

# **ITC**

**International Trypanotolerance Centre**

## **Biennial Report**

**2000 – 2001**

**ITC**  
P.M.B. 14  
Banjul  
The Gambia

## **Acknowledgements**

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International Trypanotolerance Centre (ITC)  
P.M.B. 14, Banjul, The Gambia  
Tel.: +220-462928  
Fax: +220-462924  
E-mail: [itc@itc.gm](mailto:itc@itc.gm)

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## Selected Acronyms

ADB	African Development Bank
ARI	Advanced Research Institute
BgVV	Bundesinstitut für gesundheitlichen Verbraucherschutz und Veterinärmedizin
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Germany)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (France)
CIM	Centrum für internationale Migration und Entwicklung (Germany)
CIRDES	Centre International de Recherche-Développement sur l'Élevage en zone Subhumide (Bobo-Dioulasso, Burkina Faso)
CORAF	Conseil Ouest et Centre Afrique pour la Recherche et Développement Agricoles (Dakar, Sénégal)
CRU	Collaborative Research Unit (FUB-ITC)
DGIC	Directorate General for International Cooperation (Belgium)
DIREL	Direction de l'Élevage (Sénégal)
DLS	Department of Livestock Services (The Gambia)
DNE/IRAG	Direction Nationale de l'Élevage/Institut de Recherche Agronomique (Guinée)
EDF	European Development Fund
FAO	Food and Agriculture Organization of the United Nations
FUB	Freie Universität Berlin (Germany)
GEF	Global Environment Facility
GDP	Gross Domestic Product
HIPC	Heavily Indebted Poor Countries
HUB	Humboldt Universität zu Berlin (Germany)
IAEA	International Atomic Energy Agency
IAO	Istituto Agronomico per l'Oltremare (Italy)
IARC	International Agricultural Research Centre
IDRC	International Agricultural Research Centre (Canada)
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILRI	International Livestock Research Institute
ISRA	Institut Sénégalais de Recherches Agricoles (Dakar, Sénégal)
ITM	Institute for Tropical Medicine (Antwerp, Belgium)
LISIP	Low-Input Systems Improvement Programme
MOSIP	Market-Oriented Systems Improvement Programme
MTP	Medium Term Plan
NARI	National Agricultural Research Institute (The Gambia)
NARS	National Agricultural Research System
NGO	Non-Government Organisation
PACE	Pan African Programme for the Control of Epizootics
PAPEL	Projet d'appui à l'élevage
PROCORDEL	Programme Concerté de Recherche-Développement sur l'Élevage en Afrique de l'Ouest
RFCIP	Rural Finance and Community Initiatives Project
SOLIP	Systems' Overlap and Linkages Improvement Programme
WHO	World Health Organization
WECARD	West and Central African Council for Agricultural Research and Development

## Foreword

The theme for the 2000–2001 Biennial Report “**Past Achievements Shaping Opportunities in a Changing World**” is very appropriate.

This theme succinctly reflects the Centre’s partners, management and staff belief in the progress made thus far in efforts to improve the welfare of the beneficiaries. The Centre’s Research and Development activities give even greater hope for capturing the challenges that present themselves in the future. These challenges can hopefully be transformed into larger opportunities for the benefit of stakeholders in a world that is ever changing with respect to needs in food security, employment and environmental sustainability.

Since its inception in the early 1980s, ITC’s approach to research has been to engage partners to implement activities that in the short to medium term translate into developments that benefit beneficiaries at the grassroots. Thus, the paradigm, “research for development” has been a guiding principle at the Centre. Since the publication of the last Biennial Report, the impact of the Centre’s work at the household and community level has formally been assessed in The Gambia by an independent expert, using some of the latest methodologies and tools of impact assessment.

The results of the study are summarised and presented in the first section of this Biennial Report. They clearly show that the returns to investments made by the national and international donor communities have been high. The users of technologies developed by ITC and partners experienced larger agricultural production and incomes. Also, the efficiency of their agricultural enterprises were clearly superior to comparable households in the same or similar locations who did not use such technologies. Some of these personal and social benefits did not fail to attract the attention of the Government of The Gambia and some Development Agencies. Perceptible positive attitudes on the part of the Government towards research have been recorded. At the same time the Centre re-positioned itself to embrace the need for better focusing and attainment of a more coherent research programme – one that was more consistent with the Centre’s regional mandate and a vision of becoming a regional Centre of excellence with international recognition in livestock-based agricultural research.

From 1999 to the beginning of 2001 several developments had occurred at the Centre and in its environment. These motivated changes in research programming and organisation. First, a regional consultation on livestock research priorities was initiated by ITC in Dakar, Senegal, under the aegis of CORAF/WECARD. At that time NARS Stakeholders identified the improvement of the low-input and market-oriented production sectors of the farming systems as the priority for ITC-led Research and Development. All future R & D at ITC was to be geared towards these two systems and their socio-economic components.

Secondly, the full regionalisation of activities in West Africa envisaged at the creation of the Centre needed a boost, beyond the administrative and political agreements already achieved by 1995. These agreements had been confirmed by the signing of Memoranda of Understanding with national and intergovernmental organisations in the region. In 1999, a financing agreement between ITC and CIRDES on behalf of NARS in the region on one hand and the European Commission on the other hand, for a regional Project (PROCORDEL) had created a greater opportunity to strengthen ITC’s collaboration with countries in the sub-region.

Thirdly, preparations for implementing a new Medium Term Plan had been initiated. These were based on consultations with NARS and the priorities of R & D that were identified in the process.

Against this background of developments, a re-organisation of the Centre's research structure and operations was achieved in late 2000. A Medium Term Plan for 2001 – 2004 was produced to guide these changes. Three Programmes and eleven Projects were created, and senior scientists were appointed as leaders. The second half of the Biennial Report presents these Programmes and Projects and results achieved in the implementation of R & D under them.

The reporting period also saw changes in the administrative and research personnel at the Centre. A new Director General and Regional Research Coordinator were recruited to replace the out-going officers. In addition, eight scientists from the West African region and three from Europe joined the Centre.

It is therefore clear that the Centre has “renewed” itself in terms of research content, focus, programme structure and personnel, thus moving into the future with confidence into demand-driven outputs. The timely delivery of these outputs and the impacts on affected individuals and communities in the region will however depend on availability of funds. In this connection the ITC Council, management and staff take this opportunity to express gratitude to our partners in the donor community and stakeholders for their support during the reporting period.

We look forward to your continued support in the years ahead, which are expected to be full of challenges, but will also present unique opportunities for bettering the welfare of the beneficiary communities.



Kwaku Agyemang  
Director General  
ITC

# Impact of ITC's Research and Development Activities

## Research for Development Impacting on Lives of Ordinary People

Kawusu Jarju: From a herdsman to a herd owner

Kawusu Jarju, aged 75, was not born into the traditional cattle owning tribes in The Gambia, namely the Fula and Mandinka. Mr. Jarju belongs to the Jola tribe, mainly associated with crop husbandry and artisanship. Among the Jola tribe the Jarju lineage are blacksmiths by profession. At the age of 12 he became an apprentice herdsman, under the tutelage of a fula man, grazing a small herd of cattle partly owned by his father, the rest been put together by individual Mandinka families in the village of Pirang, some 40 km east of Banjul. After the death of his father, Jarju inherited his father's animals and took over the management of the herd including those animals owned by neighbours. He was responsible for the herding, milking and tethering the livestock. As his payment for the service to other owners of animals in the herd, Mr. Jarju extracted the morning and evening milk from cows in the herd, part of which was consumed by his own family and the rest sold in the local market. From the sale of milk he bought additional cattle. He also increased his herd size by exchanging goats for calves.

He thus gradually assembled a number of cattle kept as part of a larger herd. The apprentice herdsman, coached by a fula man, has graduated to become a full herdowner.



Today, Mr. Jarju owns 36 head of cattle and also takes care of 26 for others. His son is responsible for the day to day upkeep of the herd. In 1986, Mr. Jarju became one of the eight herdowners registered in the village of Pirang to be part of an ITC-led large scale epidemiological study (involving animal health, milk recording, productivity and socio-economic monitoring) on the productivity of trypanotolerant livestock (N'Dama cattle, Djallonke sheep and West African Dwarf goats). From 1985 to 2000, Mr. Jarju and colleague livestock owners, who also engage in crop husbandry activities, took part in the testing of several intervention packages, ranging from proper watering of livestock, routine vaccinations, deworming, feed supplementation, kraal movements, to tsetse and tick control.

The sustainable adoption of these interventions beyond the “project periods” and the impact they made on the productivity of the herds of these farmers and on household welfare were the subjects of evaluation initiated in selected villages beginning in the last quarter of 2001 using The Gambia as a case study. The total well-being status of Mr. Jarju and his colleagues who participated in these interventions were compared first with farmers who owned livestock but did not participate in the ITC interventions, and again with those without livestock and lived in the same villages. Comparisons were also made with farmers in similar villages in the same region but where ITC interventions were not tested.

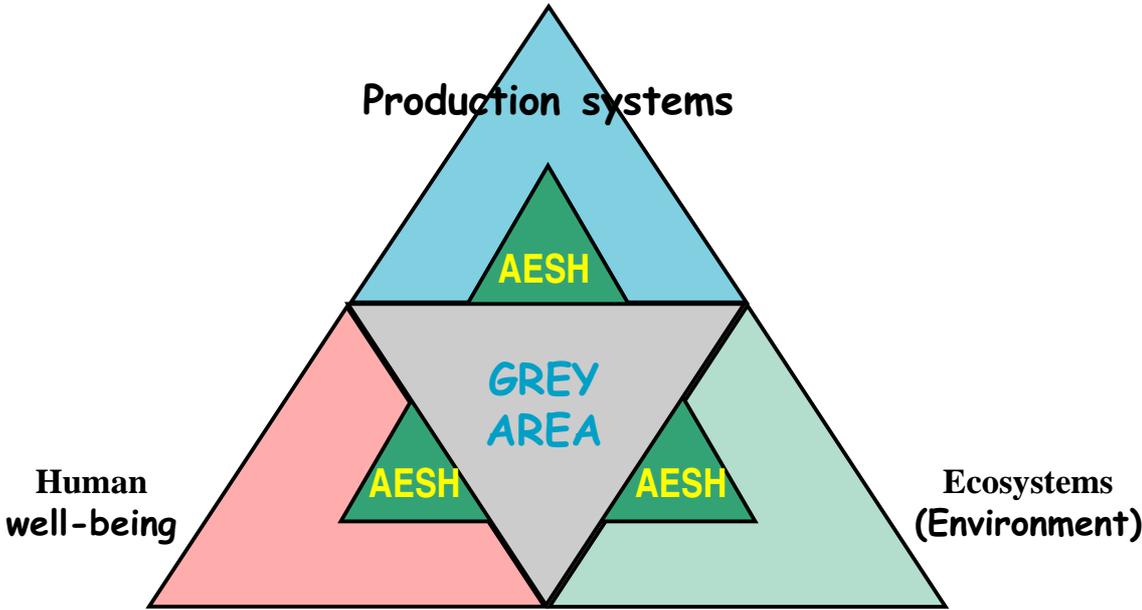
## Intervention and Impacts at what Cost?

### A “holistic” *agro-ecosystem health (AESH)* approach to impact assessment

In order to assess the impact on the whole system of which the participating farmers and their comparators were part, an all encompassing approach described below was adopted.

The framework for the socio economic impact assessment lies in tracing the translation of increased output of meat and milk resulting from ITC’s interventions into increased household income leading to improved household well-being within a healthy ecosystem. It has often been assumed that once agricultural **production**-enhancing technologies were generated and disseminated to farmers, they would lead to increased food production. Then the availability of more and better quality food could address issues of food security and poverty alleviation. The component technology approach to research and development would, therefore, intrinsically measure impacts only in terms of increased output, income, resource requirement, e.g. labour by gender, capital and credit. Whether such technology promoted crop-livestock interactions and integration or could lead to environmental degradation was left for an ‘appropriate’ **ecosystem** technology to address. As a result, it was common for the impacts of agricultural technologies on human **well-being** and ecosystem welfare, the ultimate goal of research, to be ignored or not assessed within a single survey.

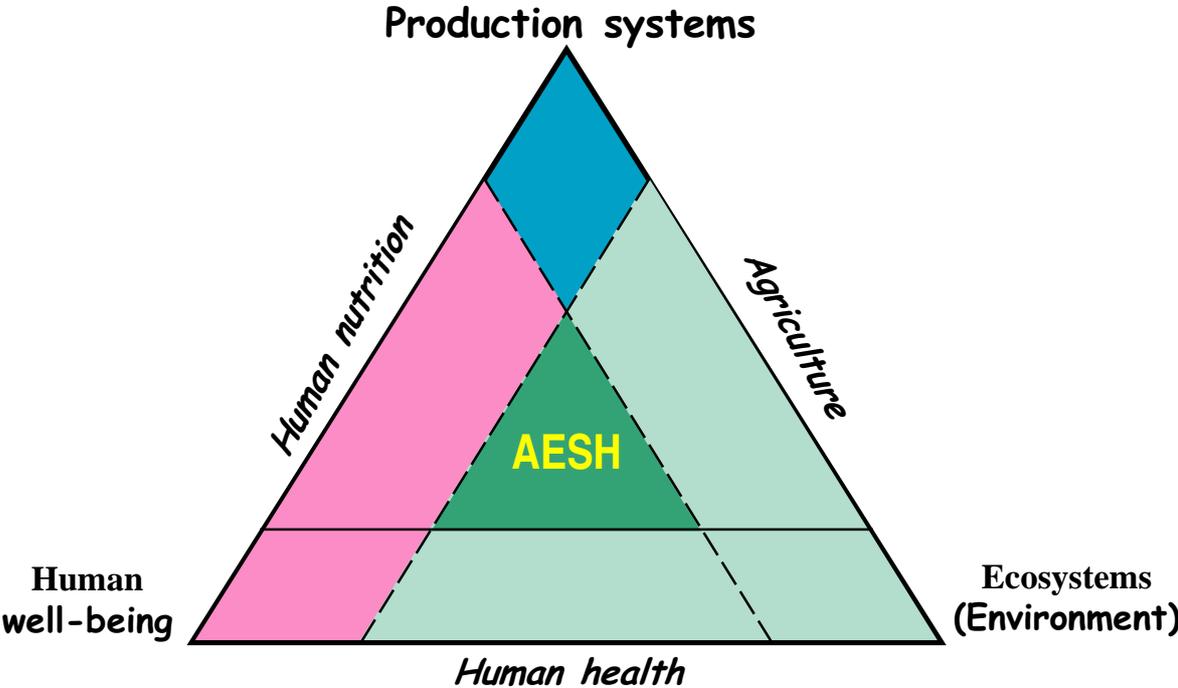
**Fig 1: Schematic presentation of production systems, ecosystems (environment) and human well-being under the component technology research and development approach.**



In fact, traditionally practitioners of the component technology approach may do so while working with a multidisciplinary team (Fig. 1). Being highly specialised, workers within each system focus sharply on one or more aspects of how their activities may affect human well-being (labelled AESH or Agro-ecosystem health in Fig. 2) without an appreciation of the entire picture. Thus, while everyone makes some effort to contribute to human well-being, there is a block of grey area impeding full understanding, co-ordination and transmission of gains in one system (e.g. production) to another system (e.g. human well-being). This means that a project such as ITC's intervention in The Gambia may increase productivity without directly enhancing household well-being or contributing to environmental protection. A partial (productivity) assessment could miss this point and encourage continuation of activities along the same lines that have transmission failures or even have potential for adverse environmental effects.

Using less holistic methods of assessment would have meant that, for example, a problem of child malnutrition and micronutrient deficiencies would be considered a problem to be addressed entirely within the ambit of the nutrition discipline. Such approaches that appear to limit the scope for linking, understanding and directly measuring the impacts of agricultural technologies on human and ecosystem welfare, which is the ultimate goal of research, are being increasingly criticized in favour of broader, system-wide, trans-disciplinary paradigms. One such approach is the ecosystem health paradigm developed and tested elsewhere in North America. This approach to human well-being has its appeal in considering people as centre-point of their agro-ecosystem (Fig. 2).

**Fig 2: Schematic presentation of production systems, ecosystems (environment) and human well-being under the 'holistic' agro-ecosystem health (AESH) approach**



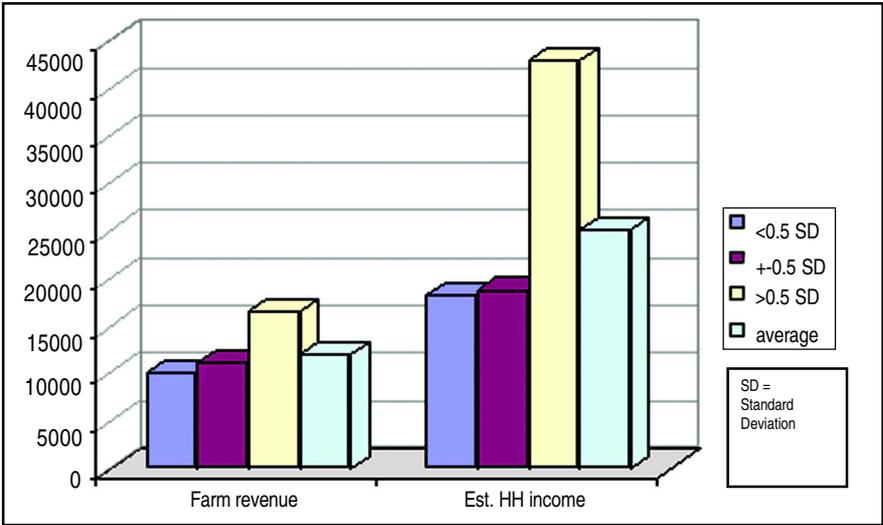
The approach is transcendental and allows common understanding of the underlying research and development goals. It ensures that the inter-linkages, human well-being and production system by human nutrition, production system and ecosystem by agriculture, human well-being and ecosystem by human health and sanitation, etc. are exploited in a synergistic manner. The holistic approach described in the preceding paragraphs formed the guiding principle in assessing the impact of the ITC interventions in The Gambia.

### Owning livestock is good news!

In the words of Mr. Jarju, owning livestock in mixed farming environments such as in his native Pirang village in The Gambia is good news. This is because livestock-owning families are better able to meet emergency demands that arise in the households. For example, selling milk helps in the daily upkeep of the family, whereas selling stock (bulls, small ruminants, etc) provides capital for major investments, such as building a house.

These assertions were confirmed in the impact assessment study which revealed that when smallholder farmers from the cross-section of The Gambia were classified into three classes, (i) those owning few or no livestock, (ii) owners of average herd size, and (iii) owners of larger than average herd size, both farm revenue and estimated household income were greatest for farmers with larger than average herd size.

**Fig 3: Farm revenue and household income of smallholder farmer owning below average, average and more than average herd sizes in The Gambia**



### ITC pilot trials and interventional packages made a difference!

The basic data assembled for the study areas prior to and after the ITC interventions were used as inputs for the ILCA-herd model employed as a methodology in the projections. This was done in order to project the monetary benefits that accrued to smallholder farmers in the study areas over time and to national level. ITC interventions led to an increase in calving rates and reduction in calf and adult cattle mortalities. The implied impacts of these interventions simulated over a 10-year period are shown in Table 1.

**Table 1: Input data for the ILCA herd model**

Age class (months)	Baseline			After ITC intervention	
	Average starting herd structure	Average slaughter offtake (%)	Average body weight (kg)	Average slaughter offtake (%)	Average body weight (kg)
<u>I. Herd structure</u>					
Females					
0 - 12	6.5	0.5	40.9	1.0	46.2
13 - 24	5.1	1.0	95.4	1.0	100.1
25 - 36	4.3	2.0	152.2	3.0	169.7
37 - 48	3.1	2.0	201.9	2.5	205.3
49 - 60	4.0	3.0	208.4	3.0	220.6
>60	23.3	3.5	229.6	4.0	244.3
Males					
0 - 12	5.9	1.0	41.5	1.5	43.9
13 - 24	5.4	1.5	99.1	2.0	115.2
25 - 36	3.0	3.5	163.5	5.5	172.4
37 - 48	2.4	4.0	210.3	5.5	217.3
49 - 60	1.8	10.0	240.2	11.0	260.1
>60	2.3	35.0	279.4	46.0	280.5
<u>II. Cow productivity data</u>					
		<u>Before ITC intervention</u>		<u>After ITC intervention</u>	
Calving rate (%)		47		52	
Age at first calving (months)		50		50	
Lactation offtake (litres)		405		445	
Lactation length (days)		434		434	
Cattle mortality % (0-12 months)		17		10.5	
Cattle mortality % (13-24 months)		6.5		6.3	
Cattle mortality % (>24 months)		6.5		6.3	

<sup>a</sup>Rounded to the nearest 0.5

## The Impacts at a Glance

The estimated impacts on herd productivity due to ITC interventions are summarised in Table 2.

**Table 2: Body weight and milk output simulated over a 10-year period using the ILCA herd model**

Parameter	Before		After	Impact of ITC intervention (‘After’ minus ‘Before’)
	Before	After		
Total liveweight of herd (kg)	16201	18543		Proportionate yield change of <b>15%</b> , also equivalent to <b>4.5 kg</b> additional BW/cattle.
Average annual milk offtake/herd (litres)	5374	7042		Proportionate yield change of <b>31%</b> , equivalent to additional <b>48 litres/ breeding female</b> at 35 breeding females per herd.
Average annual herd mortality (%)	7.9	6.7		1.2% reduction in mortality.
Average annual herd offtake rate (%)	6.6	7.6		1% increase in offtake rate.
Change in herd size, 0 yr. – 10 yrs. (%)	40.0	56.3		16.3% incremental herd growth over 10 years.
Implied av. age of exit of cows (yrs.)	13.9	13.3		Retention of younger and more productive herds.

## Annual Surplus of US\$2 million: Both Consumers and Producers Benefit

### Potential annual returns to ITC's research and development effort: Results from Economic Surplus Model

In monetary terms, in a closed economy (with insignificant importation of livestock products) the proportionate changes in meat and milk outputs brought about by the interventions translate to an annual surplus of US\$2.010 million. This made up of US\$1.368 million from the milk component and US\$0.642 million from meat (Table 3). These gains accrue because the input cost change per head of 1.25% for both meat and milk is more than compensated for by net proportional reduction of 30% and 8% in cost per tonne of output of milk and meat. Consumers enjoy a relative reduction in prices of 20% and 4% for milk and meat, respectively.

**Table 3: Potential annual benefits of ITC's interventions at full implementation**

Closed Economy Model	The Gambia	
Parameter	Milk	Meat
Elasticity of supply	1	1.7
Elasticity of Demand	0.5	1.8
Max. proportionate yield change	31%	15%
Gross cost change per ton	0.31	0.09%
Input cost change per head	1%	1%
Input cost change per ton	0.008	0.01%
Net prop. red'n in cost per ton of output	30%	8%
Relative Reduction in Price	0.20	0.04
Price per Unit (\$/tonne)	563	2241
Quantity of Units (tonnes)	7,648	3,480
Change in Total Surplus (\$)	1,367,547	641,872
Change in Consumer Surplus	911,698	311,767
Change in Producer Surplus	455,849	330,106
Change in Total Surplus (\$) if $e < 1$	1,170,716	
Change in Total Surplus for Meat and Milk (\$)	2,009,419	

Of the US\$1.368 million from milk, the change in consumer surplus (fall in price due to increase in supply and elasticity of demand) is estimated at US\$0.912 million. Milk producers (mostly smallholders) though selling at a slightly lower price sell larger quantities and accumulate an annual surplus of US\$ 0.456 million. Similarly, the US\$0.642 million from meat, is made up of US\$0.312 million and US\$0.330 million of consumer and producer surpluses.

Sensitivity analyses showed that if prices fail to decrease due to the increased supply in which case consumers get no surplus, the annual change in total surplus is lowered to US\$1.922 million - all of which goes to livestock producers (Table 4).

**Table 4: Potential returns of ITC's research and development effort in a closed economy, if there is no reduction in prices of meat and milk**

<b>Closed Economy Model (with no relative reduction in price of meat and milk)</b>		
<b>The Gambia</b>		
<b>Parameter</b>	<b>Milk</b>	<b>Meat</b>
Elasticity of supply	1	1.7
Elasticity of Demand	0.5	1.8
Max. proportionate yield change	31%	15%
Gross cost change per ton	0.31	0.09
Input cost change per head	1%	1%
Input cost change per ton	0.008	0.01
Net prop. red'n in cost per ton of output	30%	8%
Relative Reduction in Price	0.00	0.00
Price per Unit (\$/tonne)	563	2241
Quantity of Units (tonnes)	7,648	3,480
Change in Total Surplus (\$)	1,301,937	620,304
Change in Consumer Surplus	-	311,767
Change in Producer Surplus	1,301,937	620,304
Change in Total Surplus (\$) if $e < 1$	1,170,716	
Change in Total Surplus for Meat and Milk (\$)	1,922,241	

In another scenario, it was demonstrated that if the livestock industry were not protected by tariffs, allowing the importation of large amounts of meat and milk (open economy) US\$1.685 million in consumer and producer surpluses could still be made per annum by smallholder livestock producers as a result of the technologies that enabled the incremental meat and milk production (Table 5).

The point is made through the various scenarios simulated above, that potential returns to ITC's interventions remain consistently high and that there is little change of the scenario in which smallholder livestock producers would be the loser.

**Table 5: Annual change in total surplus in an open economy**

<b>Parameter</b>	<b>Milk</b>	<b>Meat</b>
Elasticity of supply	1	1.7
Max. proportionate yield change	31%	0.15
Gross cost change per ton	0.31	0.09
Input cost change per head	1%	0.05
Input cost change per ton	0.008	0.04
Net prop. red'n in cost per ton of output	30%	0.04
Price per Unit (\$/tonne)	563	2241
Quantity of Units (tonnes)	7,648	3,480
Change in Total Surplus (\$)	1,301,937	362,325
Total Surplus		1,684,786

## Impacts of interventions reach households

The study looked at household characteristics, farming expenditures, and revenue profiles of households that used ITC interventions and those which did not. The results showed that in spite of the fact that those which used the interventions spent more money they still benefited. Expenditure included animal health, supplementary feeds for livestock and inputs on crop production. However, the value of crop products, combined value for crop and livestock products, as well as the percentage of total farm revenue from livestock were 100, 102, 188 and 73% larger than those without using the interventions (Table 6). It is the superiority in revenues and incomes in the intervention user group over the non-user group that enabled the former group to purchase quality seeds, additional manure, fertilizers, pesticides and herbicides and to intervene positively in herd management which consequently improved the overall economic efficiency of farm operations as observed in the stochastic frontier production function analyses undertaken as part of the impact assessment. The experiences and observations made by Mr. Kawusu Jarju were shared by other smallholder farmers, even for those who have only recently taken up livestock farming as part time activity. One such late entry part time farmer is Mr. Joseph Faye, who after several years familiarity with ITC's breeding programmes decided to set up a herd of N'Dama cows in the peri-urban Greater Banjul Area in 1996. In 2000, Mr. Faye joined the group of farmers whose local cows were inseminated with imported semen of Holstein Friesian or Jersey to produce crossbreds with a view to producing and selling milk in this area where demand is high. For Mr. Faye the impressive milking performance of the N'Dama-Friesian cows recorded within the ITC pilot study area was an impetus for investment in the crossbred-based dairy production.

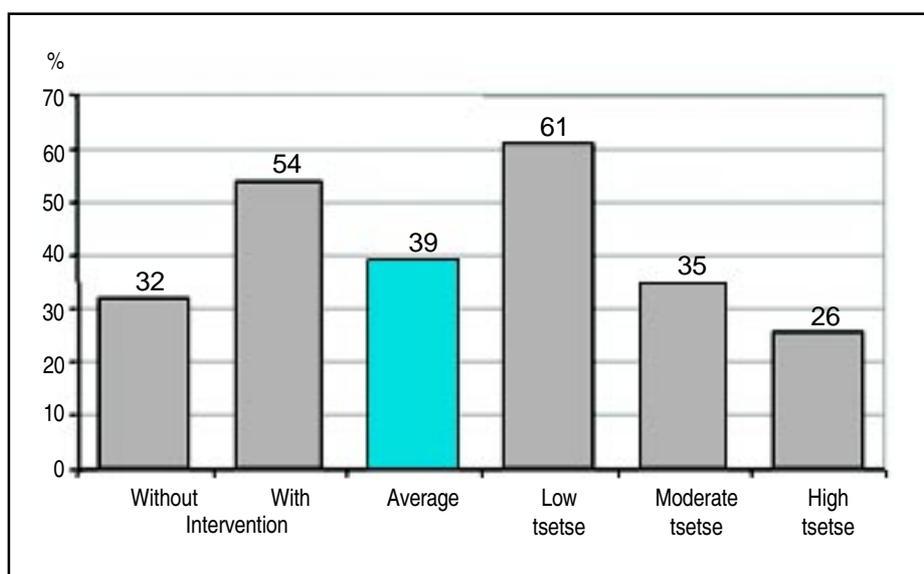
**Table 6: Expenses and revenue from crop and livestock enterprises of smallholder farmers in the Gambia**

ITEM	ITC intervention		
	Without	With	Average
Revenue / respondent's TLU (Dalasis)	210	565	330
Health expenditure/TLU (Dalasis)	13.1	21.1	15.8
Expenditure on crop farm inputs	69.4	110	83.4
Total value of crop products (Dalasis)	7761	15569	10409
Total value of crop and livestock product (Dalasis)	8969	18118	12072
Percentage of total farm revenue from livestock	6.3	18.2	10.4
Estimated annual HH revenue (Dalasis)	20222	34991	25230

## Tsetse and trypanosomosis: A negative impact on economic efficiency of farming

According to Acho Okike, the independent expert who carried out the impact assessment study, the ITC interventions improved economic efficiency of farming (54% in users of interventions and 32% in non-users). He went on further to pin-point a herd management package made up of strategic kraal movement, feed supplementation, watering and compost pen technology as the most influential four livestock development packages (Fig. 4).

**Fig 4: Economic efficiency (%) of smallholder farmers in The Gambia - ITC intervention and tsetse challenge rating**



The economic efficiency analysis also revealed that the presence of tsetse-fly and tsetse-transmitted trypanosomes decreased economic efficiency of farming at least two fold (Fig. 4). This was in spite of the fact that almost twice the household labour was required for livestock farming in high tsetse risk areas compared with low to medium tsetse areas.

In the words of Dr. Okike, “the difference in economic efficiency between the high and low tsetse challenge areas also represents the potential for improving the contribution of agriculture to the Gross Domestic Product (GDP) of The Gambia through controlling trypanosomosis”.

## ITC interventions: Child and women-friendly

As expected, the use of the ITC-promoted interventions led to extra labour or longer working hours. This was as result of more frequent changing of the kraaling site, supplementary feeding of animals and extended milking time in high producing cows. The results from the household surveys undertaken as part of the impact assessment confirmed that the total labour time (person-days) in the households that used ITC interventions was about 50% larger than in households

which did not use such interventions. However, the percentage of total labour provided by children and women in the intervention households were 23 and 22% below that of the respective age or gender classes in the non-user groups.

## **The bottom line of the good news**

Evidence from the impact assessment study confirms that owning livestock is good news in terms of poverty reduction. Also working with farmers to improve their livestock base is equivalent to reinforcing the foundation of their well-being. It is, therefore, worthwhile to engage in such activities in the first place. The study also showed that tsetse challenge (trypanosomosis) limits not only livestock productivity but also lowers economic efficiency and returns from smallholder farm operations that depend on positive and increasing levels of crop-livestock interactions and integration. However, in the last 15 years, ITC activities in The Gambia have led to productivity increases associated with improvement in farm (crop and livestock) revenue, household food supply and farm economic efficiency of participating households. The potential benefits that implementing the ITC-led activities countrywide have for producers and consumers of livestock products, national food supply and ultimately the nation's Gross Domestic Product (GDP) are enormous.

“Using various tools of impact assessment, it was possible to discern a clear and consistent string of improvements in agriculture, ecosystem health, human nutrition and household well-being that can be traced to ITC's research and development activities in The Gambia. A household cross-sectional survey showed that the projections of a 10-year herd productivity model using data from 1991 have already been realised among participants in ITC's interventions, thus lending credence to its economic estimates of future returns to research and development. Considering these facts, it can be concluded that ITC's interventions have made a difference in The Gambia and need to be supported to further harness its potentials”, concluded Dr. Acho Okike.

## **Current and future research thrusts propelled by past achievements**

The level of household impacts and the social acceptance of past ITC interventions, together with the new enthusiasm for regionally-focused collaboration expressed by partners and other stakeholders during roundtable consultations, greatly influenced the selection of priority themes to be addressed in the medium term. The implementation of the regional mandate inspired the need to work on topics of regional importance, and to use implementation mechanisms that are flexible, while at the same time allowing collaborating institutions to contribute without impeding their core national programmes.



## **ITC New Programme Areas**

The re-organisation of the ITC research structure and implementation mechanism was instituted with a view to integrating the various restricted donor-funded ongoing projects at the Centre into focused and more coherent Programmes that address priority issues of stakeholders and partners in the Region.

Seven broad research and development areas of relevance listed below identified by the stakeholders in the region during various consultations served as the basis of the ITC Mid-term Plan 2001-2004:

1. Evaluation of current and emerging animal health risks and public health issues including zoonoses related to the consumption of animal products
2. Optimal integration of animal health management practices
3. Crop-agroforestry-livestock integrated systems and conflict resolution

4. Genetic improvement of indigenous ruminant livestock
5. Animal nutrition and feeding systems
6. Socio-economic and policy dimensions of technological innovations, adoption and impacts on households and natural resources
7. National institution capacity building, critical mass for research and exchange of information among NARS

To address these R&D areas with the view to develop existing and emerging livestock production systems in the Region, three **Institutional Programmes** were set up of 11 **Institutional Projects** (IP) each dealing with specific or cross-cutting themes of strategic importance:

- A. Low-Input Systems Improvement Programme (**LISIP**)
- B. Market-Oriented Systems Improvement Programme (**MOSIP**)
- C. Systems' Overlaps and Linkages Improvement Programme (**SOLIP**)

<b>ITC Institutional Programmes and Projects</b>	
Programme	Institutional Project (IP) - short title
<b>Low-Input Systems Improvement Programme (LISIP)</b>	IP 1: Disease Risk Assessment IP 2: Disease Control Strategies IP 3: Stress Factors and Maintenance of Disease Resistance / Resilience IP 4: Crop-Agroforestry-Livestock Integration IP 5: Genetic Improvement of Indigenous Ruminants
<b>Market-Oriented Systems Improvement Programme (MOSIP)</b>	IP 6: Development of Meat and Milk Systems in Peri-Urban Areas IP 7: Feeds and Feeding Strategies IP 8: Development and Application of Novel Techniques
<b>Systems' Overlaps and Linkages Improvement Programme (SOLIP)</b>	IP 9: Consumer Safety and Public Health IP 10: Socio-Economic Aspects of Livestock Production IP 11: Training and Information

## Enhancing the efficiency of the low input systems of West Africa – The ITC response



### Low Input Systems Improvement Programme (LISIP)

Trends in the evolution of livestock production systems in sub-Saharan Africa show a dynamic, continuous process moving towards integrated and more intensive production. However, a considerably large segment of the livestock systems will continue to operate in the low input context. The latter systems are referred to variously as traditional, local, unimproved or low-input. These are targets of ITC and its national partners, as these systems are well placed to respond to interventions that can increase their performance and efficiency.

The objectives of the Low-Input Systems Improvement Programme (LISIP) are to improve the livelihoods of resource-poor livestock farmers in areas where low-input agriculture is practiced, through better exploitation of adaptive traits of indigenous livestock and through the deployment of improved technological options.

In order to achieve these objectives in the medium term, the LISIP focused on

- Assessment of prevailing disease risks
- Development of integrated vector and parasite control strategies
- Impact of diseases and other environmental factors on livestock production
- Genetic improvement of indigenous domestic ruminant resources
- Integration of farm and non-farm resources to obtain synergies in farming enterprises

Highlights of results obtained for each of these themes are provided under each of the projects.

## IP 1: Disease Risk Assessment in Ruminant Livestock

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Project, ADB-funded Project
NARS/NGOs:	DLS, NARI (The Gambia), DNE/IRAG (Guinea), ISRA (Senegal)
ARIs:	ITM (Belgium)

Appropriate disease control policy for domestic ruminant livestock is dependent upon knowledge and assessment of disease risks under given epidemiological situations. The objectives of this project are to obtain such information through diagnostic investigations and epidemiological tools, such as rapid rural appraisals. Outcomes will support decision-making for appropriate approaches to disease control in differing production systems.

Activities undertaken within the project included:

- Assessment of risk of vector-borne diseases of ruminant livestock in Guinea, The Gambia and Senegal
- Assessment of trypanosomosis risk to newly established crossbred dairy cattle herds in Gambia and Senegal

### **Tsetse-transmitted trypanosomosis**

A synthesis of the results from tsetse trapping in several locations in The Gambia, Senegal and Guinea showed that *Glossina morsitans submorsitans* and *G. palpalis gambiensis* are prevalent in the region and transmit pathogenic trypanosomes to various classes of livestock. However, the level of trypanosome prevalence in livestock and their impact on anaemia, morbidity, mortality etc. appear to be dependent on several factors, particularly human density and management interventions at the herd level. Similarly, ticks were common at the various locations and their prevalence and impact on crossbred livestock were much greater than in indigenous animals. New diagnostic tools such as PCR proved to be able to detect more infections than traditional methods. Thus, the wider use of the new techniques should lead to a better risk assessment.

### **Heartwater – a major tick-borne disease**

An indirect enzyme-linked immunosorbent assay (ELISA), based on the major antigenic protein 1 fragment B (MAP1 B) of *Ehrlichia ruminantium*, was used to assess the seroprevalence in cattle in The Gambia. Two groups of 20 N'Dama and 20 Gobra zebu cattle and controls were monitored for a period of 12 months with acaricide treatment and for another 10 months without acaricide treatment. During the period of acaricidal treatment, the cumulative proportion of positive serum samples was 26 % and 35 % in treated N'Dama and Gobra cattle respectively. The cumulative proportion of positive sera in untreated cattle was clearly higher in both groups: 52 % in N'Dama and 61 % in Gobras. In the 10 months following suspension of acaricide application, the proportion of positive serum samples in previously treated N'Dama and Gobra cattle also increased. The peak of positive seroreactions in both previously treated and untreated animals occurred during and

subsequent to the period of activity of *A. variegatum* adults Cumulative seroprevalences in previously treated N'Dama and Gobra cattle were 33 % and 45 % respectively whereas in untreated animals seroprevalences were 39 % in N'Dama and 65 % in Gobra cattle. Within the N'Dama breed, the seropositive rate in previously treated cattle did not differ from that in untreated animals throughout the study period. Within the Gobra breed, in contrast, the number of positive seroreactions was higher in untreated animals than in previously treated cattle. These results provide a support for designing heartwater control strategies.



*Taking an impression smear from calf brain capillaries: Search for Heartwater organisms at ITC*

The potential impacts of the activities carried out under this Project include improved disease management of livestock, leading to decreased mortalities and higher productivity. Higher household incomes, better human nutrition and well-being, particularly in poorer rural communities are expected from these research activities. Identification of areas of high disease risk and categorisation of the agricultural potentials of land that permit better natural resource management and reduced land degradation will lead to lasting benefits.

ITC worked closely with stakeholders in order to ensure that results from disease risk assessment are rapidly translated into practical use. One such participatory research with grassroots beneficiaries was the establishment of a “bush” clinical laboratory in the village of Touba in The Gambia.

## Taking the Research Laboratory to the Farmers

The field laboratory (background) and 'Bantaba' (foreground) shown here were constructed and established in 2001 at Touba village in Niamina East, Central River Division of The Gambia, by the ITC Small Ruminant Research Project, financed by the Belgium Government, with additional funding and support from the Gambian Rural Finance and Community Initiatives Project (RFCIP).



The purpose of the field station is to establish closer links with farmers in their villages to facilitate research work carried out in partnership with those farmers. The field laboratory also provides veterinary services, much valued by farmers in the area, who know that for three days every month they can bring their livestock for clinical examination and treatment for a very reasonable cost. The

value put upon this service by farmers is clear from the numbers of people bringing their animals each month. Trypanosome infections have been the commonest reason for animals to be brought to the field station. Horses are frequently brought, which is indicative of the growing importance of those animals for traction in The Gambia. Equines are particularly susceptible to trypanosomes, but under the reduced tsetse challenge prevailing in recent years, with appropriate affordable treatment it has become economically viable to keep these animals in the country and their numbers are rising.

In addition, research is being carried out with livestock owners in Niamina East to investigate the effects of disease on milk production of WAD goats and the impact on the performance of their offspring. Goat milk provides an important source of calcium and other nutrients for children.

The Bantaba provides a forum for participatory dialogue with farmers regarding their problems and desires. This reflects an increasing component of participatory research approaches and evaluation of farmer's needs within ITC.



## IP 2: Development and Evaluation of Control Measures against Vectors and Vector-Borne Diseases

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Project, ADB-funded Project
NARS/NGOs:	DLS, NARI (The Gambia), DNE/IRAG (Guinea), ISRA/DIREL (Senegal)
IARCs/Regional Centres:	ILRI (Kenya), CIRDES (Burkina Faso)
	IAEA (Austria)
ARIs:	ITM (Belgium)

Tsetse transmitted trypanosomosis, tick-borne diseases and tick associated infections, such as dermatophilosis, together with gastrointestinal parasites constitute the major pathological parasitic complexes responsible for limiting animal production in sub-Saharan Africa. Control of these disease problems is mainly carried out by the use of drugs, a strategy for which limitations have been identified. Therefore, integrated strategic control measures, based on key epidemiological features of vectors and parasites, need to be developed.

Key objectives include:

- Assessment of the impact of parasites on animal health and production by breeds/species and by production systems
- Integrated strategic vector and parasite control measures

### **Boosting productivity and incomes from small ruminants through disease control**

The impact of parasitic diseases in Djallonké sheep was assessed in Sedhiou, Senegal between February and December 2001, as a prelude to recommendations on disease control. The impact of parasitic diseases was studied in 90 Djallonké sheep from 9 village flocks. Regular sampling for the detection of helminth infections, trypanosomes and *Cowdria ruminantium* and tick counts were performed. *Haemonchus* and *Trichostrongylus* were the most common gastrointestinal parasites detected, followed by *Strongyloides*, *Bunostomum* and *Oesophagostomum*. Fenbendazole anthelmintic administered in February stopped helminth egg output and delayed the onset of egg output in the rainy season for at least one month. There was also a positive impact on weight gain resulting from the treatment with anthelmintics. An ivermectin treatment given in April did not significantly affect weight gain.

A cost-benefit analysis of strategic anthelmintic treatment of small ruminants started in September 2001 as a follow-up of a previous research at ITC which demonstrated improvement in productivity parameters. The results led to the recommendation to determine if such strategic treatments were economically viable and could be recommended to livestock owners.

Vector-associated diseases in The Gambia -  
Will farmers adopt control measures at a cost?

Farmers behaviour toward control measures against trypanosomosis and tick-borne diseases and their vectors was investigated to evaluate the potential for their adoption and willingness to cover the associated cost. The results of the contingent valuation surveys indicate a general willingness by farmers to contribute resources to vector and parasite control. For parasite control, 82% of respondents indicated their readiness to contribute, among them 63% offering labour and 37% pledging both money and labour. For vector control measures against tsetse flies and ticks, 90% were willing to contribute resources, 75% among them offering labour only and 25% providing both labour and money. These results indicated that farmers did distinguish between labour and capital intensive technologies.

### **IP 3: Impact of Levels of Production (including Traction) and Nutrition on the Maintenance of Disease Resistance / Resilience in Ruminant Livestock**

Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Project, ADB-funded Project
NARS/NGOs:	DLS (The Gambia), DNE/IRAG (Guinea), ISRA (Senegal)
IARCs/Regional Centres:	ILRI (Kenya), CIRDES (Burkina Faso)

The exploitation of resistance/resilience of local stock to parasitic diseases constitutes an economically profitable and an environmentally sound strategy for the control of these diseases.

It is known that potential stress factors such as poor nutrition, physiological status and intercurrent diseases may influence the ability of indigenous breeds to express their resistance/resilience to endemic diseases. In addition, increasing numbers of trypanotolerant cattle (especially N'Dama) both male and female, are being used for work purposes and it has been shown that work can compromise the immune response to trypanosome infection. Moreover, the rapid expansion of use of exotic germplasm for crossbreeding is likely to dilute the indigenous gene pool and therefore might erode the ability of genetic resources to adapt to diseases. The objectives of this project are (1) to investigate the interactions between the stability of disease resistance / resilience and known stress factors such as plane of nutrition and work, and (2) to study the level of resistance/resilience of crossbred ruminants to vector-borne diseases.

Outputs include:

- Quantification of the impact of stress factors on indigenous and crossbred ruminants
- Production of packages (technical and environmental) that minimize impact of stress on targeted stock

## **Raising farm productivity through draught power from crossbred bulls**

As part of a study to investigate the potential of using crossbred bulls to provide work input for farming systems in peri-urban and rural areas, pairs of F1 (N'Dama x Jersey, N'Dama x Friesian) bulls were trained for work. The animals also ploughed land for establishment of *Andropogon* under controlled conditions.

Ploughing sessions lasted between 42 to 82 min with an average working speed of 0.54 m/s. Draught forces of 734 Newton were required to plough wet soils at an average depth of 13 cm. Pairs of crossbred cattle ploughed an average surface of 700 sqm per hour of work. It would take about 2.5 working days of 6 hours per day for a team of crossbred cattle to plough one hectare of wet soils. These first results indicated that available crossbreds resulting from the ITC-led breeding programme could significantly contribute to national demands for draught animal power provided that diseases to which they are susceptible are sufficiently controlled. About 50% of the crossbred work bulls became infected with trypanosomes and two of them died. However, whether the infections occurred because of a compromised immunity due to the work performed could not be determined.



The high work capacity of crossbred bulls, observed in the pilot study, if confirmed in subsequent trials, would imply that in areas with low tsetse fly/trypanosome challenge, there will be opportunities to add to the already established sources of animal traction (oxen/bulls of zebu or trypanotolerant cattle e.g. N'Dama, and equines). This increase would be expected to significantly impact on food and fodder production.

## IP 4: Crop - Agroforestry - Livestock Integration and Resource Management

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgian Government-, IDRC-, ADB-funded Projects
NARS/NGOs:	DLS, CRDFP II, RFCIP (The Gambia), DNE/IRAG (Guinea), DIREL/ISRA (Senegal)
IARCs/Regional Centres:	ILRI (West Africa)
ARIs:	ITM (Belgium), FUB (Germany)

Throughout sub-Saharan Africa increasing human and livestock populations and livestock are putting pressure on the available cultivable land and other natural resources. Increasingly, agroforestry practices, crop residues from farming activities and agro-industrial by-products are being used to augment the feed supplies to livestock. Livestock are a key component of mixed crop-livestock farming systems. All aforementioned changes are contributing to agricultural intensification, a phenomenon, which many recent assessments identify as a natural consequence of the severe resource competition. Thus, integration of cropping, agroforestry, and livestock will become imperative in the region.

The objective of this project activity is to develop analysis tools and research strategies that will promote and guide the maturation of emerging production systems of crop - agroforestry - livestock integration that are the consequences of intensified land use.

### **Integration of livestock into community-based forestry projects**

In order to combat the problem of annual bush fires and forest degradation in the Central River Division, the Department of Forestry, through the funding of GTZ and KfW (Germany), is encouraging community-based participatory management of state forests the ownership of which will eventually be transferred from the state to villages. Encouraged by the results, the Central River Division Forestry Project (CRDFP II) now focuses on joint management of Forest Parks (Gazetted State Forests) with local communities and other stakeholders. Within the framework of the project launched in 2000, the International Trypanotolerance Centre, the Department of Livestock Services (DLS) and the donor organisations through the Forestry Department signed a Memorandum of Understanding for collaborative studies. The aim is to develop research and development strategies which integrate livestock production with forestry for sustainable natural resource conservation and exploitation, improved productivity and poverty alleviation of rural communities.

In four sensitisation workshops at district level, the new concept of joint forest park management was discussed with key intermediaries who are to disseminate the information at the grassroots, namely district chiefs (Alkalos), community forest committee members and community based organisations. In order to combat the annual problem of bush fires, several village-level sensitisation meetings, and fire belt demarcation and controlled burning activities were held in communities around the forest parks.

### The “Taungya Approach”: Rejuvenated cropland under fodder trees

Sikunda Forest Park, one of the forest parks in Central River Division of The Gambia, has been encroached upon for farming. A meeting was called to discuss the importance of preserving the forest cover for the present and future generations and the need to reclaim the land. Although the farmers acknowledged that the encroachment was illegal, they would like to retain the land for farming. There was a deadlock!

A compromise was reached with the “Taungya approach” whereby fodder trees would be planted within the cropland. This system would allow farming to continue for the next 3-5 years before the trees’ canopy close. Farmers in turn would maintain these trees and have access to use the products from the trees.

The trees will provide good quality protein feed materials as supplements for livestock, while improving the soil fertility and the environment. In addition, farmers were also told that they could plant these fodder trees on their degraded farmlands for the same purpose.

The farmers listened in disbelief. Then one of them commented: “If truly this approach could help to restore soil fertility status, then we would even be willing to give up more land to be converted to forests, because one of our main problems why we need to clear more land is because the land is tired and we cannot afford fertilizer.”

## Promoting nutrient recycling in a women-owned mixed farm

Through funding provided by the IDRC of Canada to ITC and its partner, ISRA of Senegal, the prospect of integrating livestock into an on-going women-owned commercial horticultural enterprise was assessed. Potentially viable options were put into practice.

In order to determine the extent to which horticultural production farm-types integrated with livestock production can be self-sustaining in terms of nutrient use and generation, the feed types, feed quantities, and nutritive values were investigated. In addition to application of *in-vitro* procedures on the feeds, pre-weaning crossbred calves were used to evaluate the quality of residues from various crops grown on the farm, when and as the residues became available. These residues served as basal diets and were supplemented only occasionally with groundnut hay and fresh elephant grass. Patterns of growth and average growth rates in the crossbred calves were used as a measure of transfer of nutrients from vegetative materials (mainly horticultural residues) to animal tissues. Manure from the calves served in various forms to fertilise selected plots of different types of vegetables. Incremental yields from manured plots compared to non-manured plots were determined to estimate complete flows of nutrients (plant-livestock-soil-plant) and the extent of recycling.

Preliminary results obtained for the various activities integrating crops and livestock suggest that producers may derive immediate benefits. These come from the conversion of horticultural waste into valuable products such as milk and meat, when used as ruminant feed. The availability of such wastes potentially contributes to feed budgets at farm and community levels. Nutrient loss due to the non-incorporation of the wastes into soils directly is more than compensated from processed excreta from the ruminants. Thus, the long term impact of integration of horticultural and livestock activities appear to be large.

## **IP 5: Genetic Improvement of Indigenous Animal Genetic Resources**

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Small Ruminant Project, BMZ/GTZ- supported Project (Germany)
NARS/NGOs:	DLS (The Gambia), DNE/IRAG (Guinea), ISRA (Senegal)
ARIs:	TU Munich, HUB (Germany)

For tsetse-infested areas in West and Central Africa, the use of trypanotolerant livestock remains one of the few viable options for livestock agriculture and bridging the gap between demand and supply in livestock products. Genetic improvement through selection and breeding represents one of the sustainable methods of increasing productivity and efficiency of production.

The objective of the genetic improvement programme at ITC is to increase individual animal productivity among trypanotolerant cattle and small ruminants while retaining their resistance to diseases. The breeding programme tailored to involve stakeholders participation, including the definition of breeding goals, uses simple infrastructure and logistics and is therefore deemed inexpensive enough for implementation by NARS.

### **Making breeding schemes work for the poor**

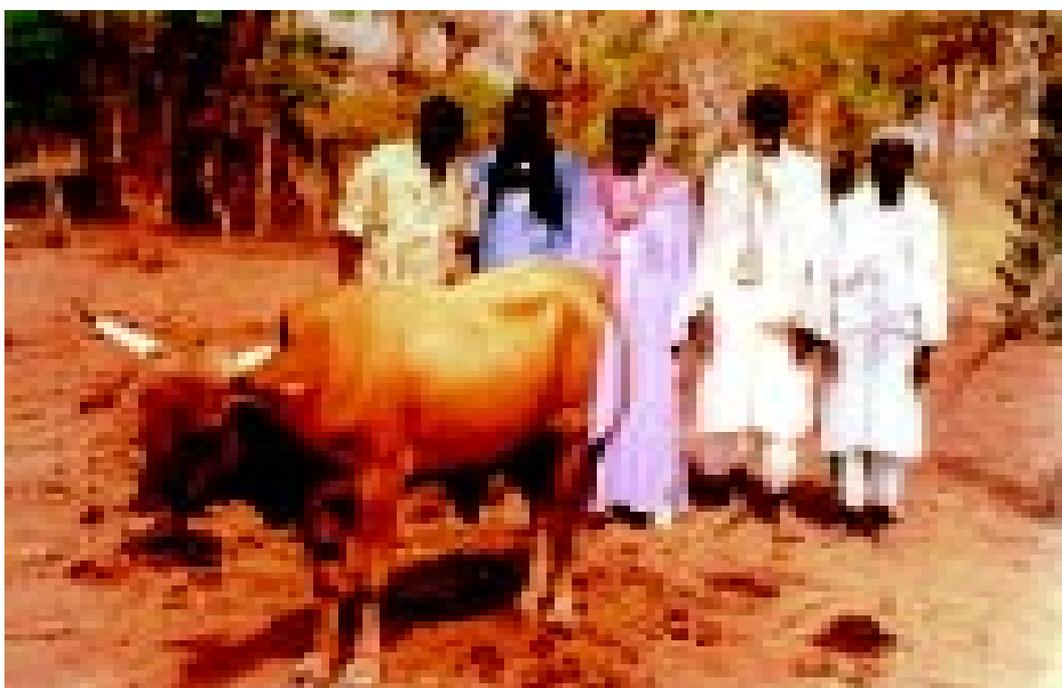
Both cattle and small ruminant genetic improvement programmes were designed by ITC scientists as *three tier schemes*: nucleus – multiplier – farmers. Breeding goals were defined to increase milk and meat production for cattle and goats, and increase meat production in sheep.

The breeding programmes, designed in a simple and robust way paying due attention to the economics of operations, are ongoing long-term activities. The extension (multiplication tier) of the small ruminant breeding programme started in 1999, for cattle in 2000. For small ruminants, whole villages are operating as multipliers as individual flock sizes within villages are small (“village approach”). Other strategies for extension-multiplication tier were elaborated: the “*kafo* approach”, whereby groups with shared interest within a village join and put their resources together. For cattle, the “individual owner approach” is typically the only applied approach.

Since 1995, a computer-based data management system has been operational at ITC, with prescribed data recording, entry and processing routines, to monitor and support the breeding programmes (selection, breeding value estimation) and for modelling and optimisation purposes.

Genetic improvement of local breeds of small and large ruminants realised at the nucleus flocks and herds at ITC Stations in Keneba and Bansang began to be moved into farmer multiplier flocks, and to the general farming communities in The Gambia. Sires born in multiplier flocks already won prizes at Livestock Shows (2001).

Since 2001, the methodologies and approaches developed in The Gambia have also been successfully adopted and applied to situations in Boké, Guinea.



*Multiplier farmers choosing improved bulls from the ITC nucleus herd*

## Misira Yirwa Kafo

### From vegetable gardening to successful small ruminant multipliers

Misira is a typical Mandinka village located in Sandu District in the Upper River Division of The Gambia. The main occupation by the inhabitants is crop farming and some livestock rearing.

Formed in 1987, the all women Yirwa kafo (cooperative group) started off primarily as vegetable farmers owning few small stocks. From a modest foundation stock of four ewes and four rams the group fenced off a holding area and more animals herded by their children were purchased. The women engaged in annual tobaski ram fattenings.

However, many of the “big” sahelian rams imported from Senegal succumbed to various diseases before even reaching the markets.

“Our livestock production was like this until 1999 when ITC and DLS informed us of a multiplier breeding programme to improve our flock of local breeds.” The whole village welcomed the idea and the kafo bartered most of its old stock of ewes and does for improved Djallonke ram and West African Dwarf buck from ITC.

“Ever since we have these improved animals from ITC, our ewes are kidding two times in the year which was not the case before. Offspring are healthy and grow fast. We have sold a lot of males to farmers who want them for breeding or for slaughter. Recently, the Department of Livestock Services bought four breeding males worth 2,400 Dalasis, and there are still several left which can be sold.”

*“ITC brought us very good ram and buck!”*, said Mme Amie Mboob.



Because the community has seen the progress in the flocks, the kafo lends breeding ram and buck to other farmers. In this way they have enough offspring in the village for sales. Out of their savings the kafo is paying the school fees for an orphaned student as well as helping poor members who cannot afford their own foundation small ruminant stock. From their savings, subsistence credit is given to members during the rains to hire labour, tractors to work on their farms\rice fields

## Meeting the challenges of adequately feeding human populations in urban areas – The ITC approach



### Market-Oriented Systems Improvement Programme (MOSIP)

One of the most noticeable changes in agricultural practices in much of sub-Saharan Africa over the past 25-30 years is the intensification of farming processes. Time-tested shifting cultivation and fallow systems are giving way to continuous cultivation that require more inputs of soil ameliorants. Where animal power had been used in the past, its use is becoming more intense. New forms of integration of livestock and crop agriculture have been observed in areas where such integration did not exist before. In West Africa, this phenomenon is occurring principally from the settling of pastoral or transhumant herd owners, with their herds, to engage in cropping, thereby becoming agro-pastoralists. In some situations, crop farmers are introducing livestock into their cropping systems.

The objectives of MOSIP are to enhance the livelihoods of urban and peri-urban producers and their dependants, and to make high quality livestock products affordable and accessible to consumers. This can be achieved through increased productivity per unit of land and cost and through sustainable livestock production, processing and marketing in medium to high input systems. ITC and its partners are addressing market-oriented production systems, in which feed, drug and labour inputs are substantial and products are supplied to highly populated areas, through socio-economically acceptable technologies on production and health for improved resource utilisation and output efficiency. The ultimate goal is to reduce hunger and poverty in urban and peri-urban areas through proper use of inputs and integration of systems.

## TACKLING HUNGER HEADON -

### Taking the path of horticulture and livestock integration

“We are re-discovering a natural phenomenon of increasing our on-farm and off-farm income generation potentials” - Khadissa Sambou, President of a women operated urban horticultural garden in The Gambia.

Livestock, through their multiple functions are recognised as a cornerstone for development and the improvement of livelihoods in The Gambia. Positioning livestock in such a way that they can satisfy the future demands in an eco-sustainable manner is therefore, a critical element of the ITC approach to food security in the region and The Gambia in particular. The objective of the integrated approach is to economically produce milk through low-cost peri-urban milking schemes that can be adopted by small- to medium-scale farmers near urban centres.

In this context, of particular relevance to current issues on food security is the support of research and development provided by ITC to peri-urban milk production based on production of crossbred cattle, through artificial insemination, which are subsequently integrated into producers' enterprises. The key objective is to raise the productivity (meat and milk) of N'Dama cattle without compromising on the disease resistance traits such as trypanotolerance. After a few years of experimentation and monitoring of the productivity of crossbred animals on-station, ITC took a giant step by breaking into the peri-urban farming system with this new product.



In an animal ‘soft loan’ scheme set up in 2000, resource-poor urban farmers were provided with milking crossbred cows as a possible path towards hunger and poverty reduction. One of the women beneficiaries is Madam Khadissa Sambou, President of the Banjulunding Horticultural garden, a group of 140 women urban cooperative farmers.

Farmer groups or individuals such as Khadissa Sambou are already demonstrating the profitability and sustainability of their enterprises enhanced by the special animal loan package. Today, Khadissa has become a role model, providing milk for her household consumption with her immediate neighbours as priority clients for milk sales. In her words, *“it is like having a milk tap that does not fail in your backyard, and the cow is paying her cost. I will never buy milk again!”*

## **Multiplying and spreading the good news**

In order to bring the enthusiasm and confidence exuded by Khadissa Sambou and members of her farming cooperative to many more communities, research and development activities were designed for the three Projects under MOSIP. The highlights of results achieved in the course of their implementation are presented:

### **IP 6: Development and Evaluation of Crossbreds and Other Improved Breeds for Milk and Meat Production in Urban / Peri-urban Areas**

#### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Small Ruminant Project, IDRC-, ADB-funded Projects
NARS/NGOs:	DLS (The Gambia), DNE/IRAG (Guinea)
IARCs/Regional Centres:	ILRI (West Africa)
ARIs:	ITM (Belgium), FUB (Germany)

The demand for milk and meat far exceeds supply from local production in sub-Saharan African countries. Crossbreeding of indigenous ruminants with exotic breeds is considered justified to increase supplies in peri-urban areas, where tsetse-transmitted trypanosomosis is low or absent.

ITC's crossbreeding programme aims at:

- the supply of crossbred animals that are comparatively more productive
- support of viable, small-scale F1 production units or community-based cross-breeding schemes in selected areas
- evaluating their performance under various conditions
- quantifying their roles in household welfare
- identifying technological and socio-economic options in support of crossbred-based dairying and meat production systems
- exploit factors that favour profitable enterprises in urban areas

### **Understanding farmers' resource base and input requirements for dairy production**

Surveys based on participatory rural appraisal techniques were conducted in 10 villages in the Groundnut Basin of Senegal by ITC and its partners (ISRA, PAPEL, Project Jachère). This was to characterise local livestock production/feeding systems (i.e. natural resource base; disease risks; ecological, social and economic trends) as a prelude to developing profitable crop-dairy systems in the area.

Survey results showed that crossbred (exotic dairy x local breeds) cattle are kept mainly by smallholder mixed crop-livestock farmers that had benefited from subsidised artificial insemination services. Farm livestock resources include cattle, sheep, goats, and horses used for cropping activities and transportation purposes. Crossbred cattle benefit from feed supplements in the

form of concentrate made up of cereal bran, locally produced groundnut cake or cotton seeds. However, because of feed shortages during the dry season and the high cost of concentrates, a number of farmers graze their crossbred cattle. Many farmers have also adopted fodder production technologies with niébé and sorghum. Farmers make extensive use of easily accessible trypanocidal drugs to treat their animals.

The assessment of the profitability of crossbred dairy production in mixed crop-livestock systems in the Senegambia Region is a focus of on-going analysis.

## **Could semi-intensive dairy production be profitable in West Africa?**

A simplified cost-benefit ratio analysis was calculated from milk yields of approximately 44 crossbred cows maintained within a “low-cost” scheme at ITC facilities and from the gross expenditure on the feeds consumed during the lactation period. Results from the long-term monitoring at ITC showed that the crossbred cows produced 4 to 5 times more milk than indigenous N'Dama cattle, with yields ranging from 600 to 2,200 litres per lactation period. From preliminary financial analysis it is concluded that the returns to investment are high: for US\$1 invested on feeds there was a corresponding return of \$2.50 (not included the additional benefits from the sale of manure, weight gains of offspring and sales from culled animals). Additional data on labour, management and veterinary inputs are being generated to enable full economic assessment of crossbred-based dairy production.

Meanwhile, the crossbred programme has been received with great enthusiasm by a cross section of the peri-urban farming community and the Government of The Gambia which committed additional funding under a World Bank support to heavily indebted poor countries (HIPC) for its expansion.

## **IP 7: Establishment of Feeding Standards and Strategies for Urban and Peri-urban Ruminant Production**

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Small Ruminant Project, IDRC-, ADB-funded Projects
NARS/NGOs:	DLS (The Gambia), DIREL (Senegal), DNE/IRAG (Guinea)
IARCs/Regional Centres:	ILRI (Ethiopia)
ARIs:	University of Antwerp (Belgium), University of Hohenheim

The limited access to sufficient feed resources is one of the major production constraints in peri-urban livestock production. Consequently, appropriate guidelines and balanced feeding strategies including incorporation of alternative feed resources are imperative.

The objective of this Institutional Project is to develop feeding and management strategies in support of the evolving intensified production systems, i.e.

- Definition and characterisation of intensive urban/peri-urban production systems
- Establishment of optimum input-output ratios for modelling profitable feeding and production systems
- Socio-economic appraisals of feeding systems

## **Non-conventional nutrients in support of dairy production: Horticultural residues to the rescue**

### **Livestock as part of a horticultural farm (a model integrated approach)**

The major objective was to exploit potential avenues of increasing productivity per unit area of land, as well as income generation potential using nutrient recycling. Comparative studies on-station had shown that crossbred (F1) cows are superior to the local breeds in terms of milk yields. However, the question of how profitable the crossbred enterprise will be on-farm when the nutrition and management of the crossbred animals were taken into account needed to be addressed. The Banjulinding Horticultural Garden women were willing to test and participate in the peri-urban dairy production scheme. This presented ITC and partners with opportunities for assessing feed and management gaps through feed budgeting that included availability of horticultural residues and possibilities offered by nutrient recycling.

As the profitability of small scale crossbred dairy production in the context of mixed crop-livestock farms depends on the survival of the calf crop, research on nutrition and management of calves were given priority. Feeding trials in crossbred calves based on horticultural residues revealed that growth rates of 450 g/day were possible with non-conventional feeds from the horticultural enterprise.

A preliminary analysis of the digestibility, and efficiency of conversion of the horticultural residues into animal products had shown that they have great potential as non-conventional feed resources that can be used for the peri-urban smallholder dairy enterprise. To pursue this further, ten candidate crop residues were identified and characterised with respect to organic matter, protein, acid detergent and neutral fibres and true dry matter digestibility. The samples were collected post harvest during the dry season 2001. The feed samples analysed included the residues of common beans, bitter tomato, cabbage, cassia leaves and pods, elephant grass, fresh groundnut, green maize stover, potato and radish leaves.

Although it was not possible to estimate digestibility *in vivo*, the physico-chemical characteristics of the farm wastes appeared to be quite attractive for ruminant nutrition. Preliminary assessment of all samples tested showed a promising potential. On a dry matter basis, the organic matter content varied between 80 and 95%. Apart from maize stover and fresh groundnut residues with Acid Detergent Fibre (ADF) of over 40%, all other samples had ADF-values of less than 40%. These results were correlated with very high digestibility indices *in vitro*, with values over 80% IVTDMD for radish and cassia leaves. In addition, the protein content of the leaves of bitter tomato and radish were also high (24.5%), similar to that obtained from high quality leguminous fodder trees. These physico-chemical analyses show that there are some potential benefits that can be harnessed for high producing animals in intensive systems.

### **Refining feeding and management strategies for the forward looking milk producer**

In order to optimise the production of milk in the context of urban market oriented production, a 300-day trial was set up to assess the effect of two different feeding levels on milk yield and milk

composition, calf weight gain and postpartum return to oestrus in 26 milking cows, i.e. 10 N'Dama, 8 N'Dama x Jersey crosses, and 8 N'Dama x Friesian crosses. These were assigned randomly to two nutrition levels:

- Medium feeding level, i.e. groundnut hay *ad libitum* (120% of voluntary feed intake offered)
- High feeding level, i.e. groundnut hay *ad libitum* and 2 kg of concentrate (50% rice bran, 50% groundnut cake)

Results based on data recorded during the early and mid phases of lactation showed that the maximum daily milk offtake (10 litres/day) was observed in the N'Dama x Friesian crossbred. Supplementation influenced the timing of peak yield in both pure and cross breeds. Supplemented cows attained peak yields later than their non-supplemented counterparts and cows of higher parities had higher overall milk yields. The total feed intake varied from 4.2 kg per day for the N'Dama breed to 9 kg for the Friesian crosses. Although there was a significant difference in dams' daily weight gain between the two feeding levels and breeds, only the supplemented N'Dama had a positive daily weight gain during the lactation period. These results and their implications for feed budgeting are being examined for inclusion in technological and socio-economic options to be adopted by producers.

## **IP 8: Development and Application of Novel Techniques in Health, Reproduction, and Genetics (Biotechnology) in Support of Market-oriented Production Systems**

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), Belgium Government-funded Project, ADB-Project
NARS/NGOs:	DLS (The Gambia), ISRA (Senegal), DNE (Guinea)
IARCs/Regional Centres:	ILRI (Ethiopia), CIRDES (Burkina Faso), IAO (Italy), FAO
ARIs:	ITM (Belgium)

It is recognised that an integrated approach to disease control offers the best prospects for improving livestock productivity in order to meet the growing demand for animal products in sub-Saharan Africa. This could combine several strategies such as vaccines, drugs, vector control, use of resistant breeds and management practices. Recent advances in biotechnology have opened up new perspectives and prospects for the development of improved diagnostic tests for animal diseases and in the improvement of animal genetic resources.

Under Institutional Project 8, research work aims to contribute to:

- develop and /or test improved diagnostic tools (ELISA, PCR)
- genetically characterise indigenous domestic livestock
- a better understanding of spatial relationships of factors affecting livestock production through the application of GIS as decision-support tool

## **Building capacity in biotechnology in support of livestock agriculture**

### **PCR and recombinant MAP1-B ELISA as tools**

#### **Cowdriosis**

Tick-borne diseases, cowdriosis in particular, account for a considerable loss to animal production and productivity in both the market-oriented and traditional systems. However, the use of advanced diagnostic tools like Polymerase Chain Reaction (PCR) and recombinant enzyme-linked immunosorbent assays (ELISA) would significantly increase the accuracy of epidemiological investigations. Therefore, it would enable the development of effective control measures and strategies to reduce livestock mortality and increase animal productivity. Genetic characterisation of potentially different stocks of *Cowdria* in the various agro-ecological zones of West Africa as an activity to be executed in the near future, would contribute significantly to the prospects of developing a reliable and protective vaccine. This would also open up new prospects for the rearing of improved but susceptible breeds of livestock in endemic regions where such ventures were previously not feasible.

As a prelude to planning of research on biotechnology at the Centre, capacity and expertise in Polymerase Chain Reaction (PCR) technique for *Cowdria* diagnosis was acquired that would allow the conduct of routine diagnostic tests at the diagnostic facility of ITC headquarters at Kerr Serigne.

In 2001, validation of Polymerase chain reaction for the detection of *Cowdria ruminantium* DNA in blood samples of small ruminants was carried out, with the aim to examine the geographic genetic diversity of *Cowdria* in The Gambia. The PCR assay amplified a 281-bp fragment from DNA of *C. ruminantium* present in the blood samples collected from small ruminants. Preliminary testing of buffy coat samples on filter paper from suspected carrier small ruminants in Keneba detected *C. ruminantium* DNA in 60 % of 14 samples tested. Similarly all the samples collected from clinically and post mortem confirmed cases of cowdriosis in goats kept on station tested positive for *Cowdria ruminantium* DNA by nested PCR. These results confirmed the presence of the specific primer target sites and indicated the ability of the PCR based on the pCS20 DNA sequence to detect both clinical and carrier infections in small ruminants.

#### **Trypanosomosis**

Blood samples collected at ITC, Kerr Serigne, from a newborn calf (as a negative sample) and randomly from several apparently healthy animals were tested. Additional field samples from cattle positive for either *T. congolense* or *T. vivax* infections (determined by the buffy coat technique) were also tested.

The PCR assay amplified the target base pair fragments of the samples tested. Blood samples collected from cattle positive for *T. congolense* and *T. vivax* infections tested positive by PCR. All field samples from cattle parasitologically positive for *T. congolense*, *T. vivax* and *T. brucei* tested positive, negative controls negative. The results indicated the ability of the primer pairs to detect target DNA sequences of pathogenic trypanosome species in blood samples of cattle in The Gambia and confirmed that PCR could be used as a reliable diagnostic tool.

The future is therefore bright for the Centre to play an increasingly significant role in the use of advanced tools on old problems to relieve producers of the stresses imposed on their livestock and thus improve the opportunities of getting out of poverty.

### **The paradox of drive for quick innovations and the apparent inertia of beneficiaries - The ITC approach to reconciliation**



### **Systems' **O**verlap and **L**inkages **I**mprovement Programme (**SOLIP**)**

Three institutional projects, addressing (1) Livestock production-related consumer safety and public health issues, (2) Socio-economic factors of improved livestock production, and (3) Training, information exchange and capacity building, have been subsumed under SOLIP, the Systems' Overlaps and Linkages Improvement Programme. The themes of all three are dealing with people and their concerns directly and cut across the low-input and the market-oriented systems.

The objectives of SOLIP are summarised as follows:

- Highlight and address public health issues on livestock products and zoonotic infections in livestock
- Quantify economic impact of disease, nutrition and management stresses and benefits from technologies

- Elaborate models for enhancement of research and development capacities of NARS through targeted training and information exchange

## **IP 9: Epidemiology and Risk Assessment of Diseases Associated with Consumption of Livestock Products and Public Health Issues (Consumer Safety and Public Health)**

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU)
NARS/NGOs:	DLS (The Gambia), ISRA-CRZ (Senegal), DNE (Guinea)
IARCs/Regional Centres:	Pasteur Institute (Senegal), MRC (Gambia), ILRI (Kenya), CIRDES (Burkina Faso)
ARIs:	FUB, BgVV (Germany)

The objective of the Project is to contribute to the evaluation of public health risks resulting from the consumption of meat and milk. It focuses on the West African sub region and covers selected zoonoses such as tuberculosis, brucellosis and cysticercosis in both low input and market oriented livestock production systems.

Attention was paid to building up or reinforcing research capacities of the NARS personnel, with training inputs related to bacteriology and milk hygiene, i.e. on consumer safety, diagnostic procedures for *B. abortus* and *M. bovis*, as well as mastitis diagnosis.

### **Ensuring wholesome milk reaches consumers**

Locally produced milk is usually consumed either raw or fermented. There is little information about the quality at the farm gate and at the market level.

To investigate the hygienic status along the *animal-farmer-collector-vendor* chain, several study components were carried out. The locations were in The Gambia, Senegal and Guinea, including some private pasteurisation units in Senegal which marketed pasteurised milk and milk products. Preliminary results demonstrated a high total level of bacteriological contamination in market milk samples (both raw and sour milk). However, higher contamination rates were already detectable at the producer level.

In non-pasteurised milk, bacteria causing mastitis or of zoonotic importance were found, e.g. *Escherichia coli*, *Bacillus cereus*, coagulase-positive *Staphylococcus* spp., H<sub>2</sub>S-reducing *Clostridia*, *Listeria* spp. (only Guinea samples) and *Salmonella* spp. (only Senegal). The pasteurised samples from Senegal clearly demonstrated the positive effect of this comparatively simple technology on bacteriological counts and on the shelf life of milk. The inhibitory effect of the acidification process of sour milk on the bacteriological growth could also be demonstrated.

## A typical day for a milk vendor

Serign Bah is a milk vendor in Brikama, 40 km east of Banjul. Every day he goes to the market to sell raw milk. His wife Awa processes some of the raw milk into sour milk and sells it. Serign often has to wait up to mid-day or longer before he receives milk which is brought by the dairy farmers' wives or collectors who bring it from the farms to the market. When asked about problems he faces, Serign replies that he could sell more milk but the volumes he receives are too little. Another constraint is the poor quality of the milk offered to him. Often the milk had already started fermenting when it arrives in Brikama. His wife, who lets the milk become sour before she sells it complains that she loses if the milk is of bad quality, because in that case the curdled milk separates a lot of water and the volume of sour milk that she can sell is markedly reduced. Both, Serign and Awa, mention the problem of short shelf life. They don't have the possibility of refrigeration and therefore can keep the raw milk only for a few hours and the sour milk for only one day.



Serign and Awa participated in the study on milk hygiene carried out by ITC and partner institutions because they hoped to find solutions to the problems that they are facing. The results of the study proved a high bacterial contamination of milk already exists at farmer's level. Dirty udders and contaminated containers were important factors among others that contributed to high bacterial counts. Additionally, milk is not cooled and the transport from the farm to the market usually takes more than one hour at high temperatures (around 30°C). In order to improve the milk quality it is necessary to apply proper hand milking practices and to use clean and disinfected containers. It is also advisable to introduce heat treatment such as pasteurisation in order to reduce public health risk and extend shelf life.

Together with other vendors, collectors and dairy farmers, Serign will soon participate in training about milk hygiene being organised by ITC. He will learn how to disinfect the containers for milk that he uses and more about milk pasteurisation and processing.

## Reducing public health risks from zoonotic diseases

A number of zoonoses are recognised as emerging diseases that increase public health risks in West African countries. Some, such as rabies, are well known, others are chronic and debilitating and their impact is neither always recognised nor easy to measure.

In order to determine the prevalence of infections of *Mycobacterium bovis*, *Brucella abortus* and *Cysticercus bovis* in bovines, several pilot studies were carried out as abattoir surveys (The Gambia) and on-farm screening surveys (The Gambia, Senegal, Guinea).



A very low prevalence of *B. abortus*, *M. bovis* and *C. bovis* in cattle (Table 7) indicated a low risk for consumers in Gambia and Senegal. The results of samples from Guinea were quite different, with positive reactors found on 27 of 36 farms. A close relationship between serological findings and clinical signs of *B. abortus*-infections was observed on positive farms, often with pathognomic signs for brucellosis such as hygroma. No vaccination programme was found in place. The prevalence rates for *B. abortus* correlated positively with the age of animals. As nearly all milk is consumed raw or fermented, brucellosis appears to be a major cause of concern.

**Table 7: Status of major zoonoses in selected locations in The Gambia, Guinea and Senegal**

	Abattoir survey for <i>M. bovis</i> / <i>C. bovis</i>		On-farm herd screening for <i>B. abortus</i> / <i>M. bovis</i>	
	<i>M. bovis</i>	<i>C. bovis</i>	<i>M. bovis</i> (skin test)	<i>B. abortus</i>
<b>Gambia</b>	<b>0%</b> (n=1617 cattle)	<b>0.7%</b> (n=1617 cattle)	<b>0%</b> (n=20 farms)	<b>1.1%</b> (n=20 farms)
<b>Guinea</b>	---	---	---	Boké: <b>6.7%</b> (n=19 farms) Dubréka: <b>15.6%</b> (17 farms)
<b>Senegal</b>	---	---	<b>0.1%</b> (n=30 herds)	<b>0.6%</b> (n=30 herds)

The results from the studies on the hygienic status of milk in the production-marketing-consumption chains, and for the investigations into public health risks derived from selected zoonoses have implications for within-country and regional trade. Results have been shared with the newly created Food Control Board of The Gambia and are being used as a basis for setting national standards for microbial quality through the National Codex Committee. Thus, consumer confidence in livestock products has been boosted, which in turn is acting as an incentive for higher production, processing and marketing activities.

## **IP 10: Socio-economics, Macro-economics and Policy Aspects of Livestock Production, Utilisation, Conservation and Marketing**

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), IDRC-, ADB-funded Projects
NARS/NGOs:	ISRA (Senegal), DLS (The Gambia), DNE (Guinea)
IARCs/Regional Centres:	ILRI (Ethiopia), CIRDES (Burkina Faso)

Socio-economic livestock research at ITC aims at complementing technical research in order to understand the factors that facilitate the adoption of generated technologies. It aims at better livestock productivity and sustainability of agricultural systems promoted through adoption of socio-economically acceptable technological options and methods in partnership with NARS.

In 2000 and 2001, several studies were undertaken towards the understanding of linkages among sub-enterprises policy, socio-economic and market environments and how they impact on producers and consumers. Specifically the studies targeted:

- Typology of milk production-marketing-consumption patterns
- Identification of potentials and constraints of smallholder dairying at production, marketing and consumption levels.
- Evaluation of economic profitability of improved technologies
- Understanding of farmers' behaviour towards improved technologies
- Clarification of the role of key policy reforms in livestock production

### **Tracking the key factors for dairy production**

Surveys were conducted with farmers in Guinea, Senegal and The Gambia to characterise smallholder farmers engaged in milk production and evaluate enterprise profitability in the context of mixed crop-livestock production systems. The results of discriminant analysis indicate that smallholder farmers could be characterised on the basis of their differences in resource endowments. The most discriminating variables were farm size, number of crossbred cows (N'Dama x Zebu Gobra and/or N'Dama x European breeds) they own, and the value of investment in farm equipment. The results also showed that improved technologies for milk production such as feed supplementation are scale-neutral, whilst a technology such as the use of crossbreds is not. Notwithstanding the difference in productive resource endowment, current smallholder milk production in the region is profitable for both resource-poor and wealthy farmers in terms of resource endowment. In The Gambia for example, the estimated monthly farm profit varied from US\$ 54 per household in the resource-poor group to \$US 88 per household in the well endowed group. Major factors limiting the performance of the smallholder milk production include lack of or inefficient milk processing/handling that reduces the quantity of surplus milk

that could effectively be sold. Poor infrastructure (lack of feeder roads in particular) in conjunction with lack of processing facilities increase the transaction costs and consequently reduces the amount of milk surplus.

### **Adding value to dairying through processing and marketing**

Domestic milk marketing systems in The Gambia were surveyed to assess market operations using the Structure-Conduct-Performance (S-C-P) paradigm. The results indicated absence of formal organisations to handle this linkage between milk producers and consumers. Three informal outlet paths were identified: short (producer-consumer); medium (producer-retailer-consumer); and long (producer-collector-retailer-consumer). The latter was used by more than 76% of the sellers. Most of the milk from farmers is “home-processed” in the form of sour milk that keeps well under the heat, but some retailers (27%) traditionally process butter as well as cream from fresh milk. Women represented 90% of the surveyed milk processors in the sample, indicating that they play an essential role in handling milk for marketing. System performance was evaluated through gross margin analysis and there is evidence that the short outlet pathway was more beneficial to the sellers. The individual gross margin averaged 3, 2 and 2 Gambian Dalasis/litre for the short, medium and long outlets, respectively. The main constraints in the system were identified as lack of facilities for milk processing and preservation which impacts negatively on sellers’ opportunities; lack of funding support to sellers, which constrains them to handle large amounts of milk and dairy products.

### **Letting the producers say what they care about and motivate them**

Focus group discussion and questionnaire surveys were carried out in The Gambia and Guinea to assess farmers’ breeding practices in cattle and their preferences for cattle traits. The results indicated that farmers rank cattle breeds differently with respect to their advantages and disadvantages. Although N’Dama crossbreds were highly appreciated for their high productivity and their big size, the cost of rearing was a determinant factor for farmers’ adoption. Major traits that farmers prefer were identified and ranked as follows: size, feeding ease, body condition, mating ability, resistance to disease for males; and milk production, body condition, size, calving interval and disease resistance for female cattle.

#### **Shells and the Matrix Rating Game**

*“We have never looked at it that way. This is a very helpful tool, because it makes us see things differently and also gives us new ideas”,* says one of the owners of a cattle herd from Jawo Kunda, Central River Division of The Gambia, evaluating three different cattle breeds in a matrix rating exercise. The cattle breeds are well known to him. He is comparing the local N’Dama breed, the Senegalese zebu-type Gobra breed and their cross-bred, commonly called Macha or Djokeré.

Cattle owners are asked to evaluate each breed by ranking it for six predefined traits. The traits are animal size, milk yield, calving frequency, traction ability, ability to cope with hunger stress and disease resistance. One to five shells are placed in each cell of the matrix, where on the horizontal axis the cattle breeds are illustrated and on a vertical axis photographs symbolize the traits.

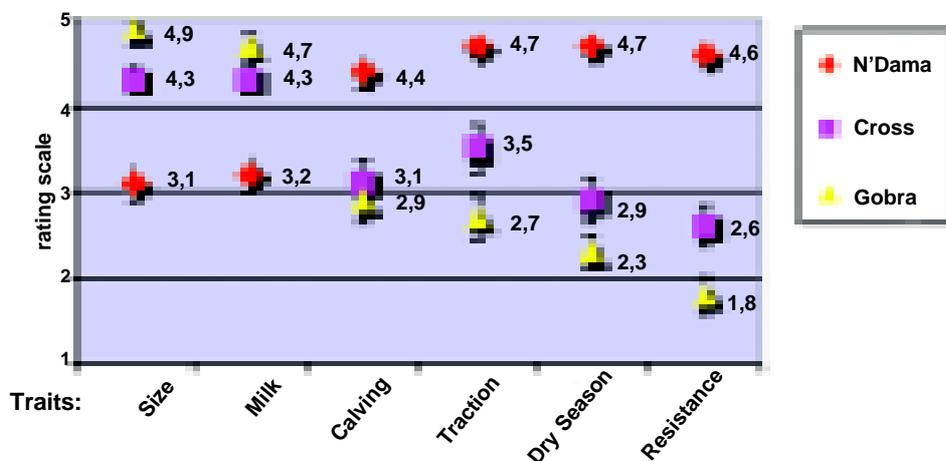


Cattle owners in Jawo Kunda busy with the matrix rating exercise

Matrix rating is an analytical tool, which has so far been more frequently applied in research and development investigating farmers' preferences for different varieties of seeds. Here it is used to look into the breed preferences of cattle owners. It is the final step in a sequence of different survey techniques employed to investigate and evaluate traditional livestock breeding systems. Other aspects of traditional breeding systems, such as breeding practices, production objectives, herd management and perception of disease pressure are likewise assessed in this largely participatory survey, which is carried out among herd owners and herders of 27 villages in three districts in The Gambia. One important aim in utilizing participatory techniques is to facilitate the exchange of relevant breeding knowledge and experience between researchers and farmers while simultaneously satisfying the more quantitative data requirements.

The diagram below depicts the matrix rating results. In comparison to the zebu-type Gobra, the N'Dama received far higher ratings for its adaptation to dry season stress, disease resistance and traction ability. The zebu-type Gobra on the other hand received lowest ratings for disease resistance and ability to cope with dry season stress, but was highly valued for its size and milk yield.

Diagram depicting matrix-rating results - average ratings of cattle breeds/types (n=96):



Cattle owners also expressed their general preference for the N'Dama breed and clearly establish the important role of the N'Dama as a multipurpose animal within the farm-household. Nevertheless, animal size and milk yield also matter and were ranked as criteria of high priority in the selection of breeding stock. A preference conflict becomes apparent, which cattle owners have to solve. It is then not surprising that cross-breeding of N'Dama and Gobra cattle are to be found among the options in traditional breeding strategies.

Interviews with key informants in preparation of the survey likewise supported the general perception that the N'Dama is the breed of choice in the study area, which is usually related to its trypanotolerance. Nevertheless, this question had never been addressed at the cattle owners themselves. A comprehensive investigation that seeks to understand traditional breeding strategies and emphasises the existing local knowledge base is an approach that builds on cooperation with livestock owners and other stakeholders, which is necessary for successful management of animal genetic resources. Ignoring it, on the other hand in the process of developing improved initiatives for animal genetic resource management is synonymous to trying to reinvent the wheel. Study results underline the importance to investigate, understand, and evaluate existing local knowledge systems related to livestock breeding as a basis of further development of formalized breeding systems.

## IP 11: Training, Information and Capacity Building

### Contributing Projects and Partners:

ITC:	PROCORDEL (EU), IDRC-, ADB-funded Projects, CIM (Germany)
NARS/NGOs:	ISRA (Senegal), NARI (The Gambia), DNE/IRAG (Guinea)
IARCs/Regional Centres:	ILRI , CIRDES (Burkina Faso), ISNAR
ARIs:	FUB, Univ. of Hohenheim, Utrecht Univ, Antwerp ITM, Pretoria Univ., CTVM, CIRAD, regional Universities (Senegal, Ghana, Nigeria)
Int. Organisations:	FAO, IAEA, WHO

The shortage of well trained, competent technical, scientific and extension personnel, frequent isolation from sources of information and limited opportunities for collaborative research are major constraints to the effective generation and dissemination of agricultural-based adapted technologies and innovations in the Region.

Therefore, human resource development (HRD) became a vital part of ITC's R&D agenda. The Institutional Project "Training, information exchange and capacity building" is the third pillar of SOLIP.

ITC increasingly applied a systematic approach by responding to identified training needs at various levels, focusing on subjects closely related to and considered important for the implementation of technical, scientific and socio-economic research activities at the Centre and the partner institutions in the Region, in particular the NARS.

Specific objectives are to:

- Strengthen the research capacity of technical and scientific personnel at NARS and ITC

- Support networking and information exchange between NARS, regional and international research and academic institutions
- Increase ITC's capacity to offer training at different levels
- Promote the dissemination of research results and technology transfer through targeted training, workshops and seminars

## **Sharing the burden of human and institutional capacity building**

Whereas human resources development and institutional capacity building are well accepted essentials of development, the financial resources to achieve these are not always readily available. The need for collaboration among partners in sharing responsibilities is evident. Therefore, much effort was expended on collaborative arrangements. The Centre of International Migration and Development (CIM) of Germany in collaboration with BMZ funded a 3-year position for a Training Coordinator. Collaboration between ITC, IITA, University of Hohenheim and Free University of Berlin were important in tailoring courses for staff of both ITC and partner NARS institutions. Regionally, collaborative support from NARS was essential in undertaking studies on meat and milk hygiene and related training.

During 2000-01, the Centre continued to extend its training activities mainly through funding provided by special projects of ITC of which the EU-funded PROCORDEL was the major contributor. The need for a series of various short courses was identified during work planning workshops as it became obvious that each project activity and goal revealed rather specific training needs for the personnel involved. Some six regional and two national scientific and/or middle level training courses, scientific seminars on various themes as well as a number of individual training activities were conducted, with the aim to give timely and appropriate support to capacity building of scientific and technical personnel at ITC and collaborating NARS. The majority of the programmed training activities in technical and managerial subjects were implemented during the reporting period, reaching an overall number of 132 trained staff from Gambia, Guinea, Guinea-Bissau and Senegal.

### **List of training courses conducted at ITC and in the Region in 2001**

Applied Animal Nutrition Research Design & Implementation	Guinea
Participatory Rapid Rural Appraisal	Guinea
Milk Hygiene & Microbiology	Guinea
Tsetse/Trypanosomosis & Ticks/Tickborne Diseases	Gambia
Participatory Rapid Rural Appraisal	Senegal
Statistics with Veterinary Applications	Gambia
Methods of Monitoring Animal Productivity & Health	Senegal
Ruminant Nutrition in the Tropics	Gambia
Scientific Writing and Project Proposal Formulation	Gambia
Database Management & Statistical Analysis	Guinea
Data Management – Introduction to LASER Software, for Handling Productivity & Health Data	Senegal
Oestrus Synchronisation & Artificial Insemination in Cattle	Gambia

Special emphasis was also given to the development and guiding of research proposals and securing University PhD admissions and scholarships/bursaries for five young ITC scientists from Burkina Faso, Cameroon, Côte d'Ivoire, Gambia, and Senegal.

The international position of Training Coordinator co-funded by CIM/BMZ of Germany was created to coordinate the present and future training programmes executed by ITC with an outreach to the Centre's mandate countries and to establish a training data base and network to link with other institutions.

### Taking capacity building to the grassroots

Training as a major instrument for human resource development has certainly contributed to a solid scientific and technical base within the Centre and the collaborating NARS, with an increased knowledge and skills level, and to the further harmonisation of techniques, protocols and approaches.

It is envisaged to include the partner countries even more in the running of training activities. Besides training of scientists, technicians and managerial staff during regional training courses, regional mobility and scholarships for special studies outside the region, the added component of training of farmers as ultimate beneficiaries through the "Training of trainers-approach" (training of technicians/extensionists) will be introduced as group training closely linked to ongoing process of knowledge, skills and technology packages transfer. It has become obvious that

close collaboration with extension services and the initiation of farmers training and sensitisation are imperative to the successful implementation of development activities, to improve livestock management, breeding and feeding knowledge and practises.



Training and capacity building are already, and will be of particular importance for those mandate countries of ITC which are recovering from civil conflicts and serious internal disturbances and displacements (Sierra Leone, Liberia, Guinea Bissau) to train or re-train their personnel for a successful rehabilitation of the livestock sector.

## Annex 1

### ITC Publications in 2000-2001

#### *International Journals*

Faye, D., Pereira de Almeida, P.J.L., Goossens, B., Osaer, S., Ndao, M., Berkvens, D., Speybroeck, N., Nieberding, F. & Geerts, S. (2001). Prevalence and incidence of trypanosomosis in horses and donkeys in The Gambia. *Vet. Parasitology*, **101**, 101-114.

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Mattioli, R.C., Bah, M., Reibel, R. & Jongejan, F. (2000). *Cowdria ruminantium* antibodies in acaricide-treated and untreated cattle exposed to *Amblyomma variegatum* ticks in The Gambia. *Experimental and Applied Acarology*, **24**: 957-969.

Mattioli, R.C., Faye, J. and Jaitner, J. (2001). Estimation of trypanosomal status by the buffy coat technique and antibody ELISA for assessment of the impact of trypanosomosis on health and productivity of N'Dama cattle in The Gambia. *Veterinary Parasitology*, **95**, 25-35.

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Rowlands, G.J., Leak, S.G.A., Woudyalew M., Nagda, S.M., Wilson, A. & d'Ieteren, G.D.M. (2000). Use of deltamethrin 'pour-on' insecticide for the control of cattle trypanosomosis in the presence of high tsetse invasion. *Medical and Veterinary Entomology*, **15**, 87-96.

Rowlands, G.J., Leak, S.G.A., Peregrine, A.S., Nagda, S.M., Woudyalew Mulatu & d'Ieteren, G.D.M. (2001). The incidence of new and the prevalence and persistence of recurrent trypanosome infections in cattle in southwest Ethiopia exposed to a high challenge with drug-resistant parasites. *Acta Tropica*, **79**, 149-163.

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## **Annex 2**

### **ITC Senior Staff**

#### ***Directorate***

Kwaku Agyemang	Director General (took office on 1.10.2000)
Raffaele Mattioli	Regional Research Coordinator (until 2.12.2000)
Dieter Mehlitz	Director General (until 30.9.2000)
Susanne Münstermann	Regional Research Coordinator (took office on 4.1.2001)
Ransford Owusu	Head of Finance and Administration

#### ***Scientific Staff***

Stanley Adams	GIS Liaison Consultant (joined in November 2001)
Adeniyi S. Adediran	Nutritionist (joined in September 2001)
O.O. Akinbamijo	Nutritionist
Austin Bosso	Biometrician, Geneticist (joined in November 2000)
Modou L. Ceesay	Entomologist
Aladji Diack	Animal Scientist (joined in November 2000)
Sofie Dhollander	Veterinarian
Bonto Faburay	Veterinarian (joined in November 2000)
Abdou Fall	Animal Scientist (joined in November 2000)
Dethie Faye	Veterinarian
Dutto Fofana	Veterinarian
Michaela Hempen	Veterinarian
Sandra Heuwinkel	Veterinarian (joined in September 2001)
Eric Hoeven	Animal Scientist (joined in September 2001)
Jutta Jaitner	Animal Scientist (left in September 2000)
Stephen Leak	Agricultural Zoologist (joined in April 2000)
Momodou Mbake	Veterinarian

Simplice Nouala	Nutritionist (joined in November 2000)
Chris Nwafor	Socio-economist (joined in June 2001)
Jörg Saecker	Veterinarian (joined in September 2001)
Famara B. Sanyang	Veterinarian
Andreas Schoenefeld	Veterinarian (joined in November 2001)
Jacques Somda	Agricultural Economist (joined in November 2000)
Ulrich Sondern	Veterinarian (left in March 2000)
Mirjam Steglich	Agricultural Economist (joined in November 2000)
Fred Unger	Veterinarian (joined in July 2000)
Jan van Wingham	Agronomist (left in April 2001)

### ***Senior Technicians***

Nerry Corr	Animal Production
Joseph Faye	Parasitology/Laboratory Technology
Mamud Njie	Animal Production

### ***Administrative Staff***

Yero Jallow	Senior Accountant
Florence Muthigani	Private Secretary

## **Annex 3**

### **Donors to ITC in 2000-2001**

#### **Unrestricted (core) funding**

Gambian Government

Belgian Government

#### **Targeted (project) funding**

European Union

- PROCORDEL - Programme Concerté de Recherche-Développement sur l'Élevage en Afrique de l'Ouest
- European Volunteer Programme (EVP) – Junior Expert assistance

Belgium

- Small Ruminant Project
- Flemish Association for Development Cooperation and technical Assistance (VVOB) – Expert and material assistance to applied research in small ruminant production
- Institute for Tropical Medicine (ITM), Antwerp – Scientific and technical support

Canada

- Cities Feeding People – Crop-livestock integration in peri-urban areas of The Gambia and Senegal (International Development Research Centre -IDRC)

Germany

- Improved Performance of Trypanotolerant Livestock (BMZ/GTZ)
- Collaborative Research Unit (Free University of Berlin/Senate of Berlin) – Expert and material assistance
- Agroforestry – Integration of livestock into agroforestry. Collaborative project with CRDFP II (GTZ/KfW)
- Integrated expert programme (CIM)

Italy

- Consultant and material support for establishing GIS-unit (Istituto Agronomico per l'Oltremare - IAO)
- Third World Academy of Science - Conference co-sponsoring (Int. Centre for Theoretical Physics, Trieste)

The Gambia/IFAD

- Rural Finance and Community Initiatives Project (RFCIP): Agroforestry – Intensive Feed Gardens

African Development Bank

- Dairy Production – Continuous F1 crossbreeding programme for dairy cattle

## **Annex 4**

### **Statement of Income and Expenditure**

*International Trypanotolerance Centre (ITC)  
Financial Statements*

#### **Income and Expenditure Account**

*for the years 2000 and 2001*

	<b>2001 (US\$)</b>	<b>2000 (US\$)</b>
<b>Income</b>		
Donations	1,262,348	1,635,306
Sundry income	127,354	137,173
Total income	1,389,702	1,772,479
<b>Expenditure</b>		
Research	1,033,758	870,528
Training	49,613	14,458
Library and information	1,036	1,764
General administration	173,739	191,852
General operations	112,311	96,518
Council matters	12,980	11,987
	(1,383,437)	(1,187,107)
Surplus before depreciation	6,265	585,372
Depreciation	248,478	251,661
(Deficit) / Surplus for the year	242,213	333,711

*International Trypanotolerance Centre (ITC)*  
**Financial Statements**

## Balance Sheet

*as at 31 December 2000 and 2001*

	2001 (US\$)	2000 (US\$)
<b><u>Assets</u></b>		
<b>Non-current assets</b>		
Property, plant and equipment	3,452,115	3,602,116
<b>Total non-current assets</b>	3,452,115	3,602,116
<b>Current assets</b>		
Inventories	22,898	23,570
Receivables	305	
Cash and cash equivalents	693,085	584,214
<b>Total current assets</b>	716,288	607,784
<b>Total assets</b>	<u>4,168,403</u>	<u>4,209,900</u>
<b><u>Equity and liabilities</u></b>		
Accumulated fund	3,684,330	3,944,000
<b>Liabilities</b>		
Bank overdraft	83,070	105,300
Accruals	20,563	98,380
Deferred income	365,887	0
<b>Total current liabilities</b>	484,073	265,900
<b>Total equity and liabilities</b>	4,168,403	4,209,900

## ANNEX 5

### MEMBERS OF ITC COUNCIL

**Dr. Momodou Sompo-Ceesay**

CHAIRMAN

Cape Point, BAKAU

The Gambia

Tel: +220 495 929

E-mail: itc@itc.gm

**Prof. Stanny Geerts**

VICE CHAIRMAN

Prince Leopold Institute of Tropical Medicine

Nationalestraat 155, B-2000

ANTWERP, Belgium

Tel: + 323 - 247 6262

Fax: + 323 - 216 1431

E-mail: sgeerts@itg.be

**Prof. Peter Holmes**

Department of Veterinary Physiology

Bearsden Road

GLASGOW G61 1QH, United Kingdom

Tel: + 44 141 330 3582

FAX: + 44 141 330 5797

E-mail: p.holmes@enterprise.gla.ac.uk

**Dr. Kwaku Agyemang**

Director General (since 1/10/2000)

ITC, PMB 14, BANJUL, The Gambia

Tel: + 220 462928 (office)

+ 220 463423 (direct office)

+ 220 960094 (mobile)

Fax: + 220 462924

Email: k.agyemang@itc.gm

**Prof. Dieter Mehlitz**

Director General (left 2000)

ITC, PMB 14, BANJUL, The Gambia

**Dr. Mamadou Diallo**

Directeur Général  
Direction Nationale de Elevage  
B.P. 559, CONAKRY  
Republic de Guinea  
Tel: + 224 412 137/ 453 050 / 402 447  
Cell: + 224 134 024 47  
Fax: + 224 447 184  
E-mail: dne-cep@biasy.net

**Honorable Hassan Sallah**

Secretary of State for Agriculture  
Department of State for Agriculture  
The Quadrangle  
P.O. Box 739, BANJUL, The Gambia  
Tel: + 220 228 270 / 227 994  
Fax: + 220 227 994

**Dr. Samuel Bruce-Oliver**

Director General  
National Agricultural Research Institute (NARI)  
YUNDUM, The Gambia  
Tel: + 220 484-925 / -928 / -931  
Fax: + 220 484 921 / -927

**Dr. Arouna Gueye**

Directeur de Recherches  
LNERV/ISRA  
B.P. 2057, DAKAR HANN, Senegal  
Tel: + 221 832 2118  
Fax: + 221 832 2118  
E-mail: lnerv@syfed.refer.sn

**Dr. John McIntire**

Country Director  
World Bank Office  
DAKAR, Senegal  
Tel: + 221 849 5011 (Office)  
Tel: + 221 825 5555 (Home)  
Cell: + 221 638 5129  
E-mail: JMcIntire@worldbank.org

**Dr. Didier Richard (left 2001)**

CIRAD  
Montpellier  
FRANCE

