in both rural and urban areas by setting up semi-intensive and intensive cattle feed lots.

(2.18) Develop, adapt and promote animal traction methods for cropping in the humid zones.

(2.19) Involve producers in the management of the cattle sub-sector by encouraging the creation of professional committees on livestock and meat production. These consultative bodies would bring together livestock producers and government officers working in the sub-sector.

(2.20) Encourage research and development and promote wide dissemination of research results.

Small Ruminants

The main constraints on small ruminant production are

- diseases: respiratory infections, PPR (*peste des petits ruminants*), pleuro-pneumonia, pasteurellosis, worms, contagious epididymitis
- poor nutrition due to improper production practices
- lack of marketing channels

These species grow rapidly and are prolific and trypanotolerant. Despite their enormous potential, small ruminants have rarely been the subject of animal improvement programs or of well planned commercial exploitation projects.

Recommendations for the small ruminants sub-sector as follows:

(2.21) Encourage popular interest in the production of small ruminants, notably by youth and women's groups.

(2.22) Put in place national development plans for small ruminant production that would include simple, inexpensive interventions, specifically vaccinations, systematic deworming, habitat improvement and genetic improvement.

For examples of successful small ruminant production, countries should refer to the experience of Togo and Côte d'Ivoire.

Poultry

Major constraints on poultry production are

- diseases: Newcastle disease, pasteurellosis, *Gumboro*
- predators

- excessive cost of poultry feed linked to the increasing cost of imported concentrates and the high price of maize
- lack of availability of day-old chicks
- insufficient follow-up research

The potential for increased poultry production is enormous, based on

- the largely open market for eggs and broilers
- strong popular interest in this activity, which generates income for both rural and urban people and provides food security
- the wide range of available stock: chickens, guinea fowl, ducks, etc.

Recommendations for the poultry sub-sector are as follows:

(2.23) Support and improve village poultry production through simple and inexpensive intervention programs: vaccination, regular de-worming, habitat improvement, and feeding improvement. For exchanges of information and experience, look to Burkina Faso and Gambia which have acquired considerable expertise in this area.

(2.24) Encourage the creation of modern, intensive poultry production through control of

- *day-old chick production*
- *feed production*
- *the supply of veterinary medicines and other products*
- *marketing channels for poultry products.*

Pigs

Major constraints on pig production in the region include

- diseases, especially trypanosomiasis, internal parasitosis and African swine fever
- limited availability of feed grain, especially maize, mainly in traditional livestock systems
- socio-cultural and religious restrictions in regions with Muslim populations
- difficulties with pork distribution.

In areas afflicted by African swine fever, production is low but demand high. Production deficits in the region are compensated for by substantial imports of raw pork, canned meat products and cooked dishes.

Recommendations for the pig sub-sector are as follows:

(2.25) Due to the perennial threat posed by the African swine fever virus, strengthen health legislation and policy.

(2.26) Improve animal habitat in the traditional sector and encourage the introduction of modern production systems.

(2.27) Ensure the production of genetically improved piglets.

(2.28) Control animal feeding.

(2.29) Encourage the creation of pork processing industries and set up reliable marketing channels.

(2.30) Set up exchanges between Africa and Asia, a continent where piglet production is well developed.

Mixed Livestock Systems

Mixed systems are an effective way to intensify livestock production and are providing significant market opportunities in areas where such activities are gaining in importance as yields go up.

Recommendations concerning mixed livestock systems are as follows:

(2.31) Encourage mixed animal production, especially pigs in association with pond-raised fish and poultry in association with pond-raised fish.

(2.32) Encourage research into the synergy of different mixed production activities with a view to maximizing benefits.

Non-Conventional Livestock Production

Recommendations for non-conventional production are as follows:

(2.33) Given that wild ruminants are trypanotolerant and able to exploit poor-quality pasture land successfully, the well-planned development of these species in their natural habitat should be promoted.

(2.34) The production of micro-livestock such as guinea pigs, grass cutters, Gambia rats, bees and giant snails should be encouraged.

Crop-Livestock Associations

Recommendations are as follows:

(2.35) Crop-Livestock associations in which organic manure can be used to fertilize soils should be promoted.

(2.36) The production of alternative draught animals such as horses and asses should be encouraged in those areas to which they are well adapted.

On-Farm Diversification

Recommendations are as follows:

(2.37) Livestock farmers should diversify their production so as to cope better with economic hard times.

(2.38) Furthermore, they should be engaged not only in mixed farming but also, at the same time, in product processing and marketing.

Processing and Marketing of Animals and Animal Products

For highly perishable animal products such as milk and meat, the following measures are recommended:

(2.39) Create dynamic animal production sub-sectors with infrastructure adapted to rural and peri-urban areas, such as modular slaughter houses and small milk processing centres in rural zones and refrigerated slaughter houses and modern dairy facilities in urban centres.

(2.40) Create a regional centre for extension and information on methods of milk collection and of milk and meat processing. The aim is to ensure outlets for farm products by promoting their preservation, diversification (cheese, canned goods and so on) and marketing.

(2.41) Encourage the improvement of traditional products through the introduction of appropriate methods.

(2.42) Reinforce quality control of animal products, especially in large urban centres.

(2.43) Step up commercial development of slaughter house by-products such as leather, skins, blood and fat.

(2.44) Improve marketing channels for both livestock and livestock products in the sub-region.

Report of Working Group 3: Institutional Environment

Chairperson: W. van Vuure, European Union, DGXII

Rapporteur: A. Douati, Ministry of Agriculture and Animal Resources, Côte d'Ivoire

Issues and Discussion

The working group reviewed the plenary presentations and analyzed the discussions that followed. It summarized the salient ideas gleaned from the subjects covered by the papers and pinpointed the central issues. Below is a brief account of the working group's analysis. The recommendations following it were formulated with direct reference to the identified issues.

Public versus Private Roles

The group discussed the changing roles of the public and private sectors in livestock development. In this redistribution of roles, it noted a transfer of responsibilities from government to private operators such as professional associations, non-governmental organizations and newly established credit-granting institutions. All these institutions serve as new intermediaries between the donors and producers/beneficiaries. This change in government role is considered unavoidable.

One major concern is that the transfer of functions from the State to the private sector is not being done gradually and smoothly. This is mainly due to several factors:

- inadequate training and organization within the private sector
- lack of resources
- inadequate legal framework to deal with new trends in the livestock sector.

Higher Education

The paper on the role and place of higher education raised the issue of inadequate training of managers in the livestock sector. The paper addressed the lack of appropriate staff in our universities to deal with the new trends in the sector and the poor working relations between universities on the one hand and research and development institutions on the other hand. The universities do not seem to be well-informed about training needs and have difficulty in seeking alternative sources of financing for training.

International and Regional Bodies

Although the role and place of international and regional institutions is well-defined, we cannot say the same for their impact on livestock development. These institutions do not offer adequate support to national institutions. This is mainly because of competition for funds amongst institutions, poor coordination of their activities, and the fact that African institutions are not sufficiently represented in regional and international organizations. The major problem here lies in the lack of coordination among national, regional and international institutions in the assignment of tasks and in the use of external funding. The most notable constraints are the lack of standardized policy among donors and insufficient communication among institutions operating in the same areas.

International Research

The issue of international research institutions is a specific example of the general situation discussed above. The working group discussed the real impact of system-wide and eco-regional initiatives on the humid and sub-humid zones of sub-Saharan Africa in general, and West Central and Africa in particular. It was feared that ILRI's new global mandate, which is not backed by a substantial budget increase, could be detrimental to Africa. Finally, the group agreed that we have to examine seriously the issue of the status of national agricultural research institutions and our responsibility to set out research priorities in the new global system.

Following this analysis, we noted that the major problem posed by ILRI's global mandate is the institution's diminishing focus on livestock in Africa.

Recommendations

From the considerations presented above, the working group made the following recommendations:

(3.1) Governments should formulate strategies to transfer some livestock responsibilities from the public to the private sector. As a first measure, over the short term, a legal code for private operators should be established. The costs for doing so are relatively low. Over the medium term, governments, donors and professionals should foster the creation of professional organizations. This can be done through consultation, training and financial and technical support. The costs of such support measures will be relatively high.

(3.2) All levels of training should be adapted to the evolving needs of livestock producers. In the short term — say, within two years — a survey of training needs in the region should be carried out by organizations such as FAO and the African Development Bank. Over the medium term, governments and training institutions should adapt curricula to suit the emerging needs of the livestock sector. Both the survey and curriculum changes are considered low-cost measures.

(3.3) Consultation and coordination mechanisms among donors and national and regional institutions should be enhanced to adapt their mandates to their intervention capacities, through joint programmes.

(3.4) *Donors should coordinate and standardize livestock sector policies.* Specifically, they should consult regularly with one another and provide timely information to beneficiary institutions and governments. The costs of doing so are minor.

(3.5) *Its global mandate notwithstanding, ILRI is requested to enhance its primary role, namely to support livestock development programmes in sub-Saharan Africa.* To this end, ILRI should, in the short term, solicit the participation of African national agricultural research systems in the development of its research programs.

(3.6) *We call upon sub-Saharan African countries and African and regional organizations such as the African Development Bank to show interest in livestock development by contributing to the funding of regional and national research programmes.*

(3.7) *Donors as well as international and national research organizations should offer more support to CORAF (an association of African agricultural research managers) to enable it to engage in scientific development and coordinate livestock research in West and Central Africa.* In the short term, CORAF should draft a fundable action plan. Over a period of two to three years, a series of liaison meetings should be held between CORAF and national institutions. The costs of such liaison work will be moderate.

National Organizing Committee for the Seminar

Ministry of Agriculture and Animal Resources, Côte d'Ivoire

Dr Luc KOFFI (Committee Chairperson), Director General, Animal Resources
Dr Jules ABO SOH, Director of Veterinary Services
Dr Henri BOSSE, Director of Livestock Production
Dr Camille DADJO, Veterinary Services Directorate
Dr Koffi KOUASSI, Veterinary Services Directorate
Dr Ibrahima BAKAYOKO, Livestock Production Directorate
Mr Appry AGOBLE, Livestock Production Directorate
Mrs Laurette BOETTE, Veterinary Services Directorate

Support Team

Mrs Loboué LEVRY
Mr Jean DJATCHI
Miss Hortense FANNY
Miss Bertine CHETAGNI
Mr Mathieu ABONOU YAPI

Participants/Contributors

Participants and contributors are listed by the country of their given address. The countries are in alphabetical order.

BELGIUM

ADIGO, V.
ACP Secretariat
Avenue Georges Henri 451
B-1200 Bruxelles
BELGIUM
Tel: (32) 2 743 0600
Fax: (32) 2 735 5573
Telex: 26558 ACP-B

MORTELMANS, J.
Member, CTA Advisory Committee
Professor Emeritus
Institute of Tropical Medicine
Nationalestraat 155
B-2000 Antwerpen
BELGIUM
Tel: (32) 3 827 1664
Fax: (32) 3 216 1431
Telex: 31648 (via IMT)

VAN VUURE, W.
Commission of the European Union
DGXII B/4
Rue de la Loi 200
B-1049 Bruxelles
BELGIUM
Tel: (32) 2 295 86 66
Fax: (32) 2 296 62 52

BENIN

SIDI, Latifou
Directeur de l'Élevage
Ministère du Développement Rural
BP 03-2900, Cotonou
BENIN
Tel: (229) 33 02 85
Fax: (229) 33 54 08

MEDENOU, T.K. Christophe
Chargé des Productions Animales
Ministère du Développement Rural
BP 03-2900, Cotonou
BENIN
Tel: (229) 33 02 85
Fax: (229) 33 54 08

BURKINA FASO

NAGALO, Marcel
Secrétaire Permanent de la
Coordination de la Politique de
l'Élevage
Ministère de l'Agriculture et des
Ressources Animales
01 BP 6607, Ouagadougou 01
BURKINA FASO
Tel: (226) 31 52 90
Fax: (226) 31 63 07

NANEMA, M.
Coordonnateur National du
Programme Sectoriel d'Appui à
l'Élevage
Ministère de l'Agriculture et des
Resources Animales
BP 6607, Ouagadougou 01
BURKINA FASO
Tel: (226) 31 52 90 / 31 84 74
Fax: (226) 31 63 07

OUEDRAOGO, Moumouni
CIRDES
01 BP 454
Bobo Dioulasso 01
BURKINA FASO
Tel: (226) 97 20 53 / 97 22 87
Fax: (226) 97 23 20

PODA, Godefroid
Directeur de la Santé Animale
Ministère de l'Agriculture et des
Resources Animales
03 BP 7010, Ouagadougou 03
BURKINA FASO
Tel: (226) 33 32 49

TOURÉ, Saydil M.
Directeur
CIRDES
01 BP 454, Bobo Dioulasso 01
BURKINA FASO
Fax: (226) 97 23 20

CAMEROON

DOUFFISSA, Albert
Sous-Directeur de la Formation
MINEPIA
Yaoundé
CAMEROON
Fax: (237) 22 14 05

ENGUELE GUELE, É.
Directeur Général
Société de Développement et
d'Exploitation des Productions
Animales (SODEPA)
BP 1410, Yaoundé
CAMEROON
Tel: (237) 30 24 28
Fax: (237) 22 18 73

CANADA

TOOMEY, Gerald
Proceedings Editor
B.P. 4296 Kirks Ferry
15, chemin Brown
RR1 Chelsea, Québec J0X 1N0
CANADA
Fax: (1) 819 827 1504
E-mail: g.toomey@cgnet.com

CENTRAL AFRICAN REPUBLIC

BEREKOUTOU, Mathieu
Directeur Général, ANDE
BP 1509 - Bangui
CENTRAL AFRICAN REPUBLIC
Tel: (236) 61 69 60 / 61 67 55 / 64
00 13
Fax: (236) 61 60 83

EREPE, Basile
Chargé de Mission (Élevage)
Ministère de l'Agriculture et de
l'Élevage
BP 786, Bangui
CENTRAL AFRICAN REPUBLIC
Tel: (236) 61 19 31
Fax: (236) 61 55 95
Telex 5290 RC

KOTA-GUINZA, Alphonse
Directeur Général
Fonds Interprofessionnel du
Développement de l'Élevage (FIDE)
BP 996, Bangui
CENTRAL AFRICAN REPUBLIC
Tel: (236) 61 17 76 / 61 09 77
Fax: (236) 61 29 36

CONGO

ANVOUO, Daniel
Vétérinaire Inspecteur
Conseiller à l'Élevage
Ministère de l'Agriculture et de
l'Élevage
BP 2453, Brazzaville, CONGO
Tel: (242) 83 35 63
Fax: (242) 83 23 93

BASSOUKISSA, Jean Marie
Directeur de l'Élevage
Ministère de l'Agriculture et de
l'Élevage
BP 83 Brazzaville
CONGO
Fax: (242) 83 23 93

YERMO, Francisco
Expert on Training
Delegation of the European
Commission
Av. Lyautey, near Hotel Meridien
BP 2149, Brazzaville
CONGO
Tel: (242) 83 38 78 / 83 37 00
Fax: (242) 83 60 74
Telex: DELEGFED 5257

CÔTE D'IVOIRE

ABO SOH, Jules
Directeur des Services Vétérinaires
Ministère de l'Agriculture et des
Ressources Animales, BP V 84,
Abidjan, CÔTE D'IVOIRE
Tel/Fax: (225) 21 68 63

ACKAH ANGNIMAN, Pierre
Direction de l'Appui aux
Organisations Professionnelles
Agricoles
Agence Nationale de l'Appui au
Développement Rural
BP V 183, Abidjan
CÔTE D'IVOIRE
Tel : (225) 21 82 34
Fax : (225) 21 10 58

DOUATI, A.
Sous-Directeur de la Santé Animale
Ministère de l'Agriculture et des
Ressources Animales
BP V 84, Abidjan
CÔTE D'IVOIRE
Tel/Fax: (225) 21 68 63

GADJI, Honoré
Conseiller Technique
Ministère de l'Agriculture et des
Ressources Animales
BP V 84, Abidjan
CÔTE D'IVOIRE
Tel/Fax: (225) 21 68 63

KOFFI, Luc
Directeur Général
Ministère de l'Agriculture et des
Ressources Animales
BP V 84, Abidjan
CÔTE D'IVOIRE
Tel/Fax: (225) 21 68 63

ETHIOPIA

EHUI, Simeon K.
Agricultural Economist
Head, Socio-Economic Science
Division
ILRI, PO Box 5689
Addis Ababa, ETHIOPIA
Tel: (251) 1 61 32 15
Fax: (251) 1 61 1892
E-mail: s.eui@cgnet.com

FRANCE

RICHARD, Didier
CIRAD-EMVT
2477, avenue du Val de Montferrand
BP 5035
34032 Montpellier Cedex 01
FRANCE
Tel: (33) 67 59 37 17
Fax: (33) 67 59 37 95

GABON

NOMSI, Josette
Directeur de l'Élevage
Ministère de l'Agriculture, de
l'Élevage et du Développement Rural
BP 43, Libreville
GABON
Tel: (241) 72 03 82 / 72 24 42
Fax: (241) 72 82 75

GAMBIA

TOURAY, Bakary N.
Deputy Director General
International Trypanotolerance Centre
PMB 14, Banjul
GAMBIA
Tel: (220) 462 928/9 or 462 925
Fax: (220) 462 924

TOURAY, Omar
Department of Livestock Services
Ministry of Agriculture
Abuko
GAMBIA
Tel: (220) 47 28 20
Fax: (220) 22 89 98

GERMANY

LAWRENCE, Peter
Department of Animal Production in
the Tropics and Subtropics (480)
Universität Hohenheim
Centre for Agriculture in the Tropics
and Subtropics
Garbenstrasse 17
D-70593 Stuttgart
Tel: (49) 711 459 3645
Fax: (49) 711 459 3170
Telex: 722959

SELMİ, E.
REAPER Secretariat
c/o GTZ, Dept. 422
PO Box 5180
Dag-Hammarskjöld Weg 1-2
D-6236 Eschborn
GERMANY
Tel: (49) 61 96 790
Fax: (49) 61 96 79115
E-mail: elyazid.selmi@gtz.de

GHANA

BOSUNER, Henning
Delegation of the European
Commission
81 Cantonment's Rd
PO Box 9505 KIA Accra
GHANA
Tel: (233) 21 77 42 36
Fax: (233) 21 77 41 54

LARYEA, A.M.
Deputy Minister for Agriculture
Greater Accra Regional Coordinating
Council
PO Box M 196, Ministries Post
Office
Accra, GHANA
Fax: (233) 21 22 15 55

MOSI, A.K.
Agricultural Director of Animal
Production
PO Box 5779, Accra-North
GHANA
Tel (233) 21 66 63 74
Fax: (233) 21 22 15 55

GUINEA

TRAORE, Amara
Conseiller chargé de l'Élevage
Ministère de l'Agriculture et de
l'Élevage et des Forêts
Direction nationale de l'Élevage
BP 599, Conakry, GUINEA

GUINEA-BISSAU

MENDES, Henrique
Directeur des Services d'Élevage
Ministère du Développement Rural et
de l'Agriculture
Rue Corca So
CP 26
GUINEA-BISSAU
Tel: (245) 22 13 93 / 22 14 93
Fax: (245) 25 27 74

NAMA, Nhasse
Chef de Division des Études,
Programmations et Suivi des Projets
Direction des Services d'Élevage
Ministère du Développement Rural et
de l'Agriculture
Rue Corca 50, CP 26
GUINEA-BISSAU
Tel: (225) 22 13 93 / 22 14 93
Fax: (245) 25 27 74

ITALY

LAMBERT, J.C.
Meat and Dairy Service
Animal Production and Health
Division
Food & Agriculture Organization of
the United Nations
Via delle Terme di Caracalla
00100 Rome
ITALY
Tel: (39) 6 52 25 47 01
Fax: (39) 6 52 25 31 52
Telex: 625852

KENYA

MASIGA, W.N.
OAU/IBAR
PO Box 30786, Nairobi
KENYA
Tel: (254) 2 33 85 44
Fax: (254) 2 33 20 46
Telex: 22 893 IBAR

NETHERLANDS

HOSTE, Christian
ISNAR, PO Box 93375
2509 AJ The Hague
NETHERLANDS
Tel: (31) 70 349 6100
Fax: (31) 70 381 9677
E-mail: c.hoste@cgnet.com

NARAIN, T.M.
Conseiller Spécial
CTA
Agro Business Park 2
6708 PW Wageningen
NETHERLANDS
Tel: (31) 317 467100
Fax: (31) 317 460067

SÈNE, Djibril
 Membre du Comité Consultatif du
 CTA
 Président, Commission du
 Développement Rural et de
 l'Hydraulique
 Assemblée Nationale
 BP 86, Dakar
 SENEGAL
 Fax: (221) 22 73 87
 Tél. (221) 22 55 73
 Telex: 222887 asnat sg

SIERRA LEONE

KANU, Bai Henry
 Officer-in-Charge of the Production
 Unit
 Livestock Division
 Department of Agriculture & Forestry
 Youyi Building, Brookfields
 Freetown
 SIERRA LEONE
 Tel: (232) 22 242 167
 Fax: (232) 22 242 128

SIDI BAH, Mohamed
 Officer-in-Charge
 Livestock Planning
 Department of Agriculture & Forestry
 Youyi Building, Brookfields
 Freetown
 SIERRA LEONE
 Tel: (232) 22 242 167
 Fax: (232) 22 242 128

TOGO

ADOMEFA, Kossi
 Coordonnateur réseau Élevage
 Directeur Scientifique - Inst. de
 Recherche
 s/c DNRA
 BP 1163, Lomé
 TOGO
 Tel: (228) 25 21 48
 Fax: (228) 21 87 92

NAPALA, A.
 Vétérinaire-Inspecteur
 FAO, Projet de Lutte contre la
 Trypanosomiase Animale
 BP 114, Sokode
 TOGO
 Tel/Fax: (228) 50 00 07

UNITED KINGDOM

JAMES, Andrew
 University of Reading
 V.E.E.R.U. Unit
 Department of Agriculture
 PO Box 236
 Reading RG6 6AT
 UNITED KINGDOM
 Tel: (44) 1734 264 888
 Fax: (44) 1734 262 431

PICÃO, Vitor
 University of Reading
 V.E.E.R.U. Unit
 Department of Agriculture
 PO Box 236
 Reading RG6 6AT
 UNITED KINGDOM
 Tel: (44) 1734 264 888
 Fax: (44) 1734 262 431
 E-mail: veeru@reading.ac.uk.

REYNOLDS, Sarah
 World Radio for Environment &
 Natural Resources (WREN)
 Lodge Farm
 Fressingfield
 Eye, Suffolk IP21 5SA
 UNITED KINGDOM
 Tel: (44) 1379 58 67 87
 Fax: (44) 1379 58 67 55
 Telex: 987703

USA

CHABEUF, Noël
Senior Livestock Specialist
The World Bank
AF3AE Room J 6062
1818 H Street, N.W.
Washington, D.C. 20433
USA
Tel: (1) 202 473 7554
Fax: (1) 202 473 5147

ZAIRE

ALI, Ramazani
Directeur de la Production et Santé
animales
Ministère de l'Agriculture et du
Développement Rural
BP 8722, Kinshasa
ZAIRE
c/o Masimango NDYANABO
PDG
INERA, Direction Générale
BP 2037, Kinshasa I
ZAIRE
Tel: (243) (1) 33334
Fax: 871 150 3261 (UNDP)
Telex: 21164 UNDP

MATESO, Wabubyula
Directeur des Études et Planification
Ministère de l'Agriculture et du
Développement Rural
BP 8722, Kinshasa
ZAIRE
c/o Masimango NDYANABO
PDG
INERA, Direction Générale
BP 2037, Kinshasa I
ZAIRE
Tel: (243) (1) 33334
Fax: 871 150 3261 (UNDP)
Telex: 21164 UNDP

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Nigeria
Togo
Zaire

Organizations which made brief oral presentations:

Centre International de Recherche-Développement sur l'Élevage en Zone Subhumide (CIRDES)

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