ILCA: Objectives and achievements

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SUMMARY

ALTHOUGH FOOD production per capita has increased in Asia and Latin America over the past decade, in Africa it has continued to decline. The African continent now imports large and increasing amounts of food to feed the growing population.

The International Livestock Centre for Africa was established in 1974 to improve livestock production in sub-Saharan Africa. The overall objective of ILCA is to identify the key constraints to production in the major livestock systems of Africa and to find ways of alleviating these constraints. ILCA seeks specifically to develop and exploit the complementarity between livestock production and food crop production and to use increases in livestock output to generate the incremental case that subsistence farmers need to purchase fertilizer, seeds and other food crop inputs.

ILCA's research concentrates on ruminant livestock and uses a farming systems approach to isolate production problems. The central research units at headquarters are complemented by field programmes located in the major ecological zones of sub-Saharan Africa.

Research in these ecological zones emphasizes the selection of appropriate forage legumes to stimulate both food crop and livestock production. Studies on animal draught power focus on improved methods for land cultivation and on constructing surface water ponds. In the pastoral areas, ILCA's work has shown that the simple sealing of water-holding ponds associated with deep wells, and the use of ox-drawn scoops to desilt surface ponds, greatly increases the efficiency of water use. Animal nutrition studies focus on dry season feed and mineral deficiencies, the mortality of young stock and the competition between pastoral herders and calves for limited milk supplies. ILCA's studies on livestock genetics have highlighted the good productivity of trypanotolerant stock in areas of moderate infection.

ILCA has established African networks in trypanotolerance, animal nutrition, forage production and documentation. A collaborative programme on satellite imagery between ILCA and NASA focuses on the development of early warning systems for drought and the aerial survey team has developed a rapid resource inventory technique for development planning. The Livestock Policy Unit, newly established, has studies under way covering the financing of livestock services in Africa, the factors affecting the performance of the livestock sector and the effects of imports of dairy products on domestic consumption.

The long-term potential for sustained increases in agricultural production in Africa is high. ILCA's experience has brought to light realistic ways by which this potential can be realized.

The 'quantitative' techniques available for the appraisal and ranking of research proposals and for the allocation of resources are fragile, cumbersome and time-consuming. The process of the allocation of funds at ILCA begins with the wide focus of a systems approach. The areas where ILCA can achieve the greatest impact are then identified. ILCA aims to undertake only those activities where the Centre has a specific advantage over national research organisations, and which complement and strengthen national research efforts.

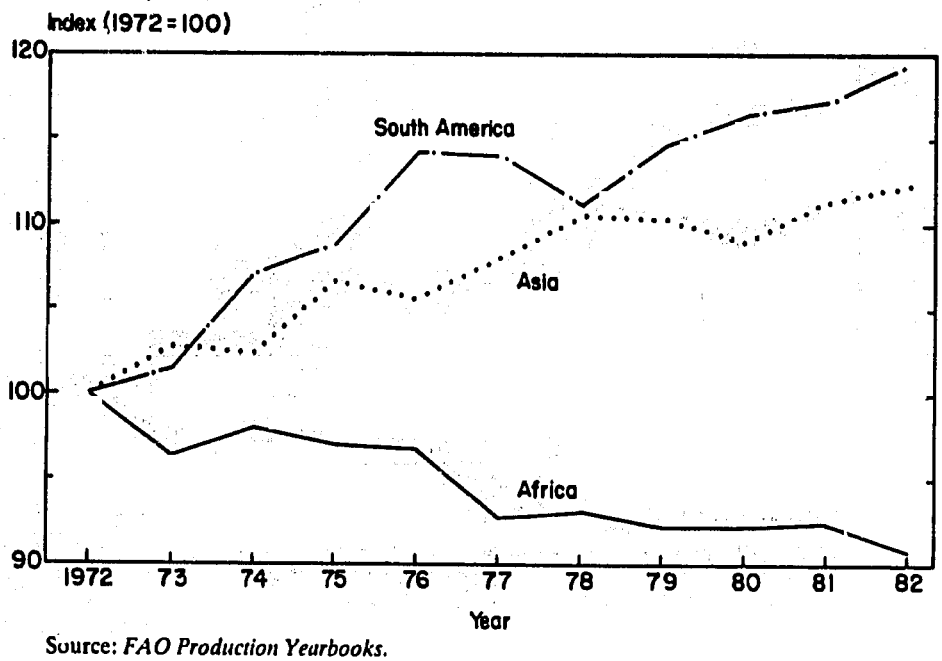
INTRODUCTION

The food crisis in Africa is likely to dominate the thinking of many people concerned with development in the Third World for the foreseeable future. It is now clear that the shortage of food in many countries of Africa is not transitory and is not simply due to drought. There is inadequate food produced in Africa, and there is poor food distribution from areas of plenty to those in need. The poverty of those working Africa's small farms results in hunger and malnutrition even in countries where overall food supplies may be adequate. Such poverty also prevents the investment in seeds and fertilizers that is necessary to reverse the downward trend in food availability.

The food crisis in Africa will not be solved by ad-hoc or short-term remedies. The problems are long-term and involve difficult policy, infrastructural and technical issues. Livestock and crop yields in Africa remain low and there are few technical improvement packages available for smallholder farmers. Research has had little impact on food production in Africa while the 'green revolution' has improved food production in Asia and Latin America dramatically (Figure 1).

Four fifths of Africa's population are involved in agriculture, and about half of Africa's GDP comes from the agricultural sector. However, the organisation of agriculture in Africa differs from other developing regions of the world. Almost all African farms are small and land ownership is very evenly spread. There is a tradition of pastoralism and shifting cultivation in many areas of the continent. Under the subsistence farming conditions that prevail farmers and their families eat most of their agricultural produce; remarkably little is actually marketed. The main source of the cash income of many of these subsistence farmers is livestock. In these circumstances, increased livestock sales enable small farmers to earn the cash to purchase the fer-

Figure 1. *Index of food production per capita in Africa, South America and Asia, 1972 to 1982.*



Source: *FAO Production Yearbooks.*

tilizer and better seed needed to increase grain production. It is now increasingly clear that improvement in livestock output acts as a powerful catalyst to growth. This is clearly observed in the national output figures of Africa; those countries with the largest increase in livestock output are also those countries with the largest increase in food grain production (Table 1).

Until recently the slow pace of Africa's agricultural development was thought to be due to a failure to make effective use of available technology. Large sums of foreign exchange were spent on agricultural projects which involved the import of techniques and equipment. There is now general agreement that the results of most of these projects were poor. It has become clear that we need to know more about the production systems we are trying to improve if the improvements generated are to give long-term benefit to food production in Africa.

The information available on the changes in cereal, meat and milk production in sub-Saharan Africa in the 1970s are summarised in Table 1. While food production overall increased over the decade, the population of African countries also increased markedly, and food production per capita decreased. This decrease has been offset by a marked rise in food imports (Figures 2 and 3).

Although the offer of higher prices to producers would increase production, this would also result in higher consumer prices, thus making the overall development effort more difficult. Increased output with lower production costs is sorely needed – but this will only be feasible with the development and adoption of improved and appropriate technology and the ready availability of production inputs such as fertilizers and vaccines. The major source of improvement in agricultural production must be technical change.

OBJECTIVES

The International Livestock Centre for Africa (ILCA) was established in 1974 by the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is a group of donor agencies and governments who seek to provide long-term support for agricultural development in the Third World.

ILCA's task is to apply existing knowledge to improve livestock production in sub-Saharan Africa and to undertake research on major gaps in that knowledge. Initial emphasis was given to the transfer of existing techniques but the experience of ILCA and other organisations in this technology transfer is well summarised by Evenson and Kislev (1975) who noted that "programmes designed to transplant 'modern' technology continuously come up against the realization that the technology offered had little or no advantage over the old and traditional methods, given the economic, soil and climatic conditions facing producers".

More recently at ILCA greater emphasis has been placed on original research, particularly that aimed at understanding how key changes in vital parts of a livestock production system might improve the productivity and efficiency of the system as a whole. The overall research objective at ILCA is to identify the key constraints to production in the major livestock systems of Africa and to find ways to alleviate these constraints.

The association of increases in crop production and those in livestock production, and the critical role that livestock play in improving cash flow and reducing risks for Africa's poor farmers, has been outlined elsewhere (Brumby, 1984). The role of livestock in stimulating economic growth is based on livestock's potential for generating sustained increases in the cash income of subsistence farmers. Such increases then enable poor farmers to purchase the agricultural inputs needed for increases in food grain production. It is on this that the complementarity between livestock output and crop production is based, with an increase in the former quickly leading to an upturn in the latter.

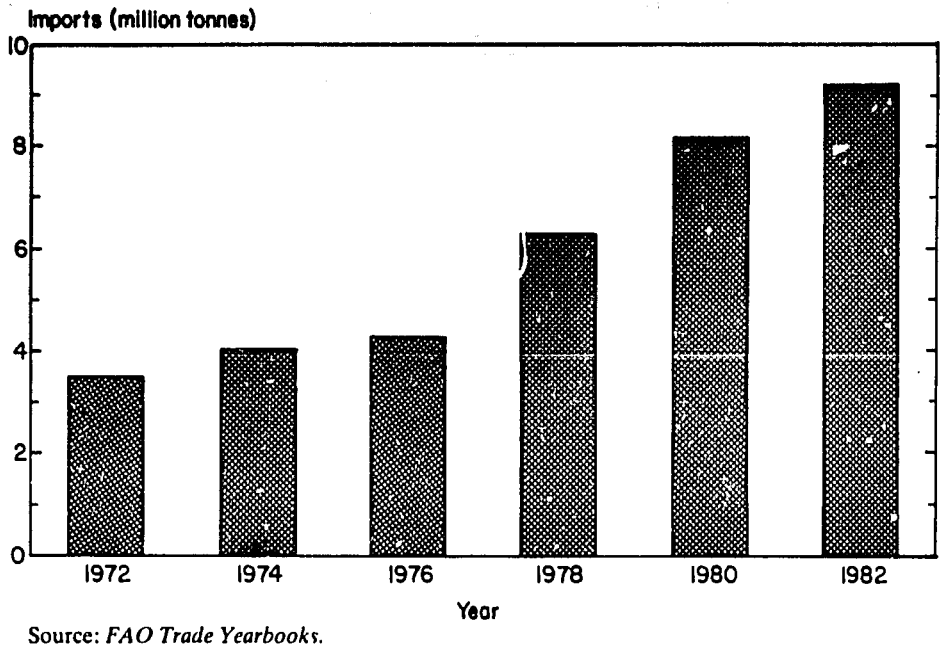
Table 1. *Percentage changes in food production in sub-Saharan Africa, 1969/71 to 1979/81.*

		Percentage change	
	Average change[a]	Best 6 countries	Worst 6 countries[b]
Cereal production	12.3	25.62	3.62
Cereal yield (kg/ha)	2.8	5.91	-9.89
Cattle numbers	16.1	26.35	2.32
Meat production	27.8	40.28	16.36
Milk production	21.8	35.41	9.75

[a] Weighted average of percentage change in the decade, 48 countries.

[b] Excluding countries producing < 0.5 million tonnes cereal grain per year.

Figure 2. *Cereal imports by sub-Saharan Africa, 44 countries, 1972 to 1982.*



Source: *FAO Trade Yearbooks.*

ILCA specifically seeks to develop and exploit this complementarity and to expand the critical role of livestock as a source of incremental cash income for subsistence farmers.

STRUCTURE

Resources

Approximately 60% of ILCA's annual budget is allocated to research, reflecting the major orientation of the Centre. About 10% of the budget is currently allocated to training and 10% to information. The remainder is used to cover the costs of hostels and catering, transport, building maintenance and administration. Staff salaries account for 50% of the total budget, allowing adequate funds for equipment and other support.

Research characteristics

ILCA's research activities are characterised by a concentration on ruminant livestock. Research activities focus on a farming systems approach used principally to define component research problems and to test and evaluate technical interventions. Research at ILCA is further characterised by a centralised research administration with decentralised field research groups situated in the major ecological zones of Africa.

The Centre's headquarters provide core facilities and services for the Centre as a whole. The central research units at headquarters provide specialised research support for ILCA's field programmes and carry out research on topics of relevance that transcend ecological zones and national boundaries. ILCA's departments, research units and field programmes are listed in Figure 4.

Training

An increasingly important activity at ILCA is the training of African research scientists. It is aimed at increasing the knowledge and specialist skills of African scientists in livestock research and production techniques. Emphasis is placed on short courses in areas of key importance together with workshops and seminars designed for research planners, administrators and managers, and for development personnel. Increased collaboration in post-graduate degree training with national universities is now also under way.

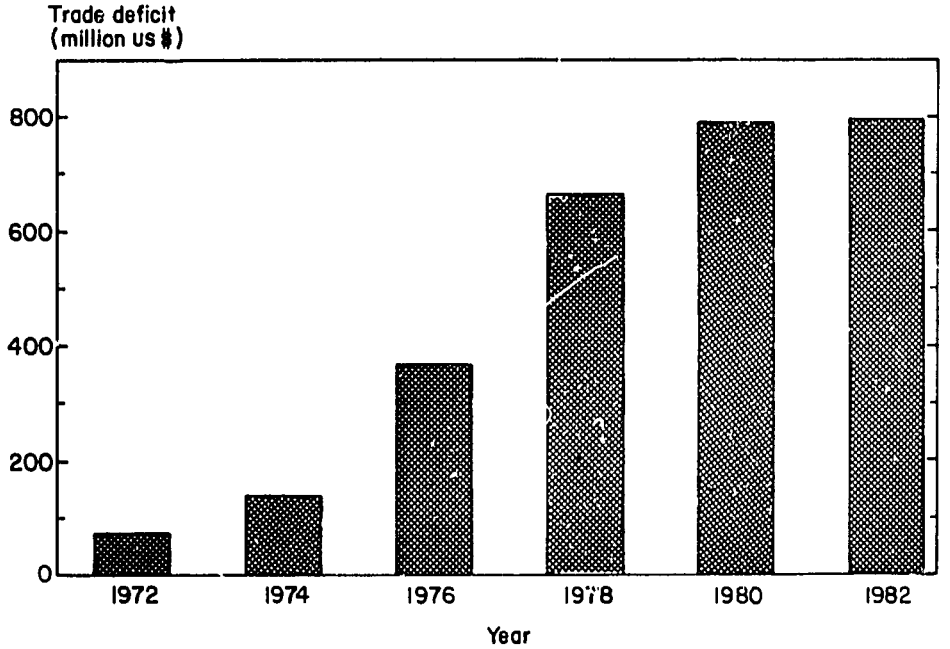
Information

The Library and Documentation Section forms the central part of ILCA's information activities. A microfiche service for non-conventional literature collected from African countries and a computerised information storage and retrieval system are further key components. This system provides free of charge, and on a monthly basis, a selective and personalised abstract service for research workers throughout Africa.

ACHIEVEMENTS

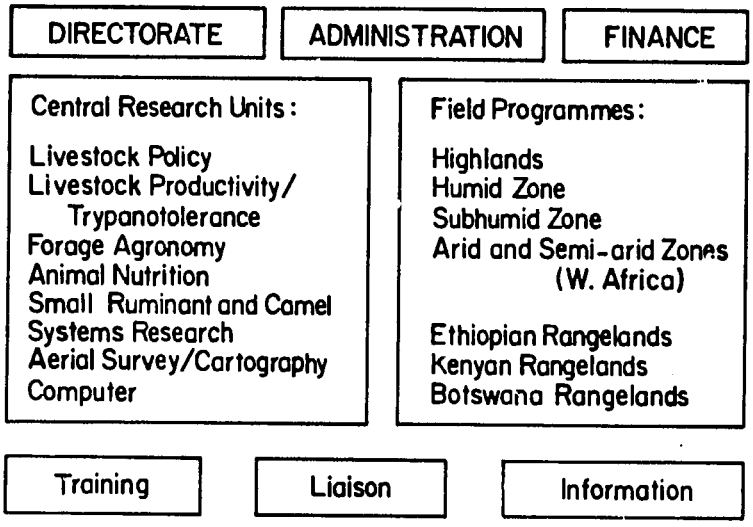
ILCA has made a substantial contribution to the improvement of research capacities of national programmes in Africa. This has been achieved through the information and documentation services, the training of African scientists, the organisation of seminars and conferences, the coordination of networks, the generation of knowl-

Figure 3. *Trade deficit in livestock products for sub-Saharan Africa, 42 countries, 1972 to 1982.*



Source: *FAO Trade Yearbooks.*

Figure 4. *The components of ILCA.*



edge on livestock production systems in Africa, and the development of new methodologies and research techniques including ILCA's approach to livestock systems research. ILCA has also assisted in the planning and review of various national research programmes, and has influenced the design and planning of new livestock development projects.

One of the more specific research objectives at ILCA is to provide a forage legume linkage between cropping and livestock enterprises, thereby promoting increases in both livestock and crop output. Phosphorus and nitrogen are two limiting factors in many soils of Africa. The use of nitrogen fertilizer is rarely practical, but in many locations it is feasible to use small amounts of phosphatic fertilizer to stimulate the growth of leguminous plants. Trials at ILCA have shown dramatic responses of forage legumes to added phosphorus. The legumes in turn fix greater amounts of atmospheric nitrogen and stimulate the yields of subsequent food crops. The increased availability of forage legumes also increases the intake, digestibility and utilisation of forages which are readily available to livestock in Africa.

The major nutritional problems of livestock in Africa occur in the dry season when the availability, quality and palatability of animal feeds is low. The use of forage legumes suited as animal feed during the dry season offers great potential for improving livestock productivity, and as described above also stimulates food crop production. Current research in the different ecological zones now includes the selection of appropriate legumes for incorporation into the major farming systems.

For example, in the semi-arid zone of West Africa cowpea – millet intercropping has been found to enhance greatly the value of cereal crop residues and to increase total crop yields compared with traditional practices. In the subhumid zone, fodder banks of *Stylosanthes* spp. are providing an excellent dry season grazing resource for agropastoralists and their cattle. In the humid areas alley cropping, with *Gliricidia* and *Leucaena* spp. grown in rows across fields of cereals, is giving improved feed for small ruminants and improved yields of food crops. In the highlands, annual native *Trifolium* spp. sown with very small amounts of phosphate are greatly increasing forage yields on crop fallows.

Cattle in Africa have many functions, and animal draught power is particularly important in the more densely populated arable areas. ILCA has aimed to increase the efficiency of animal traction and has successfully developed a 'single-ox plough' to replace the conventional plough drawn by two oxen. Another modification of the traditional *maresha* in Ethiopia enables farmers to plough a broadbed furrow giving further improvements to food crop production. Surface water ponds have also been constructed using ox-drawn scoops, and improved drainage of heavy clay soils has been achieved by modifying the conventional method of flat-bed cultivation.

In the highlands ILCA has developed an improvement package comprising the use of crossbred dairy cattle, legume forage crops, the processing of surplus milk into boiled curd cheese, water conservation in surface ponds and better land cultivation methods. This is leading to major increases in both land and labour productivity and consequently to a marked increase in the welfare of the African smallholder. This package represents relatively low-cost, intermediate technology capable of widespread applicability and adoption.

Some 40% of Africa's cattle are raised by pastoral groups in rangeland areas generally unsuited to arable farming. The scarcity of stock water limits the use of these range pastures, while very high labour requirements, in lifting water manually from deep wells and in desilting surface ponds, limit stock water supplies and reduce potential output levels. ILCA's work has shown that the simple sealing of the water-holding ponds associated with deep wells, and the use of ox-drawn scoops to desilt surface ponds, increases greatly the efficiency of water use.

In pastoral areas, calves and humans are in competition as consumers of milk from lactating cows. The widely varying wealth status of individual pastoral families, and the seasonal availability of green grass, greatly influence milk availability and cash expenditure on purchased food. When subsistence milk is in short supply consumption of purchased cereals rises markedly, as does the purchase and consumption of tea, sugar, fats and oils. Additionally calves experience high stress conditions and high mortality rates. The use of limited areas of cereal crops, alternated with a forage legume, is a most promising method for minimising these nutritional problems in pastoral areas. This approach also provides attractive alternative investment opportunities for pastoralists whose surplus cash income is traditionally invested in additional livestock.

ILCA's network activities in trypanotolerance, animal nutrition, forage production and documentation have expanded greatly and an impressive database on many aspects of livestock production in Africa, and of the factors affecting it, is being compiled. The relationships between lactation length and calving interval, between body condition and fertility, and between sex of the calf reared and subsequent conception delays, are now quite clear, as are the large differences in breed produc-

Livestock systems research at ILCA

Livestock systems research at ILCA is based on a farming systems research philosophy and seeks to:

- *understand all components and their interactions in a given farming system;*
- *identify the constraints to agricultural production within that system;*
- *design and carry out research aimed at removing those constraints;*
- *test potential improvements through on-farm or on-range trials;*
- *monitor the adoption of the improvements.*

The process is iterative, and there is overlap between its different stages. Information from the testing and extension stages is fed back into the design of improvements to the system.

Livestock systems research at ILCA is carried out by multidisciplinary teams of scientists in which generalists are backed up by specialists in all fields of livestock research. The identification, testing and assessment of improvements is a team effort.

ILCA's systems approach to research has evolved from programmes which began in 1976 in Mali, Kenya and the Ethiopian rangelands, in 1977 in Botswana and the Ethiopian highlands, in 1978 in the subhumid zone of Nigeria and in 1979 in the humid zone of Nigeria. It embraces the following stages:

1. The diagnostic stage

The diagnostic stage includes the description of the existing livestock system in order to determine the environmental, technical, economic and social context in which improvements are to be sought. This descriptive process, coupled with continuous analysis of data, leads to the identification of constraints to improved livestock production in the system.

2. The design stage

Potential improvements are then designed, and their likely impact on the natural environment and on the welfare of different social groups is assessed. How quickly an improvement will be adopted is also determined, through the more detailed study of social and economic constraints. Research sites are selected as representative of the target area for improvement. Research on the different components of the system is then carried out, taking into account the other features of the overall system. At this stage trials which are both managed and carried out by the researcher may be made on the research station.

3. The testing stage

The improvements designed in stage 2 are then tested in trials carried out by producers in the target area. Initially these trials are managed by the researcher, but subsequently by the producer himself. Comparisons are made between enterprises testing the improvements and those using traditional methods in order to evaluate the improvements and assess producers' acceptance of them. There is continuous feedback between the different stages of testing so that adjustments can be made where appropriate.

4. The application stage

Improvements which have proved successful in trials which were both managed and carried out by the farmer can then be presented for adoption through national extension services. Adoption is closely monitored so that changes in the system can be taken into account in subsequent diagnostic research.

tivity in areas of differing trypanosomiasis challenge and other environmental stresses. Very large productivity differences among grazing cattle and sheep herded in communal areas are also apparent.

ILCA's aerial survey team has developed a rapid resource inventory technique for development planning. This three-phased interlinked approach comprises remote sensing, followed by aerial surveys and complemented by socio-economic investigations on the ground. The team has also developed a new technique for surveying cropping activities as neither traditional aerial photography nor satellite imagery is suited to such surveys. The new technique uses low-altitude aerial surveys and a combination of wide-angle and telephoto photography giving enhanced resolution and clear identification of individual crop species.

The use of ground interpretation of satellite imagery at ILCA has recently increased, and a strong ILCA–NASA collaborative programme focusing on the development of early warning systems for drought is under way. A new computer programme which assesses and specifies areas of overlapping ecological characteristics has also been developed.

ILCA's Livestock Policy Unit began operations in 1983. Three major studies have focused on the financing of livestock services in Africa, the identification of factors influencing the performance of the livestock sector and the effects of imports of dairy commodities on domestic consumption, production and welfare. Initial results indicate that many governments spend on their livestock sector only a small proportion of the revenue they raise from that sector through taxation and various fees, and that an excessive and increasing proportion of expenditure on livestock services in most countries goes to staff costs with a consequent shortage of money available for vaccines, drugs and transport. A second policy study indicates strong positive correlations between growth in cereal and in livestock output, between changes in livestock output and livestock numbers, and between GNP and growth in milk output.

ILCA's research achievements in 1983 are summarised in ILCA (1984).

THE REALISTIC POTENTIAL

Africa is a huge land mass, and sub-Saharan Africa alone comprises over 42 countries. These countries constitute an extremely diversified area, and the wide variety of environmental zones can be classified as humid, subhumid, arid or highland. ILCA's mandate region is further complicated by the large number of production systems which range from sedentary mixed farming by smallholders to pastoralism. Soils and climatic conditions are frequently unsuitable for agriculture. Plant growth in many areas is highly seasonal. Under-nutrition of man and livestock alike is common.

However, the long-term potential for sustained increases in agricultural production in Africa is high. ILCA's experience in several areas of research has brought to light realistic ways by which this potential can be realized.

The work with trypanotolerant cattle is showing that these animals can produce well in areas of modest tsetse challenge. More recent work has shown that livestock not considered tolerant to trypanosomiasis can be farmed economically under controlled chemoprophylaxis in tsetse infested areas.

In the highlands the lack of surface water during the dry season can be alleviated by the construction of simple surface ponds using scoops drawn by local oxen. Further improvements in animal traction, in milk processing and in the growth of forage crops can make the smallholder farming system, which is traditional in countries like Ethiopia, much more productive.

In agropastoral situations, fodder banks of forage legumes, alley cropping using leguminous browse trees and intercropping of legumes and cereals have shown that livestock feed can be markedly improved at the same time as achieving direct beneficial effects on food crop production.

ILCA's work on African rangelands has shown that the productivity of these areas, when assessed in terms of animal protein produced per hectare per year, compares very favourably with the productivity of similarly arid areas in Australia and the USA. Large increases in the efficiency of use of feed resources are possible by providing strategic feed supplements to young stock and breeding cows and by reducing the average age of herds. Better distribution of seasonal water points can increase the effective grazing area in rangeland areas as well as reduce the problems of the household water supply. The use of ox-drawn scoops to desilt surface water ponds is particularly important in this respect. Improved sale and marketing systems facilitate destocking during times of drought, while the use of early warning systems based on satellite imagery can help reduce the danger that drought may lead to famine.

RESEARCH PRIORITIES

The 'quantitative' techniques available for the appraisal and ranking of research proposals and for the rational allocation of resources to these proposals are fragile, cumbersome and time-consuming (Brumby, 1984). Something better than the intuition and experience of research administrators in making these decisions is badly needed – but the costs and limitations of research planning must also be recognized. As Pineiro (1984) has noted, the main advantage of a formalised process of priority setting is to make more explicit some of the elements that are involved and to clarify the relative priorities agreed upon.

It is against this background that the Board and management of ILCA have to make decisions about the allocation of resources. There is a continuing struggle to balance sensibly the competing demands of research, training and information. Is the concentration on ruminant livestock justified? What priority should be given to the different ecological zones? Have the priorities for component research been correctly identified? What should be the balance of resources allocated to research on animals, pastures and crops? What should be the relative importance attached to the goals of human nutrition and income enhancement, animal health and animal nutrition, genetics and management, and meat, milk and draught power?

The process of the allocation of funds at ILCA begins with the wide focus of a systems approach. We then try to identify those areas where we can achieve the greatest impact at the lowest cost and in the least time. We try to undertake only those activities where we have a comparative advantage over other research organisations, and we seek to do those things which complement and strengthen national research efforts.

At ILCA it has not yet been possible to construct a formal, rational decision-making process that is wholly satisfactory. In desperation rather than by desire, we fall back on the experience, intuition and imagination of our scientists to determine the likely value and productivity of our research activities.

We know we must limit our research objectives. We must keep in close contact with livestock producers. We must harmonise our activities with those of national governments in Africa. But above all, we know that we must be useful.

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