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ANNUAL PROJECT PROGRESS REPORT 2009

and

OUTLOOK 2010

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Introduction

The International Trypanotolerance Centre (ITC) is an autonomous, non-profit-making research institution, established by an act of Parliament in 1982. ITC was conceived to serve the West African region, particularly the sub-humid and humid zones. The mandate countries are member states of the Mano River Union (MRU) and the Organisation pour la Mise en Valeur du Fleuve Gambie (OMVG): Guinea, Guinea Bissau, Liberia, Senegal, Sierra Leone and The Gambia.

Vision

The medium-term (2005-8) and long-term (2005-15) vision strategy is: ITC and partner institutions are well placed to pro-actively address current and future problems in the livestock and related sub-sectors in ways that contribute to reduction in poverty and improved livelihoods while protecting the production environment.

Mission

The centre's mission is to act as promoter and leader in regional livestock-based agricultural partnerships that serve West African producers and consumers through the development and adaptation of innovations that support human welfare while protecting the environment. The general objective of ITC is to formulate, implement and make available to beneficiaries, a basket of options of livestock-based innovations whose adoption will lead to improved productivity and profitability and at the same time protect the environment.

The mission and objectives of ITC are consistent with and pertinent to the agricultural development policies of the West African Governments, the principles and objectives of CORAF/WECARD and CAADP of NEPAD. They are also linked to the overall research interests of African and overseas-based Advanced Research Institutes (ARIs) with interest in developing countries.

Strategy and orientations

- To work closely with NARS partners, ARIs, IARCs and supraregional institutions in a strategic partnership mode to address the constraints to livestock-agricultural development.
- Focal point for diverse scientific collaborations on animal agriculture for the NARS within the region while ensuring the harmonisation of research strategies adapted to local production systems.
- Give high priority to training and co-ordination of other available human resources and facilities within the region.
- Co-operate with NARS in ensuring dissemination of scientific/technical information and technology transfer.
- To convince governments and donors of the importance of livestock in the socio-economic development of the countries in the region.
- To pursue regionalisation not only at the level of research and dissemination of results but also its governance to further bring in tune with regional integrating institutions of ECOWAS and UEMOA.

- Establish working links with regional and national level stakeholder organizations such as networks and producer Platforms to ensure wider dissemination of technologies and to obtain feedbacks that could feed into designing of regionally relevant research that fit the prevailing policy environments.
- Strengthen or create new strategic alliances with CIRDES, EISMV, NEPAD, FARA, GFAR and CG centres such as IFPRI, WARDA, IWMI and IITA.

Research focus and themes

The ITC research and development programme explores synergies between animal health, animal production and livestock function, and the integration of natural resources into the eco-regional context of West Africa in relation to the socio-economic situation and the physical environment. There are three institutional programmes and ten projects designed to address the priority research themes of the centre:

Institutional Programme	Institutional Project	International donors
Low-Input Systems Improvement Programme (LISIP)	IP1: Disease risk and control for improved livestock productivity	
	IP2: Strategic exploitation of indigenous animal genetic resources for sustainable development	AfDB/GEF/GG
	IP3: Natural resource management for enhanced productivity and sustainable environments	IDRC
	IP4: Regional Project on Sustainable Management of Endemic Ruminant Livestock in West Africa (PROGEBE)	AfDB GEF
Market-oriented Systems Improvement Programme (MOSIP)	IP5: Developing meat and milk systems for market-driven enterprises	IDRC
	IP6: Appropriate feeds and feeding strategies in livestock systems for nutritional security	
	IP7: An application of biotechnology for improved animal health and production	
Systems Overlap and Linkages Improvement Programme (SOLIP)	IP8: Consumer safety and public health aspects of food production systems	VLIR
	IP9: Socio-economics and policy dimensions of livestock base agriculture	
	IP10: Training, capacity building and information exchange	

The donor funded special projects that contributed to the implementation of the ITC Institutional Programmes and Projects during the reporting period were:

IDRC Scaling-up Agricultural Innovations and Food Security Systems in The Gambia and Sierra Leone. Integrated Peri-Urban Systems: Horticulture and Livestock in West African Cities (Phase 3). IDRC Grant 103202-001. Started January 2006 for 3 years until end of 2008. The extension period of one year has ended in Dec 2009.

VLIR Epidemiology and Control of Zoonotic Infections in The Gambia and Senegal. Flemish University Development Cooperation (VLIR-UOS) Own Initiative Project. Start & duration: 1/6/06-31/5/10 (4 years).

PROGEBE Regional project on Sustainable Management of Endemic Ruminant Livestock in West Africa. The project is mainly funded by GEF, AfDB, and Governments of the four countries: Gambia, Guinea, Mali and Senegal. It has started since 2008 and will last for at least six years.

GG Gambia Government core fund

Low-Input Systems Improvement Programme (LISIP)

A larger segment of the livestock-based production systems in West Africa continues to use traditional husbandry methods, whereby producers essentially rely on browses and grasses from natural pastures/range lands and crop residues for livestock feed, with very little veterinary care provided to the animals. These systems are referred to as traditional, local unimproved or low input but they provide a living for the vast majority of resource-poor farmers in West Africa. Outputs from these systems are usually only marginally to moderately larger than subsistence requirements.

Tsetse-transmitted trypanosomosis, ticks and tick-borne infections, for example anaplasmosis, babesiosis, cowdriosis, and tick-associated diseases, such as dermatophilosis, together with gastrointestinal parasites constitute the major pathological parasitic complexes responsible for limiting animal health & production in low-input systems. It is argued that indigenous livestock found in these systems have useful traits such as disease resistance, which could add to sustainability of production, if properly exploited.

The Institutional Programme 'LISIP' contributes to technological options for better exploitation of trypanotolerant and other adaptive traits of indigenous breeds of cattle and small ruminants.

IP1: Disease Risk and Control for Improved Livestock Productivity

The long-term objectives of this Institutional Project are to:

- characterize indigenous ruminant livestock and their productive environment;
- conduct participatory selective breeding of indigenous ruminant breeds and to assist in the creation of community/association managed dispersed nucleus breeding herds;
- study the resistance/resilience of endemic ruminant livestock to vector-borne and other diseases and to assess under what conditions susceptible genotypes may be used in traditional low input systems.

Activities under this program have come to a halt as a result of the end of the INCO/EC project in 2008.

IP2: Strategic Exploitation of Indigenous Animal Genetic Resources for Sustainable Development

The objectives of this Institutional Project are in addition to those of IP1 to:

- evaluate the biological and economic impact of stress factors that affect the stability of tolerance to diseases in pure and crossbred cattle;
- study the resistance/resilience of crossbred ruminants to vector-borne diseases and to assess under what conditions susceptible genotypes may be used in traditional low input systems.

IP2-1: **Pure breeding programme for N'Dama cattle, Djallonke sheep and West African Dwarf goat in The Gambia**

Lamin K Darboe/Sidat Trawally/Nerry Corr

The International Trypanotolerance Centre (ITC) at Station at Keneba in the Kiang West district of Lower River Region is where the pure breeding programmes for the indigenous N'Dama cattle, West African Dwarf Goats and Djallonke Sheep takes place. Active breeding takes place on-station. It is an open nucleus breeding programme. The activities of the programme includes daily management of the herds and data collection, e.g. heat detection (control mating), monthly weighing, weekly milk measurement, recording of births and birth weights treatments etc.

By the end of 2009, there were 420 N'Dama cattle divided into five herds with an average of 84 cattle heads/herd to ease management. The total cattle stock includes seven breeding bulls, three vasectomised teaser bulls, a pair of oxen, 72 males and 336 females. The small ruminant flock comprises of 10 sheep and 60 goats on station.

Selection of genetic quality animals (elite males) and their dissemination is the main function of the station. The breeding program is in progress, routine management of the herds and recording of daily events is an on going process. The programme is designed in a three tier scheme: Nucleus, Multiplier and Farmer. Elite ruminant breeding males are selected from the nucleus herd level, disseminated to the multiplier level through the Gambia Indigenous Livestock Multipliers Association (GILMA), and eventually to the farmer level to improve the productivity of ruminant livestock. Data collection from the multipliers was not implemented to the lack of financial resources.

Number of livestock population on station as 31/12/2009:

	Keneba herd	Niamina herds
Cattle	420	241
Sheep	10	
Goats	60	
Total	490	241

<u>Selection</u>

Breeding Value Estimation**:** Breeding value estimations and the selection of elite animals requires sophisticated computer software and up-to-date information on all animals including monthly weights. Prof. Dempfle has updated the computer software needed to

estimate the breeding values of animals and has trained one PROGEBE site coordinator at Keneba on the applications of the program. Selection of the top elite bulls to replace breeding bulls of the nucleus herds in Keneba and potential bulls for multiplication were as well identified in 2008 and 2009 (See tables below). The selected elite bulls for the nucleus herd at Keneba are yet to be transferred from Niamina. The identified potential bulls for sale to GILMA are still at Niamina.

Replacement /New Breeding Bulls

The following bulls are selected as new breeding bulls for the nucleus herds in Keneba:

Animal Number	Date of Birth	Sire	Dam	Total Breeding Value
24548	18/08/2004	98554	92029	12.5
22624	02/11/2002	95403	90513	4.3 *
23632	15/09/2003	95516	95548	10.9
23693	16/11/2003	97710	95693	7.7

* The sire of this bull is from the screening program, thus giving him chance for diversity in the gene pool.

Bulls selected for multiplier herds

SN	Tag Number	Total BVE	Weight	Station	Herd
1	99634	10,4	268	Keneba	Breeding Bull (Keneba)
2	24587	9,4	175	Bansang	Tuba2
3	23682	9,1	179	Bansang	Tuba1
4	24628	8,2	177	Bansang	Tuba1
5	23693	7,7	178	Bansang	Tuba1
6	23600	7,4	193	Bansang	Tuba1
7	24560	7,2	182	Bansang	Tuba1
8	23660	6,4	222	Bansang	Tuba1
9	23664	6,4	155	Bansang	Tuba1
10	22622	6,0	224	Bansang	Tuba2
11	23608	6,0	207	Bansang	Tuba1
12	23574	5,6	177	Bansang	Tuba1
13	22550	5,0	259	Bansang	Tuba1
14	23528	4,9	237	Bansang	Tuba1
15	23543	4,6	176	Bansang	Tuba1
16	24575	3,6	161	Bansang	Tuba2

Dissemination of superior bulls to multipliers:

The dissemination of elite bulls is the first step in transferring genetic progress realised on-station from the nucleus herd to the multiplier level. Progenies from multipliers will also be disseminated to the farmers. However, the dissemination activity has not been implemented for the last three years due to financial constraints. The routine monitoring of the multipliers, periodical visits, and meetings with GILMA have also ceased. The bulls identified above for multiplication indicates that work is in progress at the nucleus breeding herds in Keneba and Niamina, and there is an urgent need to re-establish contact with GILMA to disseminate these elite bulls.

Constraints for the pure breeding program at Keneba

The difficulties listed in 2008 report are being gradually addressed, but there are still some outstanding issues:

Cattle

1. The herd sizes are too large to ensure proper herding in the rangelands and on station;
2. Supplementary feed for calves and mating bulls and recumbent animals is available but not sufficient;
3. Mating pens for bulls and small ruminants are in a very poor state and needs urgent maintenance;
4. Annual uncontrolled bush fires cause feed scarcity in the rangelands during the dry season which leads to the malnourishment of the animals;
5. Cattle tags are also insufficient thus needs to be replenished.
6. Lack of means to monitor and support the multiplier association (GILMA)

Small ruminants

1. The sheep and goat flock sizes are too small for a breeding program and needs to be increased as soon as possible.
2. The pens should be relocated in order to eradicate mange which had contributed to the high mortality.
3. Lot of data has been generated but unprocessed

Station

1. Insufficient fuel supply for generator (water pumps); hustle of driving every other week to collect fuel from ITC Kerr Serign station;
2. There are two non-functional old generators that need to be urgently repaired to help the only running generator in case of breakdown in operations;
3. The water pipe system, water tank, and some taps have depreciated so much that they need to be overhauled;
4. The exit of two ITC middle level staff from Keneba station to PROGEBE has reduced the human resource capacity.
5. The perimeter fence needs urgent repairs to prevent stray animals getting into the station.

Feed supplementation

1. Although funds have been provided to purchase feeds, the high cost of feeds diminish the quantity that could be purchased to satisfy all the target animals to be supplemented.

PROGEBE/ITC collaborative activities

The station has provided an office and resident to the PROGEBE site coordinator for Kiang West district. The station received one brand new land rover car, two motor-bicycles, one new desk top computer and accessories from PROGEBE in 2009. A livestock census for Kiang West district was jointly done by ITC staff of Keneba station and PROGEBE site coordination unit.

Outlook 2010

The pure breeding programme is a well established, and its potentials have been demonstrated by its ability to supply elite bulls to multipliers farmers. The activities on station will continue and there are hopes that extension work on the dissemination of breeding bulls will commence when the financial situation of the centre improves. However the infrastructure has to improve for the aims and objectives of the programme to be realised. To sustain the pure breeding programme, financial and human resources must be mobilized, the organization setup restructured, and the infrastructures for both animals and staff should be upgraded.

The intensive feed garden will be revived by planting Lucaena and Moringa to supplement the small ruminants during the dry season. The pasture fields on station will be re-established by growing improved grasses such as andropogon, etc.

PROGEBE is expected to rehabilitate the field station by renovating the labs, houses, and water system (pipes, tank, taps). This project will also construct bull mating pens, small ruminant pens, animal loading ramp, feed store, drinking troughs, and training centre. The station perimeter will be fenced by PROGEBE.

Research proposal

A new research proposal entitled *Assessment of Climatic factors on Glossina spp distribution, challenge and trypanosome infection in endemic cattle breeds at two PROGEBE sites in The Gambia (Niamina East and Kiang West districts)* has been submitted to the coordinator, National Coordination Unit of PROGEBE – Gambia. The proposal has been endorsed by the National Technical Committee and has been already forwarded to AfDB for approval. Implementation of this research activity is expected to commence by July 2010.

ITC Small Ruminant Flock at Kerr Seringe

Mustapha Touray

Introduction

The International Trypanotolerance Centre (ITC) has been the executing research institution for the IDRC sponsored project which started since mid 1990s. This project came in three (3) phases, phase I, phase II and phase III respectively. Phase I started in 1996 until 1999, Phase II started in 2000 until 2002. Phase III, which also marked the beginning of proper Moringa activities at ITC started in 2002. A number of goats were experimented on Moringa oleifera, an activity which is in line with ITCs Institutional Program, Market- oriented systems improvement program (MOSIP), until the end of IDRC Phase III in the last quarter of 2009. At the end of the program, all IDRC assets including the goats were transferred to and became ITC properties.

The ITC Senior Interim Management Committee made a decision in April 2009, to remove the ITC/ IDRC Small Ruminant Flock from the experiment site far in the field and relocate it at a new site nearer to the cattle herd which is closer to the laboratory complex to facilitate monitoring with the objective of selecting good performing goats to be transferred to the pure breeding flock in Keneba station.

Implemented Activities

Twenty two goats (19 females and 3 males) were transferred from the experiment site to the new site in May 2009. The whole flock was immediately vaccinated against Peste de Petit Ruminant (PPR). All goats were retagged, and weighed in June 2009. Close monitoring continued until August, the number of goats increased by one (1) when goat number 7109 kidded a female number 09013. By September 2009, the number increased from 22 to 25 goats when three goats kidded. There were no kidding in October and November. Four goats kidded in December 2009 producing six kids raising the flock size 31.

During the period under review, the flock has registered some exits, five goats died from different causes thought to be associated with tetanus, cowdriosis, and dog bite. A number of treatments, vaccinations and Sprayings were conducted during the period under review. From May to June 2009, seven different treatments using oxytetracycline 20% and pendistrep were done for different clinical conditions such as diarrhea, suspected tetanus condition, cowdriosis, eye infections, wounds and tick infestations. PPR vaccination, tick spraying and deworming were also conducted on the entire flock between May and December 2009.

Outlook 2010

At the moment the ITC Small Ruminant Flock consists of only goats. Suggestions have already been made to also look into sheep husbandry as another possible future activity. A number of ewes and rams will be bought to start the program. The main aim of this intended program is to enable ITC to participate in the Annual National Tobaski Ram Show and also to provide good and affordable rams for ITC staff during the month of Tobaski and also to provide a sound animal husbandry practice for farmers to adopt. Good performing goats will be transferred to the pure breeding program at ITC Keneba station.

Niamina Herds

Masanneh Bojang/Lamin Fofana/Saja Kora

The Niamina field station is an extension of the pure breeding program located in Keneba station, and the work and supervision on the herds are conducted by the Sololo station staff. There are four herds: two female herds with total of 110 heads in Sambel Kunda, and two male herds with 131 heads in Tuba village.

In November 2009, 56 hiefers and one bull were moved from Niamina ITC herds to Keneba and Kerr Serign, each receiving 36 and 21, respectively. During the same period 87 weaners (48 males and 39 females) were received from Keneba.

Activities carried out included monthly weighing, and bleeding of the four N'dama cattle herds to determine weight gains and trypanosome infections. The trypanosome infection was high in months of October, November and December with infection rates at 16%, 19% and 11%, respectively. All trypanosome infected animals with PCV levels less than 20% coupled with critical clinical conditions were treated with Diminazene Diaceturate

7% solution. There was an outbreak of lumpy skin disease (LSD). The herds were vaccinated against Haemorrhagic Septicaemia and Black-quarter. Weekly visits are conducted for recording of eventualities.

The two livestock assistants based in Kudang are carrying out the monitoring and data collection (monthly weighing, bleeding and treatment of sick animals) in the Niamina herds without having to go to Bansang or staff from Bansang having to go to Niamina by using a generator. Presently, there are about 232 heads of cattle, which are bled and weighed at monthly intervals. Results indicate that the prevalence of Trypanosomiasis is still fairly high in the area, also reflected by the considerable presence of tsetse flies. There is the need to purchase bleeding materials, as the monthly bleeding of the animals is the guide to the trypanosome infection rate which determines intervention periods.

PROGEBE/ITC collaborative activities

A livestock census for Niamina East district was jointly done by ITC staff at Niamina field station and PROGEBE site coordination unit. PROGEBE plans to rehabilitate Tuba field laboratory in 2010.

Constraints of Niamina field station

1. Late transfer of hiefers from Niamina to Keneba leads to undesirable mating by unknown bulls which could jeopardise data collection and analyses
2. Dry season feed problem: it would be necessary to have some groundnut hay and rice bran during the dry season for the sick animals
3. The car battery is used for weighing is no longer functional and needs replacement.
4. The bleeding materials are in short supply.
5. The weighing scale and beams should be replaced.
6. Need to have quality rain boots and rain coats.
7. Tuba field laboratory is non-functional.

IP2-2: **Activities at ITC Bansang/Sololo station**

Alpha Jallow/Saja Kora

Sololo is only partially active with few programs connected to the pure breeding program at Keneba, and achievements are minimal for the period under review. It must be recalled that the Bansang Station in the Central River Region is located in a livestock region with the following characteristics:

a) Large animal population
b) Cooperative livestock owners
c) Excellent site for testing tsetse challenge of weaned animals from the Keneba nucleus herd.
d) Four herds of cattle belonging to ITC and are located in Niamina East District CRR
e) Excellent station facilities
f) Excellent working relationship with the farming communities in the region.

Activities

The Gate clinic is rendering services to the livestock owners in terms of treatments and advices on good management practices in the field of livestock rearing. The clinic gives treatment to visiting sick animals based on laboratory diagnosis. The livestock assistant at the gate clinic does give services to livestock owners such as vaccinations against Haemorrhagic Septicaemia (HS) and Black-quarter (BQ).

The annual fire belt exercise to protect the station from bush fires has been completed on time before the bush was burnt.

The follow up for the connection of ITC Sololo station to the National Electricity Grid by National Electricity and Water Company (NAWEC) has been pursued but we are yet to be connected. The part payment receipt of D100,000.00 was taken to NAWEC's office in Bansang for follow up. NAWEC is waiting for the arrival of transformers to connect ITC Sololo/Bansang.

In a trace back of index human salmonella cases detected by MRC laboratories at Basse, anal swabs were collected from animals (five chickens, five goats, five sheep) in the compound of the human index case to determine similarities between human and animal salmonella isolates. The samples when collected were stored at the MRC laboratories in Basse until analysed. This field sampling is part of a collaborative research between ITC/VLIR project and MRC on Salmonellosis study.

The station was visited by different personnel from or outside ITC. One mission comprising of Dr Ibrahima Mara, Dr Momodou Mbake, Lamin J Janneh, Mustapha Touray and Ansumana Jarju came for a two day working visit in October 2009. The main objectives of the mission were to familiarize themselves with the situation at the station, and to sought for solutions to address the major problematic issues of the station.

In November 2009 the science students of the University of the Gambia paid a study visit and were lodged on station for two weeks.

Ndeye Djigal Sall the monitoring and evaluation expert for the Regional Coordinating Unit of PROGEBE also had a night stop in the camp. Dr. Michael Dione, research associate of ITC, also came to the station to provide the necessary logistics for the salmonella study program conducted in Upper River Region.

The major constraints affecting the station are:

- Lack of electricity
- Lack of laboratory consumables
- The houses are in deplorable conditions and needs to be renovated
- The dilapidated situation of the outer fence needs urgent action.
- The erratic water supply from town calls for the maintenance of the borehole to supply water for watering the animals on station
- Lack of communication facilities as the telephone lines were disconnected since July 2005
- Insufficient imprest for the station operations.

Outlook 2010

- Follow up the process of electrifying the station by NAWEC
- Plan to revitalize Gambia Indigenous Livestock Multipliers Association (GILMA) and monitor performance of elite pure breed N'Dama bulls from the nucleus herd to the multiplier herds
- To reconnect the office telephone line for easing communication

IP3: Natural Resource Management for Enhanced Productivity and Sustainable Environments

The objective of this Institutional Project is to promote the maturation of emerging livestock production systems, with in view to specifically (1) elucidate further on the biophysical characteristics, economics of production and modalities of integration of Moringa oleifera into farming systems in The Gambia; (2) introduce Moringa cultivation into Sierra Leone as a feed security strategy.

IP3-1: Up-scaling Moringa utilization innovations for feed and food security in The Gambia

Mr Ansumana K Jarju

Several activities were conducted during the one year extension phase (Jan-Dec 2009) of the IDRC sponsored Moringa research and development.

Implemented activities

1. Moringa post-harvest trainings of the pilot intervention groups

Moringa agronomic trials conducted in ITC during the second phase of the project showed very encouraging biomass yields under high density cultivation. The volume of high quality biomass, in the range of 15 tonnes DM/ha in a 60-day growing cycle, was simply overwhelming given the context of the semi arid ecologies in The Gambia, although on-farm production would be a seasonal affair unless for exceptional cases where there are farmers that can afford to irrigate their *Moringa* fields. Conservation methods were also developed in ITC during the second and third phases of the project for an all-year round utilization as animal feed and/or supplement. These included sun-drying with or without milling, production of *Moringa* multinutrient blocks as well as the making of *Moringa* silage. Findings from the baseline data collection also revealed some other uses to which *Moringa* could be put in The Gambia along with the necessary processing techniques.

The objective of this activity was therefore to provide a guide to the current and potential project participants in the art and science of *Moringa* biomass harvesting, processing and storage. The adopted strategies involved a training of trainers (TOT) and a training of farmers (TOF). The trainings were conducted in February, March and May 2009 in Mandina ba and Jamagen. The resource persons were Malang Fofana from the National Nutrition Agency (NaNA), Seedy Fofana from Food and Nutrition Unit (FNU) of the

Ministry of Agriculture, and Francois Mendy from BAFRO, a non-governmental organization.

A synergistic approach was adopted in the implementation of the planned training sessions. Four training sessions, covering *Moringa* utilization as animal feed, cash crop, and human food were conducted during the months of February, March and May. Two training sessions were held in Mandinaba (Western Region) and Samba kalla/Jamagen (North Bank Region). A total of 26 individuals participated in the training sessions: two groundnut hay vendors, two millet sellers (representing the cash crop farmers), two potential moringa leaf marketers, and four individuals from each of the five intervention sites. There were six resource persons drawn from NaNA, FNU and the DLS.

2. Consultative meetings and seminars with stakeholders

Meetings and seminars were planned with some important stakeholders in the moringa up-scaling process in order to create mass awareness, and further mobilize for policy and financial support for moringa commercialization efforts. The target groups included the agricultural extension agencies, relevant non-governmental organizations, micro-financers and policy makers at the regional level.

Four consultative meetings were held between February and May, with a meeting held in each of the following locations: Western Region Governor's Office, the ITC Campus in Kerr Serrigne, North Bank Region Governor's Office and the groundnut hay's vendors' stalls in Abuko. A total of 48 participants and 6 resource persons took part in the meetings. The 6 resource persons were personnel from NaNA, FNU and the research team. The meetings took the form of "specific portfolio outreach and consultation

3. Formation and consolidation of Moringa Producers' Associations

The objective of this activity was to enhance the sustainability of the project outputs well beyond the withdrawal of project inputs, and make *Moringa* cultivation and commercial utilization a permanent feature in the country with the possibility of a regional dimension.

In mid-May 2009, a half day forum was created in each of the two intervention regions to conceptualize and plan for the formation of *Moringa* Producers' Association in a participatory manner with the project participating farmers. The project team took the lead position by preparing a draft constitution for the proposed association, which was then thrown open for comments and inputs from the farmers and other invited participants from other communities that showed interest in *Moringa* cultivation and utilization. It was decided at these forums that the resultant document should be presented for further deliberations during the mid-term workshop. As at the end of the exercise, the membership of the association had grown to 620 across the two regions. For ease of management, the strategy that was adopted for the formation of the association was to create "cluster communities" around some nucleus communities. This resulted in the formation of two cluster communities in the Western Region (Mandina Ba and Koubariko) and three in the North Bank Region (Kerr Jarga, Jamagen and Samba Kalla).

During the project extension mid-term workshop in June 2009, a final version of the constitution of the *Moringa* producers' association known as Moringa 'Nebedaye' Grower's Association was adopted, a copy of which was submitted along with the mid-year technical report. The registration of the regional and national associations of this body with the appropriate government agencies was then planned for the second half of the year. An election of the executive members of the association then became imperative for the registration.

Elections were held into the executive bodies of the North Bank Region and the Western Region branches of the *Moringa* producers' association in early and mid August respectively, under the supervision of the Western Region Livestock Officer, Mr. Sherifo Bojang, and members of the project team. Invited community leaders, comprising of the village chiefs and Village Development Community (VDC) leaders, served as election observers. An election was also conducted to elect officers for the Livestock Feed Vendors Association in Abuko, after the drafting and adoption of a constitution, a copy of which was submitted along with activity implementation report for July to December 2009. The lists of the elected officers of the two regional moringa producers' associations and the livestock feed vendors were also attached to the same activity implementation report. The registration certificate of moringa producers' association was attached to the activity report of July to December 2009.

4. Specialized trainings and market linkages with traders and non-governmental organizations (NGOs)

This activity was designed to further increase the awareness level on *Moringa* cultivation and utilization and it was linked to the training and seminar series.

A wider audience was however targeted with a planned bi-monthly show of *Moringa* product utilization and marketing strategies on the National Television, with a greater involvement of the NGOs. It was a continuous activity throughout 2009 in order to achieve the desired impact.

The agencies that were involved in this activity included the Gambian Radio and Television Services (GRTS), groundnut hay vendors, moringa producers from the North Bank and Western Regions, and the National Nutrition Agency (NaNA). One-day bi-monthly meetings were scheduled with these agencies. Three of such meetings were held in the first half of the year with the main goal of realizing the moringa commercialization objective. Each of the meetings was held at the Njawara Agricultural Training Centre in the North Bank Region, NARI Conference Room in Brikama (Western Region), and a field shop model at the *Moringa* community garden in Mandinaba in March, April and May 2009. The meeting at Njawara attracted an NGO-sponsored farmer organization from the neighbouring Senegal. The farmer organization expressed delight at the programme of the project, and also their willingness to collaborate with the project in the *Moringa* commercialization efforts.

As a follow-up to the one-day bi-monthly meetings in the first half of 2009, two consultative seminars were held with the concerned stakeholders at the weekly local markets in Ndungu Kebbeh (North Bank Region) and Abuko central abattoir (Western Region) during the second half of the year in order to further identify and explore *Moringa* marketing strategies and market outlets. Participants comprised of the research team, representatives of the National Nutrition Agency (NaNA), Food and Nutrition Unit (FNU) and the Department of Livestock Services (DLS). Other participants included representatives of the groundnut hay vendors, livestock dealers and the *Moringa* producers' associations. The ITC Management was represented at the Abuko forum by Dr. Famara Sanyang, who stood in for the ITC Capacity Building Expert, Dr. Mara, who had earlier on been delegated by the acting Director General of ITC, Dr. Babou Jobe, to attend the occasion.

5. Participatory monitoring and evaluation with stakeholders

The main aim of this activity was to enhance the attainment of project milestones at the designated periods, and it was planned to be a regular feature for the entire duration of the project extension phase. It was expected to provide the necessary checks and balances for project implementation as well as generate technical and logistic support for the research team.

The research team constituted a consortium comprising of the representatives of the National Nutrition Agency (NaNA), Food and Nutrition Unit (FNU), Department of Livestock Services (DLS), and a regional Director of Agricultural Services that engaged on a monthly monitoring of project activities. Five of such monitoring activities were carried out by the consortium during the first half of the project extension phase, and the small ruminant feeding trial was the major focus of all the monitoring visits. During such visits, the health status of the animals, their feeding habits as well as their response to the experimental feeds were always assessed.

In concluding the participatory monitoring and evaluation of project activities with the stakeholders, a pre-end of project stock-taking workshop was conducted. The activity was designed to provide an opportunity for the project participants; namely the moringa producers in the identified cluster communities, the live stock dealers and feed vendors, to take stock and/or reflect on the experiences they have garnered over the past twelve months of the project extension implementation phase.

6. Compilation, printing and distribution of mass awareness posters of *Moringa* product utilization

In order to achieve a wider awareness of the project outputs beyond the borders of the two regions and consequently promote their adoption, it became necessary to produce pictorial illustrations of key project outputs, in the form of posters, for dissemination to a wider audience of communities and other stakeholders. These posters were planned for release in two instalments: mid-way through the project implementation (June), and towards the close of the project in November or December.

Six hundred copies of a mass awareness poster (A3 size and coloured), as contained in the mid-term progress report, showing some key project activities/outputs during the first half of the year were produced. A few of these posters were distributed during and after the mid-term workshop to some stakeholders.

7. Establishment of new moringa gardens and expansion of previously established fields

Resulting from the various *Moringa* utilization awareness programs embarked upon by the project team in the first half of the year, there was a dramatic increase in the number of potential project participants cutting across all the target beneficiaries, such as vegetable gardens, NGOs, and livestock feed vendors that were interested in the project activities in the North Bank and Western Regions as well as in the Greater Banjul Area (the Kombos). Plans were made with a number of these potential participants to establish intensive *Moringa* feed gardens within their localities in a participatory manner with the project team. One of the major obligations of the project team was the provision of freshly harvested *Moringa* seeds for the establishment of the proposed new *Moringa* gardens. In addition, arrangements were made with the groups at the 2008 intervention sites for the expansion of their existing moringa gardens.

Communities and individuals within the North Bank and Western Regions with *Moringa* stands were contracted for the supply of ripe *Moringa* seeds from their stands at GMD35/kg (US$1.35/kg). *Moringa* seed collection strated in mid May 2009. As at the end of June, a total of about 413 kg of ripe moringa seeds had been supplied by the various communities and individuals. At the same time, about 4 ha of land had been prepared for moringa cultivation in the new intervention sites while the area cultivated with moringa at the existing intervention sites in the 2008 planting season had been increased by about 1 ha.

8. Response of small ruminants to moringa-based diets, moringa multinutrient block formulation, and construction of moringa drying shed and animal shelter

From time immemorial in The Gambia, the groundnut residue has been the traditional feed resource of choice, especially in urban areas, aside the zero feeding supplementation strategy of the traditional pastoralists. These crop residues are hauled into peri-urban animal depots where they are used on a zero-grazing basis. However, due to economic and agronomic reasons, it became necessary to investigate the potentials of alternative feed resources. A new research strategy on moringa in this regard was sponsored by the IDRC in ITC, The Gambia, for a little over a decade; 1998 to 2009. *Moringa oleifera* was investigated as an alternative to conventional concentrates in defining an appropriate supplementation strategy in a dairy production system with promising results during the second phase of the project. Positive impacts of moringa in improving the productivity of crossbred animals as demonstrated in studies in ITC with F1 cows in early and mid lactation were obtained.

Within the framework of up-scaling moringa utilization among small ruminant farmers in the third phase, a feeding trial was conducted to evaluate moringa hay, moringa multinutrient blocks and groundnut hay as dry season feed supplements to grazing rams between March and June, 2009. The feeding trial was conducted in the small ruminant housing unit constructed in Mandinaba, Western Region for a period of fifteen weeks. Twenty West African long-legged rams, weighing between 20.5kg and 27.0kg were purchased from the local small ruminant market in Banjul. They were grouped into four weight categories, and placed on four experimental diets. The heaviest animals were placed on grazing alone with no supplementation. One group of medium weight animals was placed on multinutrient block supplementation along with daily grazing while another group of medium weight animals was placed on groundnut hay supplementation in addition to daily grazing. The fourth group of animals, which were the animals with the lowest weight range, was placed on moringa hay supplementation along with daily grazing. Moringa and groundnut hay supplements were offered at 500 g/ head/ day. Each animal was housed in a pen measuring 1 m^2 and equipped with feeding and watering facilities. Each animal was weighed with the aid of a hanging scale and weighing sac before the commencement of the trial and subsequently weekly throughout the experimental period. Growth rate was monitored by regressing growth data against time.
Running parallel to the conduct of the feeding trial was the construction of the small ruminant housing units for the other four intervention sites. About 250 moringa multinutrient blocks were produced over the same period for experimental purposes and the other community animals in the five intervention sites.

9. Project extension mid-term workshop

Project activity implementation for the extension period commenced in January 2009 after a transition period spanning from October to December, 2008. During the transition period, the project team, as constituted by the then out-going project leader (Dr. Olajide Asaolu) in consultation with the ITC Acting Director General (Dr. Babou Jobe), was familiarized with the implementation stages of project activities at the existing intervention sites. The work-plan for the extension phase was thereafter developed from a series of consultative meetings between the out-going project leader and the in-coming project team, with significant inputs from Dr. Francois Gasengayire during his project monitoring and evaluation mission to The Gambia in November, 2008. A mid-term assessment of activity implementation was scheduled for June 2009 for stock-taking and to provide an outlook that can enhance the delivery of project milestones for the extension period.

A 2-day workshop was held in the third week of June 2009 with participants drawn from all the intervention sites in the North Bank and Western Regions. Representatives of groundnut hay vendors that were being targeted as potential marketers of moringa hay were also in attendance. There were three resource persons: with Malang Fofana from NaNA, Seedi Fofana from FNU and Sherrifo Bojang from the DLS. The topics that were covered include the impact of moringa utilization on small ruminants' health and the preservation methods of moringa leaves. The presentation of each topic was followed by

interactive sessions between the participants, the resource persons and the ITC project personnel. One of the project participants was also called upon to demonstrate the preparation of a moringa recipe. The draft constitution of the Moringa Producers' Association was deliberated upon and fine-tuned for its final adoption on the second day of the workshop

10. Consultancy

Dr. V. O. Asaolu was formerly an ITC Research Fellow/Animal Scientist, and the leader of the project between August 2006 and December 2008. He was hired on two different occasions, mid-way into the implementation of the project extension phase in June 2009 and at the end of the project in December 20009. Project impact assessment, provision of advice to enhance the achievement of project milestones and technical report preparations formed the core of his terms of reference. He was also required to share with the end-of-project workshop participants the results of the project during his tenure as the Project Leader in addition to synthesizing the outputs of the end-of-project workshop.

Outlook 2010

A concept note on strengthening livelihood strategies in The Gambia Sahel through improved management and utilization of Moringa and Adanzona as a major and Grilicidia and hardwickia as minor multipurpose tree species was submitted to IDRC by the ITC to request for an IDRC technical assistance grant application 2009. There is no feedback yet but emerging information from IDRC is that there is transition in place that slows own decision and new directions.

IP4: Regional Project on Sustainable Management of Endemic Ruminant Livestock in West Africa (PROGEBE)

Introduction

The Regional Project for Sustainable Management of Endemic Ruminant Livestock in West Africa (PROGEBE) is born of the will of the Gambia, Guinea, Mali and Senegal to Senegal to preserve and enhance the productivity of their endemic ruminant livestock.

Due to population pressure, drought and anthropic action (deforestation, agriculture, bushfires etc.), genetic traits of trypanotolerant livestock breeds are under increasing threat of extinction or dilution. Their habitat is also increasingly being invaded by exotic livestock breeds and converted into agricultural lands with generalized deforestation due to high fuel wood demand.

Therefore, PROGEBE aims at preserving and strengthening in a sustainable manner the genetic traits of three priority endemic livestock, species (N'dama cattle, Djallonke sheep, and the West African Dwarf goat), increasing its productivity and exploitation within an enabling physical and institutional environment. About two and a half million inhabitants in the participating countries will benefit from the project.

The project is mainly funded by the African Development Bank (AfDB), the Global Environment Facility (GEF), the Governments of member countries and its partners, ITC, UNOPS, ILRI, CIRDES and FAO. It is implemented by the International

Trypanotolerance Center (ITC) for the AfDB and United Nations Office for Project Services (UNOPS) for UNDP-GEF. The AfDB and UNDP-GEF components will last 6 years (2008-2013) and 10 years (2003-2016), respectively.

The main project partners are ministries and research institutes in charge of livestock in the four member countries: ITC in The Gambia, Agricultural Research Institute of Guinea (IRAG), Institute of Rural Economy (IER) in Mali and Senegalese Agricultural Research Institute (ISRA), ILRI based in Nairobi, Kenya, CIRDES based in Bobo-Dioulasso in Burkina Faso and FAO.

The Regional Coordination Unit is hosted by ITC in Banjul. In each country, the project operates through a National Coordination Unit, based respectively at Abuko for the Gambia, Conakry for Guinea, Bouguini for Mali and Kolda for Senegal.

In each of the four countries, five intervention sites (three primary and two secondary sites for replication of the results obtained in the primary sites) have been selected. The project covers 240 villages spread over 20 sites, including 8 priority and 12 secondary sites.

Taking into account its regional dimension, the project is supervised by: a Regional Steering Committee, National Steering Committees, and Local Steering Committees.

Summary of activities in 2009

The year 2009 was marked by the launching of the project, the completion of office set up for coordination units, the establishment of sites coordination, the preparation of basic documents, the update of the baseline situation, the definition of strategies for genetic improvement and natural resource management, negotiation and signature of several protocols with technical partners, the re-launching of breeding programs, launching of bidding process for feasibility studies and control of civil engineering infrastructures, the initiation of natural resource management and capacity building activities.

The project launching workshops were held at regional level and in the 4 countries. They were an opportunity of intense exchanges between different stakeholders and to improve project visibility at regional and national levels. Regional and national coordination units' teams are complete with the recruitment of senior and support staff. In addition, their installation and equipment (computers, office furniture, vehicles, etc.) have been made.

The three primary sites at country level were installed with the recruitment of site coordinators and technicians. Each national and regional unit has developed a draft manual procedures and a monitoring and evaluation guide. In addition the RCU has prepared an information and communication plan. These documents have been designed and developed in a participatory manner. In addition, an integrated logical framework was produced based on the two main (AfDB and GEF) project documents. Meanwhile, an integrated and computerized monitoring and evaluation and financial management system is being established.

The baseline situation of the project is being updated with the conduction of baseline surveys in Gambia, Mali and Senegal. These surveys conducted under the leadership of ILRI concerned communities, households, herds and market agents. Due to the current

situation prevailing in the country, the implementation of activities in Guinea is put on hold. Discussions have been conducted to identify alternative plans to implement activities.

The two exchange workshops and visits held respectively on genetic improvement and community-based management of natural resources have been a good opportunity to produce operational action plans and strategies for each of these themes. The re-launching of breeding programs began with the restructuration of foundation nuclei herds and the identification of multiplier herds in the Gambia, Guinea and Senegal. In Mali, the inexistence of animals at Madina Diassa centre has led to postpone the replenishment to 2010. In addition a zoosanitary monitoring system for multipliers herds and foundation nucleus has been designed and is being implemented.

The rehabilitation and/or building of civil engineering infrastructure are being prepared with the launching of the bidding process for the feasibility study and control in The Gambia, Guinea and Senegal. It relates to the research centres and marketing and processing infrastructures of livestock products.

An important step has been crossed in negotiating protocols with technical partners. At regional level, a protocol was signed with ITC which will support capacities building activities. At national level, protocols have negotiated or signed mainly with research institutes in animal production, institutes in charge of environmental monitoring, departments of livestock and forestry, private veterinarians and financial institutes. Discussions have been initiated with FAO for the organization of a regional workshop on sustainable management of animal genetic resources.

The management of natural resources at the project sites began with consultation and sensitization meetings on bush fires control in the Gambia and Senegal and equipping CBOs with small fighting equipments. Meanwhile, the mapping of the 3 sites in Senegal and one site in the Gambia has been conducted. Three workshops on the review of NRM indicators have been organized by ILRI in The Gambia, Senegal and Mali.

The start up of capacity building activities is marked up by the launching of research/development programs identification process, the selection of eight national experts to be trained in genetics and the training of technicians and agro-breeders in zoosanitary monitoring. In addition, the Senegalese technicians received an initial training on livestock techniques.

On the budgetary side, 63% of the 2009 budget has been executed with respectively 55%, 83% and 66% for AfDB, GEF and States funds. Yet, the financial execution rate is at 45% with respectively 27%, 83% and 66% for AfDB, GEF and States funds.

The major difficulties encountered during the implementation of this year annual work plan and budget (AWPB) are related to the slow procurement processes of donors, including the recruitment of site staff which has delayed the start up of field activities. In addition, the late disbursements of AfDB funds in some countries has, in some extend, delayed the implementation of activities.

Outlook 2010

Strategic intervention line 1. Preservation of genetic characteristics and improvement of production and productivity of endemic ruminant livestock (ERL)

The activities to be undertaken will include:

- the execution of community, household, livestock and marketing surveys for ERL characterization in Guinea;
- the finalization of reports on the updating of ERL baseline situation for Guinea, Mali and Senegal;
- the identification and collection of additional data (surveys, complementary studies, etc.) on ERL baseline situation;
- the collection and storage of blood samples for future ERL genotyping;
- the starting of the rehabilitation and equipment of 5 research or livestock centres ;
- the completion of the revitalization of 5 nuclei foundation existing in the Gambia, Guinea and Senegal;
- the replenishment of the foundation nucleus in Mali by recovering animals from breeders and buying complementary animals in livestock markets;
- the continuation of the identification of village cattle multiplication herds;
- the completion of the establishment of performance monitoring and control system;
- the inventory of community based organizations (CBOs) involved in genetic improvement and their support for institutional development with the assistance of a provider and the participation of animators in charge of social mobilization and organizational development;
- the implementation of at least one research-development program in each country;
- the continuation of the revitalization of the small ruminant flock in the Gambia;
- the production of a technical note on the system(s) to be promoted for the small ruminants genetic improvement;
- the formalization of relations between multiplier herds owners and station by signing a contract specifying the roles and responsibilities;
- the training by the technical partner in each country of at least 20 specialized technicians in livestock techniques and genetics, 30 agro-breeders owning multiplier herds and 20 community relays (livestock auxiliaries);
- the sensitization by specialized technicians in livestock production in each country, of at least 2500 agro-breeders in livestock breeding techniques and genetics;
- Support by site teams to multiplication herds agro-pastoralists owners for: the improvement of ERL production systems by using their production unit as demonstration herds,
- the institutional development of their organizations, and concerted identification of incentive for their effective ownership;
- the starting of the training of 8 national experts in genetics;
- the finalization and the signature in each country of partnership protocols with the private veterinarians, livestock services and institutes specialized in providing financial services;
- the finalization of discussions about the use of cryogenics and signing of the protocol related to its possible implementation in 2012;
- the training of project staff in gender;

- the organization of a regional consultation workshop on sustainable management of Animal Genetic Resources (AnGR).

Strategic intervention line 2. Improvement of the valorization (marketing and commercialization) of ERL and its products

The 2010 activities will focus mainly on:

- the completion of ERL characterization in Guinea and Mali, for the updating of the baseline situation and the identification of marketing strategies developed in the project zone;
- the feasibility study of the rehabilitation works and equipment of the 19 livestock markets, 17 slaughtering areas and 11 mini-dairies;
- the negotiation with local authorities and professionals for the establishment of a management system which will entrust more responsibilities to the professionals and allow partial reinvestment of part of revenue in the maintenance and operation of infrastructures;
- the signature of tripartite protocols (communities, professional and project) attesting those negotiations;
- the recruitment of companies in charge of the rehabilitation and the supply of equipments;
- the starting of rehabilitation works;
- the concerted identification of the location of the 160 km of feeder roads to be rehabilitated and the start up of their rehabilitation;
- the complementary study on the competitiveness as well as on the constraints and opportunities of ERL commercialization to complete the information and marketing strategies from the ERL characterization;
- the start up of discussions on strategies for commercial et information dissemination;
- the finalization of negotiation on collaborative relationships with institutions specialized in providing financial services;
- the support to the organization of competitions and fairs;
- with the assistance of a provider and the participation of animators in charge of social mobilization and organizational development, support for institutional development, the organizations that manage the processing and marketing infrastructures to be rehabilitated or built in the project area.
- the inventory and support of organizations operating in processing and marketing of livestock products in the project zone for their institutional development.

Strategic intervention line 3. Sustainable management of ERL ecosystems

The 2010 activities will focus mainly on:

- finalize surveys for the characterization of ERL ecosystems in Guinea and reports for all countries;
- concerted identification of stock routes to rehabilitate, water points and firewalls to put in place;
- identify and collect complementary information on the baseline situation;
- finalize the mapping of the project area;

- facilitate the negotiation of tripartite protocols (communities, CBOs and Natural Resource Management (NRM) project) on the emergence or strengthening of local conventions for sustainable NRM;
- train 20 technicians and 30 relays in environmental monitoring and NRM techniques;
- train on agro-breeders owners of multipliers herds on NRM topics such as composting, recycling of agricultural and agro-industrial residues, haying, forage crops, fodder banks, SDR, reforestation, etc.;
- implement annual bush fire control campaigns in the project sites;
- mark 700 km of stock routes;
- conduct feasibility studies on the establishment of water points and the rehabilitation of routes;
- introduce 1500 km of community firewalls;
- raise awareness of 2,500agro-breeders on NRM techniques (organic manure, agricultural waste recycling, forage crops, fodder banks, etc.), environmental monitoring, bush fires control;
- make an inventory of natural resources management CBO and support their institutional development with the assistance of a provider and the participation of animators in charge of social mobilization and organizational development;;
- strengthen the equipment of Bushfires Control Committees;
- train 54 site agents and community leaders in conflict management and participatory mapping;
- involve the media and opinion leaders in the popularization of sustainable ecosystems management themes via awareness workshops and their dissemination;
- develop a strategy for the establishment of a sustainable supply system of quality seeds;
- Promote the valorization of forest products.

Strategic intervention line 4. Legal, policy and institutional frameworks

It is a matter of continuing and strengthening the started activities by:

- review of laws and regulations on transhumance and AnGR management;
- launching at site level of consultation transhumance management ;
- organization of impregnating workshops for the benefit of journalist networks, locally elected and parliamentary representatives specialized in NRM, biodiversity and/or livestock
- translation into local languages, production and dissemination of laws;
- raising community awareness on the implementation of regulations and laws;
- training in negotiation, advocacy and lobbying skills of community organizations leaders involved in the project area;
- training of site staff and national experts on the implementation of regulations and laws;
- support the formalization of CBOs with the assistance of a provider and the participation of animators in charge of social mobilization and organizational development.

Strategic intervention line 5: Cooperation, knowledge management, exchange and coordination

It is a matter of continuing and strengthening the started activities by:

- the study on adapted information dissemination systems;
- the organization of 12 site and 4 national workshops to share and exploit the results of baseline situation studies the animation of an electronic forum on the management of AnGR in West Africa;
- the jointly organization of a regional workshop on genetic resources management;
- the production of exchange supports of the studies' results (baseline surveys, etc.); the preparation of a regional workshop on transhumance;
- the organization of exchange visits;
- the participation of the project representatives at the World Congress on Animal Genetics;
- the continuation of the regular publication of the electronic newsletter;
- information posting and maintenance of the website;
- radio and television broadcasting;
- promoting the emergence of ERL exchange platforms;
- Continuing to support the network of livestock breeders associations of the sub-region.

Strategic intervention line 6: Project Management

For 2010, the following activities are planned:

- hold the meetings of the Regional and National Steering Committees ;
- finalize and sign of remaining partnership protocols;
- finalize of the establishment of the monitoring and evaluation system (computerized system, zoo-sanitary monitoring system);
- audit of RCU 2008 and 2009 and NCUs 2009 accounts;
- support and internal monitoring missions;
- participate in potential donors supervision missions;
- continue the preparation and dissemination of periodic activities reports;
- prepare the mid-term project review scheduled for 2011;
- design and produce promotional materials for the project;
- mobilize the resources needed for activities implementation ;
- finalize sites team recruitment, especially in Mali;
- coordinate the research and livestock centres rehabilitation process ;
- finalize the setting up of the computerized monitoring and evaluation system integrating technical implementation and project management;
- enable internship in the project area for students within the framework of their training or thesis;
- hold regular weekly project coordination meetings;
- visit Project NCUs at least quarterly ;
- hold national and regional operational planning workshops for 2011;
- define strategies to take into account the current political situation in Guinea.

Market-oriented Systems Improvement Programme (MOSIP)

Programme goals of MOSIP are the promotion of improved and sustainable livestock production, processing and marketing technologies in medium to high input systems in West Africa through the optimization of farm and market resources.

IP5: Developing Meat and Milk Systems for meat and milk production in urban and peri-urban areas

The overall objective of the Project is to develop, evaluate and integrate crossbreds and other improved breeds in market-oriented farming systems for meat and milk production in urban and peri-urban areas, as a strategy for improving milk and meat production to meet the demands of the growing human population.

IP5-1: **Monitoring and management of ITC's on-station dairy cattle herd**

Lamin J Janneh

Background and activities

Experimentation on the production and rearing of F1 crossbred for dairying was started in ITC in the 1990ties. The first batch of F1 crossbreds (N'Dama cow x Jersey; N'Dama cow x Holstein Friesien) was produced in 1995, and subsequent batches in 1996 and 1997. This initial production and rearing of these crossbred cattle was supported from ITC core funds. Later, various donors supported specific on-station research activities or experiments as in line with their project objectives. By 1999-2000 the technology of crossbred production and rearing for dairying was transferred to on-farm involving small commercial farms and farmers living in the peri-urban areas where tsetse challenge is low.

The 1995 and 1996 produced F1 batches formed the dairy herd at ITC Kerr Serigne which serves as a demonstration and experimentation site. The herd profile registered marked numerical decline over the year under review (2009). As of January 2009, there were 18 F1 cows, two F2 heifers, 14 calves and weaners. By end of July 2009, two cows of the first produced F1 batch in 1995 died and six male weaners were culled. During the last quarter of the year, another three F1 cows and one of the two F2 heifers died. The F1 service bull was replaced by a N'Dama service bull.

Data was collected on the mortality, disease occurrence, treatments, vaccinations, milk off-takes, calvings, weanings, matings, and weights. The major constraint was the absence of proper housing of the animals, which could have contributed to disease occurrences, mortalities and low milk production.

The herd was vaccinated against Hemorrhagic septicemia and Black quarters in June 2009. Deworming of the animals was done using albendazole suspension in July and September 2009. Ticks infestations on the animals were controlled by weekly spraying with Amitraz Intraz-125EC

The dry season feeding regime for the F1 herd consists of grazing and supplementation. All animals are given 2 kg concentrate (mixture of groundnut/sesame cake and cereal

bran) every morning before milking. Animals are let out for grazing until 1:00 p.m. when they are given dried andropogon. Two kg of concentrate is given to each lactating cow before evening milking. The rainy season feeding regime of the F1 herd remains the same as in the dry season except that no dry andropogon is given but the graze longer until 4:30 p.m. on green pastures in ITC campus.

Milking of lactating cows was done every morning and evening using hand milking method. Collected milk was sieved and packaged in one liter plastic bags and sold at the local dairy unit. A total of 9,857 liters of milk was obtained from the herd during the period under review. The milk yield for 2009 was 500 L more than the yield for 2008. The monthly total milk yield in liters for 2009 is presented in figure 1. Figure 2 shows that the peak total monthly milk yields for 2009 were observed in the first quarter, whilst in 2008 the peak total milk yields were in the third quarter. The average daily yield per lactating cow is estimated at 2.0 liters valued at GMD60.00. The centre continues in its' role as educational centre of attraction to numerous and diverge students of agriculture and related sciences from the University of The Gambia and other institutions.

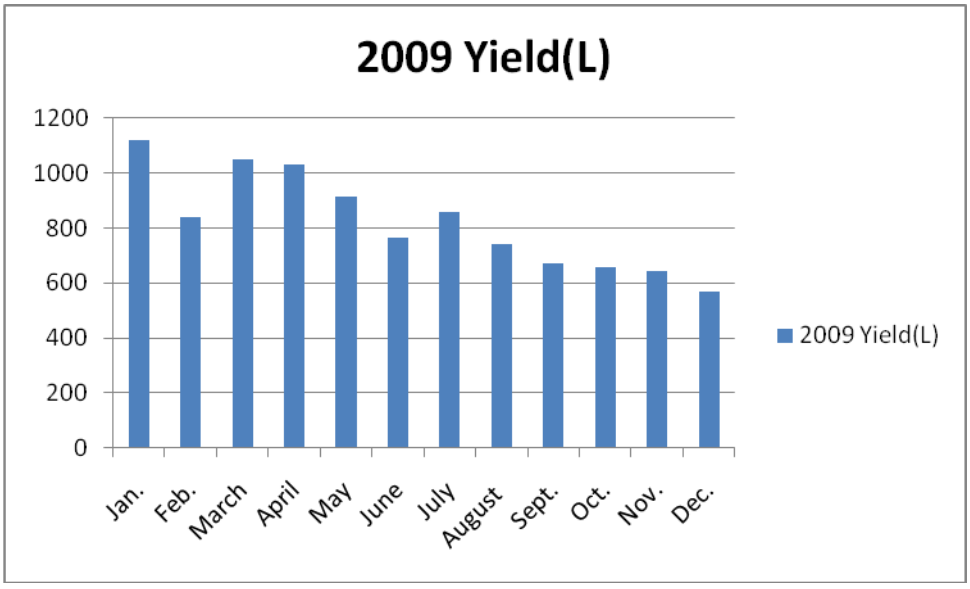

Figure 1. Total monthly milk yield for year 2009

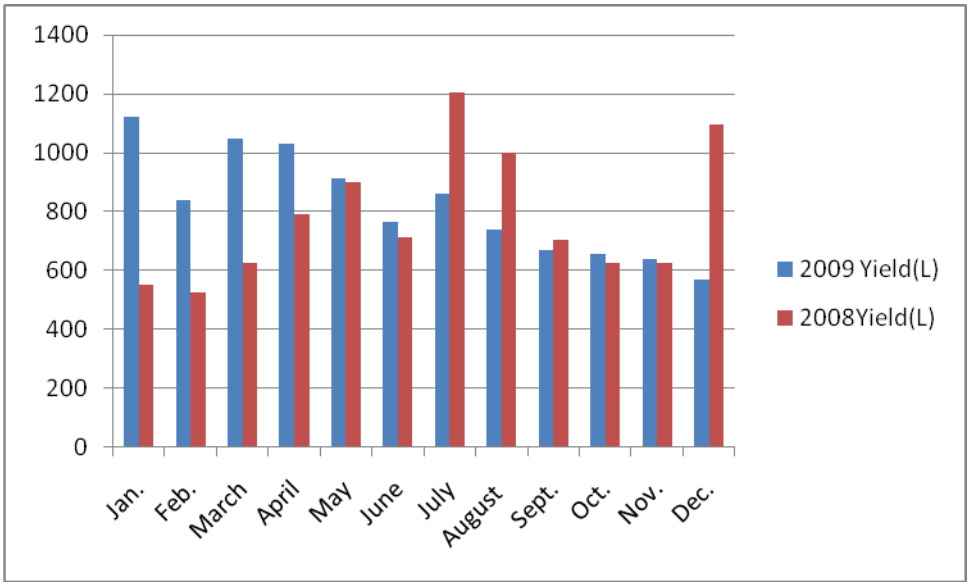

Figure 2. Total monthly milk yield for year 2008 and 2009

Constraints of the herd

Several old F1 cows that needs replacement
Housing is in a poor state
Inadequate feed

Outlook 2010

The principal asset in the much anticipated F1 replacement scheme is now at hand (twenty N'dama cows). They need a great deal of preparation (feeding) in order to cycle reproductively. Only cycling animals require artificial insemination (AI).
There is need for ITC to establish a reliable Semen source.
The maintenance of the animal shed is well underway. There are efforts to make functional the pasteurization and dairy training unit.

IP6: Appropriate Feeds and Feeding Strategies in Livestock Systems for Enhanced Nutritional Security

The objectives of this Project are to develop feeding and management strategies in support of evolving production systems by (1) strengthening the feed resource base of urban integrated farming systems; (2) evaluation of in-vitro dietary combinations for urban livestock nutrition; (3) on-farm testing and technology transfer of supplementation and nutrient recycling options.

As activities under this institutional project overlaps with IP3, it has been reported under the latter heading.

IP7: Application of Biotechnology for Improved Animal Health and Production

The objectives of this Institutional Project are to:

- enhance molecular diagnostic capabilities of ITC for epidemiological investigations of selected diseases of regional importance;
- create and strengthen institutional capacity in using DNA-based technologies for molecular characterization of: i) pathogens, ii) indigenous livestock resources;
- strengthen collaborative linkages of ITC with Advanced Research Institutes and with scientific networks for development and use of relevant agricultural biotechnologies in livestock research for development.

No activities were implemented under this program during this reporting period, except for the molecular characterization of Brucella and Salmonella isolates reported under IP8-1.1 and 3.

Systems' Overlap & Linkages Improvement Programme (SOLIP)

The crosscutting nature of this Programme addresses the enhancement of human welfare (food security, quality of life, disposable incomes) and livelihoods through the use of improved technologies, methodologies, policies and information generated through innovative collaborative research and training in three distinct areas:

1. Adoption of socio-economically appropriate technological options and methods generated in partnership with stakeholders;
2. Epidemiology and risk assessment of diseases of veterinary public health importance, food safety issues; and
3. Training, capacity building and information exchange.

IP8: Consumer Safety and Public Health Aspects of Food Production Systems

This Institutional Project addresses the identification and assessment of the importance of public hazards (zoonotic diseases), their impact on consumer safety, and development of recommendations for control and preventive measures.

IP8-1: **Epidemiology and control of zoonotic infections in The Gambia and Senegal**

The 4-year research project financed by VLIR-UOS, the University Development Cooperation of Belgian-Flemish Universities, and implemented by ITC, ITM and Antwerp University in close collaboration with partner institutions in The Gambia and Senegal, started on 1 June 2006 and will run until 31 May 2010.

The objective of the project is to investigate the prevalence, epidemiological situation and risk factors of porcine cysticercosis, bovine brucellosis, and poultry salmonellosis in selected peri-urban and rural areas in The Gambia and Senegal (Casamance). Based on the obtained results, appropriate packages for the prevention and control of these diseases will be designed, tested and their effects monitored in selected study sites, the results of

which and recommendations will be transferred to the extension services in both countries. The project shall also strengthen the diagnostic and research capacity of ITC by training of scientists/research associates and laboratory technicians in the field of epidemiology, diagnosis and control of these zoonoses.

In 2009, the project activities were concentrating on continuation of cross-section surveys that involves field sampling, laboratory testing of samples, data encoding and statistical analysis. Journal articles were drafted and submitted for publication in various peer reviewed journals.

IP8-1.1: **Brucellosis Study**

Dr Adeniran Anani Bankole

The objectives of brucellosis study activities undertaken within the framework of PhD research activities of ITC/VLIR zoonosis project were:

- To determine the prevalence of brucellosis in herds that supply urban areas of Western Region and Kolda department with milk;
- To isolate and characterise *Brucella* spp.;
- To access brucellosis contamination risk for milk consumers;
- To design sustainable prevention and control packages of brucellosis along the milk chain.

Activities carried out in 2009 within the framework of brucellosis study and results obtained are reported below. For comprehension purpose, some of these activities that started since 2007 but only achieved in 2009 are also summarized in this report.

1. <u>First phenotypic and genotypic characterization of *Brucella* isolates in The Gambia</u>

In this report, we will focus only on one herd characterised by hygromas and frequent abortion cases in Pirang village (Kombo East district) where we got serum samples and hygroma fluid for the first *Brucella* spp. isolates biotyping and genotyping in The Gambia. Apart from the latter objective, this study permitted us also to partially investigate on the relation between brucellosis clinical signs and serological status of animals.

We collected thirty five serum and six hygroma fluid samples from sexually mature cattle: three bulls (3 years old) and 32 cows (five to twelve years old) in April 2007. Data pertaining to breed, sex, age, number of calvings, number of abortions, presence of hygromas and presence of orchitis were also collected from each animal sampled. The collected samples were stored in a deep freezer (-60°C) at the International Trypanotolerance Centre (ITC) headquarters in The Gambia before their analyses at CODA-CERVA (Veterinary and Agrochemical Research Center - National reference centre for Brucellosis) in Belgium. All assays were performed at CODA-CERVA during a first research stay in Belgium in May 2007. A multi-testing, RBT and indirect Enzyme-linked Immunosorbent Assay (i-ELISA), was applied to the 35 sera.

Hygroma fluid samples were cultured. The colonies obtained were used for identification and biotyping with different tests at CODA-CERVA. *Brucella* DNA was extracted and a

MLVA-15 assay (Multiple Locus VNTR Analysis) was used to cluster the strains according to the recognized classification of *Brucella* species and biovars.

Results

The serological testing showed that 26 (74%) and 29 (83%) out of 35 serum samples were positive respectively for RBT and i-ELISA. Only seven (26%) of the 27 positive cows had aborted at least once and five of them showed hygromas.

A total of three isolates of *Brucell*a were cultured from the six hygroma fluid samples of N'Dama cattle. All the six animals with hygromas were positive to i-ELISA and five to RBT. This profile of characteristics permitted to classify the three isolates as *Brucella abortus* biovar 3 according to the Corbel & Brinley-Morgan classification. In addition, the 15-locus VNTR profile was the same for all field strains collected. The panel one markers allowed clustering the strains with *B. abortus* biovar 3 reference strain Tulya (ATCC 23450) and one strain isolated from a dromadery in Sudan. This type is also shared with one strain of *B. abortus* biovar 6 (D1744UNI-BernTgb.Nr.189 057).

Conclusion

This study permitted us to isolate and characterize *Brucella* spp. from cattle in a herd with hygroma and abortion cases in the Western Region of Gambia. The isolated B. abortus biovar 3 is common to many countries in Africa. This infection causes an important economic loss in livestock and has a serious impact on public health, not only for people close to the animals but also for people consuming the milk, since the greatest risk of developing human brucellosis is associated with direct or indirect contact with infected animals through consumption of dairy products, and/or raw milk.

The first step allowing us to access the risk of human contamination is to determine the prevalence of bovine brucellosis amongst herds involved in the milk marketing and to localize infected herds for *Brucella* spp. isolation. These were the objectives of the second and third parts of our research activities.

This work has been accepted for publication in the Veterinary Record Journal in 2009

2. Prevalence of bovine brucellosis in Western Region (The Gambia) and Kolda (Senegal) and human brucellosis in villages with serologically positive herds

The objective of this study was to determine the prevalence and risk factors of bovine brucellosis in cattle herds supplying milk to peri-urban and urban areas in WR and Kolda (Casamance), and to investigate human brucellosis in localities with high prevalence of bovine brucellosis.

Materials and methods

Data collection

The survey in Kolda département, Senegal started in September 2007 and was completed in April 2008. Forty four villages were visited, 102 herds surveyed and 1968 serum

samples collected. The survey in Western region, The Gambia started in February 2008 and was completed in June 2008. Ninety six herds were surveyed in 36 villages and 2233 serum samples collected.

For the study of human brucellosis, blood samples were taken by venipuncture from 509 people of at least 5 years old, in 5 selected villages from Western region in October 2009. The 207 samples were collected from 41 different families/households within the 302 volunteers inhabiting in the five selected villages. Out of the 41 herdsmen/herd's owners, 18 had also their herd enrolled in the bovine brucellosis survey. The questionnaire was applied to each sampled volunteer to assess his/her role in herd management, milk consumption habits, and signs and symptoms of brucellosis.

Laboratory testing

A multi-testing approach comprising Rose Bengal Test (RBT), Indirect Enzyme-Linked ImmunoSorbent assay (iELISA) and the micro-method of the Slow Agglutination Test with EDTA (SAT-EDTA) was applied to the 4201 bovine and 509 human sera.

Results

Using serial testing a seroprevalence of 2.51% and 0.05% was found in cattle in WR and Kolda, respectively. The parallel interpretation of the results gave 4.97% for WR and 0.41% for Kolda as seroprevalence rates. The true prevalence rates estimated by Bayesian approach were 4% in WR and 0.17% in Kolda. Abortion and carpal hygroma were found to be associated with bovine brucellosis. For human brucellosis study in Western region, 3 cases (2 herdsmen and one person not involved in herd activities) were diagnosed using parallel testing and none using serial testing. Close contact with infected animals was identified as the main risk factor compared to un-pasteurized milk consumption.

Conclusion

The epidemiological situation of bovine brucellosis in Western Region is completely different from the one in Kolda. The investigation on human brucellosis showed a very low seroprevalence in villages where many cases of seropositive cattle were found. For a better knowledge of the risk for humans, a study in infected herds has been proposed to know the epidemiological status of the disease.

The manuscript for publication in the Veterinary Record Journal is under preparation.

3. *Brucella abortus* detection in cow milk and molecular typing of *Brucella* isolates in The Gambia and Senegal

The objectives of this study were on the one hand to isolate *Brucella* and to detect *Brucella* DNA by classic PCR and real time PCR (RT-PCR) in milk of serologically positive cows and on the other hand to cluster by 16 multi-locus variable tandem repeats assay (MLVA) *Brucella* spp. isolated from hygroma fluids collected from cattle in Western Region (Gambia) and Casamance (Senegal). Systematic isolation either from milk or hygroma fluid and typing of *Brucella spp.* will allow us to better understand the epidemiology of this infection in a specific region, hence allowing sanitary and control measures specifically adapted to the local situation.

Materials and Methods

Data collection

Data collection took place from November 2008 to February 2009 (dry season). A second visit was made to 22 selected positive herds in WR and Kolda. Blood and milk samples were collected from all the milking cows in the selected herds, 173 in WR and 98 in Kolda department. During this visit, blood and hygroma fluids were sampled from animals wearing hygroma in the visited herds and other herds in the study sites, regardless of their sex or lactating status. As a result, respectively 11 and 1 hygroma fluid samples were collected from 7 herds located in four villages in WR and 1 herd in one village of Bignona (Casamance), the bordering department of the Kombos in WR. A sampling form to assess data pertaining to the age, abortion, hygroma, period of lactation at the time of the sampling (only for the third visit) was filled for each sampled animal.

Laboratory testing

Rose Bengal test (RBT), the micro-method of Serum Agglutination Test with EDTA (SAT-EDTA) and iELISA were applied to the sera was applied to the sera obtained from the blood samples and Milk Ring Test (MRT) to the milk samples. Bacteriological cultivation from milk was done in ITC microbiology laboratory. Milk samples kept at -20°C were analysed at CERVA for *Brucella* DNA detection by traditional PCR and RT-PCR. Only samples from animals positive to at least one of the four tests used (MRT, RBT, SAT-EDTA and iELISA) were included in the molecular analyses.

Results

Bacterial culture and traditional PCR did not give any positive result contrary to RT-PCR that showed 2 positive results out of 63 samples tested. However, the biotyping was unable to differentiate between the *B. abortus* biovar 3 identified. With 16-MLVA, 3 genotypes were identified based on the profiles obtained with Panel 1 and 2A markers. Very close herds and villages shared the same strains and the strain identified in Bignona department (Senegal) had the same profile as strains identified in 2 villages in Western Region (Gambia), bordering Casamance region in Senegal.

Conclusion

These findings promote the use of molecular techniques as epidemiological tracing tools and raise once again the risk of raw milk consumption and the need for coordinated control measures within country and between bordering countries for the eradication of brucellosis.

Manuscript for publication in a journal is under preparation.

4. Risk assessment of human brucellosis infection from consumption of cow milk sold by vendors in The Gambia

The objective of this study was to characterise the risk for people consuming raw milk from cattle herds in Western Region to be contaminated with milk through quantitative Microbiological Risk Assessment (MRA) approach.

Materials and Methods

Microbiological Risk Assessment (MRA) is used. Microbiological Risk Assessment (MRA) of food provides a powerful tool used by risk assessors to help food safety authorities in managing microbiological hazards in foods.

The hazard in this study is *B. abortus* which has been identified to be present in milk from infected herds. Milk or dairy products consumption in an endemic bovine brucellosis area can represent a risk for the consumer. Information collected and results obtained from preliminary studies on bovine brucellosis and *Brucella* detection from milk are used for the modelling of the risk.

Results

The modelling and the statistical analyses for the determination of *Brucella* concentrations in different types of milk products sold by vendors and the probability of consumers' infection are on going.

Manuscript for publication in a journal is under preparation.

Outlook 2010

Field works had been completed. The modelling of consumers' infection through raw milk consumption and the writing of the first draft of the thesis to be submitted to the University of Antwerp are on going. Three restitution workshops in the different study sites in The Gambia and Senegal are planned for the beginning of 2010. The defence of the thesis is expected to take place before the end of the project in May 2010. A conference on brucellosis slated for March 2010 will be attended to present research findings.

IP8-1.2: **Cysticercosis study**

Dr Arss Secka

Cysticercosis due to *Taenia solium* in both pigs and humans is one of the three zoonotic infections that have been studied within the framework of the project entitled *Epidemiology and control of zoonotic infections in The Gambia and Senegal* implemented by the International Trypanotolerance Centre in collaboration with the Institute of Tropical Medicine and University of Antwerp of Belgium. The project started in September 2006 and will end in May 2010. It was fully financed by the Flemish interuniversity cooperation (VLIR) of Belgium.

The whole cysticercosis study revolved around the following three objectives:

1. To determine the prevalence and assess the risk factors of porcine cysticercosis in four selected areas in The Gambia and Senegal
2. To determine what proportion of people with epilepsy and matched controls in The Gambia test positive to cysticercosis, and to look for any association between exposure to cysticercosis and the occurrence of epilepsy
3. To determine whether cysticercosis and especially neurocysticercosis is still endemic in Soutou village south Senegal about half a century after the 1962 outbreak

A study was proposed and implemented to answer each of the above objectives. These three studies constituted the PhD thesis that is supposed to be defended by the end of the project. Three journal article manuscripts have been produced out of this work. One has been accepted for publication in December 2009. Another manuscript was also submitted to Journal of Parasitology Research by end of 2009, whilst the third manuscript shall be submitted early 2010.

The three studies are presented below:

1. Porcine cysticercosis and risk factors in The Gambia and Senegal

There is limited information on the prevalence of porcine cysticercosis in The Gambia and Senegal. It has not been reported to the World Organisation for Animal Health (OIE) by both countries from 1996 to 2009, and published articles on porcine cysticercosis from these countries are scanty. One published article on data from six abattoirs in the Cap-Vert region of Senegal about causes of pig carcases condemnation during 1971-1980 showed that 0.02% had cysticercosis. This information is quite old and does not estimate the prevalence and risk factors of the disease in live pigs. Therefore, this survey was implemented to estimate the prevalence and assess the risk factors of porcine cysticercosis in selected areas in The Gambia and Senegal.

During a stratified cross-sectional survey, 1705 pigs were sampled from 279 randomly selected households, 63 randomly selected communities/villages, and four study areas in The Gambia and Senegal during the period October 2007 to January 2008. The tongue of every sampled pig was inspected for cysticerci cyst, and the collected 1705 serum samples were tested using Ag-ELISA test. A questionnaire was filled for every sampled household. The administered questionnaire was structured to gather data about the characteristics of the household, pig management, sanitation and hygiene, knowledge on cysticercosis transmission and occurrence, epileptic seizures, pig sales, and occurrence of *T. hydatigena.*

Porcine cysticercosis prevalence detected by tongue inspection at animal level per study area ranged from 0.1% to 1.0%. Using an antigen-detection ELISA the seroprevalence of cysticercosis at both community/village and animal level for the four selected study areas are: Gambian western region 80.0% and 4.8%, Bignona 86.7% and 8.9%, Kolda 82.4% and 13.2%, and Ziguinchor 81.3% and 6.4%, respectively. No risk factors for cysticercosis were found significant in this study. Kolda département had the highest seroprevalence and Western region had the lowest.

This study showed for the first time that porcine cysticercosis is endemic and distributed widely in the study areas though its incidence might be suppressed by the generalised use of toilets in the study areas. Although 64.5% and 6.5% of the households knew porcine and human cysticercosis, respectively, none of the household respondents knew how it is transmitted.

Manuscript from this study has been submitted to the Journal of Parasitology research by end of 2009.

2. Epilepsy is not caused by cysticercosis in The Gambia

Although no reports on human cysticercosis in The Gambia have been published so far, a cross-sectional survey, from October 2007 to February 2008, utilising Ag-ELISA showed a cysticercosis seroprevalence rate of 6.2% in farm pigs within Western region and Kanifing Municipal of The Gambia (Secka *et al*., unpublished results). These data suggest that cysticercosis in humans might also occur in The Gambia.

The objective of this study was to carry out a case-control study to examine which proportion of people with epilepsy and matched controls in The Gambia test positive to cysticercosis, and to look for any association between exposure to cysticercosis and the occurrence of epilepsy.

The methodology of this case-control study involved testing serum samples collected from 210 people with epilepsy and 420 matched controls by sex and age ± 5 years from 69 different places around the country during the period October 2008-March 2009. All serum samples were subjected to an antigen detection ELISA (Ag-ELISA) and enzyme-linked-immunoelectrotransfer blot assay (EITB), and the seropositives were further CT-scanned to determine the presence of cysticerci in the brain. A questionnaire was administered on every sampled person to gather information about the person's identity, epilepsy history, epilepsy predisposing factors, and cysticercosis predisposing factors.

Although not significantly different (p=0.668), circulating *Taenia* antigen was found by Ag-ELISA in 1.4% (95% CI: 0.3-4.1) of people with epilepsy and in 1.9% (95% CI: 0.8-3.7) of the controls. A non-significant (p=0.4718) odds ratio of association 0.75 (95% CI: 0.13-3.15) between epilepsy and the presence of *Taenia* antigens was found. All 630 serum samples turned out seronegative by the EITB test. There were no intracranial cysts or cyst-like structures detected among the nine CT-scanned Ag-ELISA seropositives. It was concluded that epilepsy appears not caused by cysticercosis in The Gambia.

Manuscript accepted for publication in *Tropical Medicine and International Health* (TMIH) journal in December 2009

3. Old focus of cysticercosis in the village of Soutou in Senegal still active after half a century

Taenia solium is a parasitic cestode cycling in humans and pigs. The adult stage is found in the intestine of humans, causing taeniosis whereas the larval stages mainly occurs in pigs and to a lesser extent in humans, causing cysticercosis in muscular, sub-cutaneous and nervous tissues. *T. solium* cysticercosis is endemic in many regions in Africa. However, studies on the *Taenia solium* cysticercercosis-taeniosis complex in Senegal are very limited. One report on the occurrence of human cysticercosis in Senegal emanated from a village called Soutou which is located in the Ziguinchor region. In 1962, an outbreak of human cysticercosis was reported in this village affecting 23 out of 529 people. Extra two cases of human cysticercosis were reported in the same area in 1975.

A seroprevalence of porcine cysticercosis of 26.7% (8/30) using an antigen detection ELISA (Ag-ELISA) was found in Soutou in 2008 (Secka et al., submitted). This high proportion of infected pigs tends to indicate that the environment is contaminated with *T. solium* eggs. Since humans are the definitive host of this worm and the source of infection to pigs, it is highly probable that the human population is infected by the

taeniosis-cysticercosis complex. This study was undertaken to elucidate the epidemiology of *T. solium* cysticercosis at Soutou and to determine whether cysticercosis and especially neurocysticercosis are still endemic in Soutou about half a century after the 1962 outbreak.

The study was carried out from September 2009 to February 2010. It involved a questionnaire administration, serology, treatment, coproscopy and neuroimaging. Four hundred and three serum samples (94% of the village inhabitants) were collected and tested sing Ag-ELISA and EITB. Forty three out of 48 seropositives were treated with niclosamide (Taeniadex®), their faecal samples examined for taeniosis, and their brains CT-scanned for neurocysticercosis. Cysticercosis prevalence was determined by a Bayesian approach.

Human cysticercosis seroprevalence of 11.9% and prevalence of 14.8% were found using serology and Bayesian approach, respectively. Using contrast CT-scanning test, 30.3% (13/43) of the seropositives was found to be affected by neurocysticercosis. Four out of these 43 (9.3%) were tapeworm carriers. Seropositivity was significantly associated to older age groups (41 - 60 years old; $p = 0.001$ and 61 - 91 years old; $p = 0.028$) and absence of a household toilet ($p = 0.001$). In conclusion, neurocysticercosis is still endemic at Soutou village 50 years after the first reported epidemic outbreaks.

Manuscript under preparation will be sent to PLOS neglected tropical diseases journal.

Outlook for 2010

Plans to submit my PhD thesis draft and progress report to the Secretariat of Dean's Office, Faculty of Medecine, University of Antwerp, Belgium by the end of February 2010.
In order to disseminate research findings, three restitution workshops at Kolda, Ziguinchor and ITC headquarters are planned in March 2010.
Continue to pursue publication of two other articles.
Defend PhD thesis in May 2010.

IP8-1.3: **Salmonellosis study**

Dr Michel M Dione

Non-typhoidal *Salmonella* (NTS) species are important food-borne pathogens with acute gastroenteritis being the most common clinical symptom. However, complication can occur resulting in bacteraemia with or without focal infections. Food products, especially food of animal origin such as poultry are associated in the transmission in humans. In Africa, NTS are among the most common cause of bloodstream infections in children younger than 5 years old. While epidemiological data on NTS are lacking in Africa in both humans and animal sides, a study providing a better understanding of factors that led to the emergence of the latter is a prerequisite for the design of improved intervention strategies that could reduce the probability that new pathogens can invade, and spread. Therefore, the objective of this work was to study the epidemiology of NTS pathogens in humans and animals in The Gambia and Senegal. Four study activities were undertaken within the framework of PhD research program within the ITC/VLIR zoonosis project.

1. Prevalence and Antimicrobial Resistance of *Salmonella* Isolated from Broiler Farms, Chicken Carcasses, and Street-Vended-Restaurants in Casamance, Senegal

This study was undertaken to determine the prevalence and distribution of *Salmonella* on 57 randomly selected broiler farms at the end of the rearing period and in chicken products in urban and periurban areas in Casamance, Senegal and to evaluate the antimicrobial resistance profiles of the Salmonella serovars.

Prevalences were reported as follows: on carcass skin and in muscle on 35.1, 38.6, and 29.8% of farms, respectively; in chicken meat servings from 14.3% and in 40.4% of the 285 chicken carcasses examined. The most prevalent among the eighteen serotypes identified were *S.* Brancaster (57.9%), *S.* Goelzau (10.7%), *S.* Kentucky (8.4%), and *S.* Hadar (7.3%). However, the following serotypes have never been identified in Senegal before: *S.* Bandia, *S.* Bessi, *S.* Brunei, *S.* Hull, *S.* Istanbul, *S.* Javiana, *S.* Magherafelt, *S.* Molade, *S.* Oxford, *S.* Poona, *S.* Rubislaw, *S.* Tamale, *S.* Zanzibar, and *S.* Goelzau. The prevalence on skin and in muscle was significantly associated with the detection of *Salmonella* in feces ($P \leq 0.001$), suggesting that skin and muscle are contaminated by feces. The high levels of contamination of skin and muscle can be attributed to poor hygiene at the farm level and the non-hygienic handling of chicken carcass meat during and after slaughtering.

This conclusion is supported by the fact that some serovars are present both on the farm (as found in feces) and in carcasses (on skin and meat). Food can also become contaminated through environmental contact, because hygienic measures applied in the restaurants are poor. A large proportion of our isolates (77.7%,) were resistant to two or more antibiotics commonly used in Senegalese veterinary practices and in human medicine (trimethoprim-sulfamethoxazole, tetracycline, trimethoprim, streptomycin, sulfonamides, and spectinomycin). The high prevalence of *Salmonella* in broilers in Casamance and the level of antibiotic resistance are of concern and constitute a real threat to public health.

An article has been published in Journal of Food Protection in 2009.

2. Molecular characterization of Non-typhoidal *Salmonella* (NTS) isolates from Avian Sources in Senegal by Random Amplification of Polymorphic DNA (RAPD) and Multilocus Sequence Typing (MLST) techniques

The aim of this study was to characterize 261 NTS strains isolated in Senegal from broiler farms, chicken carcasses and street-vended restaurants using Random Amplification of polymorphic DNA (RAPD) and Multilocus Sequence Typing (MLST) techniques. These techniques have provided more detail distinction among the serotypes.

Twenty distinct profiles were generated by the RAPD assay, the latter corresponding to the eighteen serotypes enrolled in the study. However *S.* Kentucky showed two distinct profiles, which distinctiveness was confirmed by MLST. The latter revealed high genetic diversity resulting in 19 clones in which 16 were new and have never been reported anywhere in the world. The 3 non novel clones namely *S.* Kentucky ST198 previously reported in Senegal, *S.* Agona ST13 and *S.* Istanbul ST33 were isolated in many countries from both humans and veterinary sources, suggesting that these clones are geographically

widely distributed and are circulating in a wide range of hosts. However, a novel clone of *S.* Kentucky multiresistant was found.

This study provided us with new insights into the genetic diversity on NTS in Senegal. Therefore, molecular tools remains essential to better study the epidemiology of NTS by tracking the sources of infection and/or contamination. These same techniques were used to study the animal to human transmission in The Gambia.

Manuscript for publication in a journal is under preparation.

3. Clonal differences between Non-typhoidal *Salmonella* (NTS) strains types from humans and those isolated from animals living in close contact in rural area of The Gambia

Fourteen children infected by NTS were traced back to the family compounds and anal swabs collected from apparently healthy animals present (chicken, sheep and goat).

Thirty five *Salmonella* serotypes were identified. Chicken were carrying *Salmonella* more frequently than sheep and goats. The most common serotypes identified were S. Colindale in human (21.42%) and *S.* Poona in animal (14.28%). Among the animals, poulrty carried the highest proportion of *Salmonella* (66.7%). In fact, poultry are considered as leader in being asymptomatic carrier of *Salmonella*. However, serotypes in humans were different from those in animals except in one case in which one serotype namely *S.* Moualine was simultaneously found in both chicken and diarrheic child but in different compounds. After proceeding MLST on all isolates, we found that those two *S.* Moualine were distinct but genetically very close because they were only one locus variant at *sucA*. Similarity matrix of the strains revealed close genetic relatedness among *Salmonella* serotypes having at least 80% similarity and the majority varying between 98% and 100%.

This revealed the compacity of the *Salmonella* genome which does not allow high genetic variability. There was therefore no indication of clonal groups that is adapted to any specific host because the genetic tree has revealed that all lineages contained isolates of mixed origin (human and animal).
The association between salmonellosis and the co-diagnosis with another disease most often malaria in our study come to point out the role of opportunistic infections and malaria in NTS infections, which role has been clearly discussed by several authors.

Almost all serotypes were susceptible to all antibiotics. This relates the fact that antibiotics are not yet in the habits of the population for treatment of NTS infections in rural area in The Gambia as well as in humans and in animal production system. These infections might have been neglected because of poverty which results to lack of access to medical facilities. Obtained results do not support the hypothesis that humans and animals in close contact in the same household carry genotypically similar *Salmonella* serotypes. Nevertheless these findings have stirred up the problem of the transmission of NTS in African context and have indexed the poultry population as playing a pivotal role of healthy-carrier in the epidemiological environment. Based on this study, we can suggest other areas to investigate like the environment and human-to-human transmission.

Manuscript for publication in a journal is under preparation.

4. Detection of virulence genes in Non typhoidal Salmonella Isolated from Humans, Animals and Food in The Gambia and Senegal

Little is known on the molecular epidemiology of NTS particularly with respect to their virulence genes. Therefore, to assess their occurrence and contribution to disease in humans and animals in The Gambia and Senegal, we screened all serotypes isolated from humans, animals and food in both countries.

A total number of 185 NTS was tested by PCR for the presence of 12 virulence genes. Among these genes, 10 belong to the five described *Salmonella* Pathogenicity islands thought to be implicated in *Salmonella* pathogenesis; and the other two genes were carried by plasmids. All genes were present at a level of more than 70% except *sopE* and *pefA* which were observed in 33% and 44% of the isolates, respectively. The most prevalent gene was *invA* (95.5%) which is an invasion gene conserved within the *Salmonella* genus. It has been widely used to diagnose *Salmonella* in humans and animals. However, the *sopE* gene which has been associated with outbreaks in human and animals was present in all serovars isolated in humans with diarrhoea except one. Interestingly, *S.* Istanbul and S. Javiana which were isolated from chicken serving restaurants carried all the virulence genes of the five pathogenicity islands. There was significant association between some virulence genes and resistance of certain antibiotics showing that resistance could increase virulence of NTS during infection.

These findings showed that all strains of *Salmonella* isolated from both humans and animals were potentially pathogenic. This is very worrying because the most virulent serotypes were also the most frequently detected in food and animals, and caused diarrhoea in immuno-compromised children.

Manuscript for publication in a journal is under preparation.

Significance and impact of the study

This study has given a clearer picture on the current situation of NTS epidemiology in The Gambia and Senegal and highlighted its public health importance in humans and animals. Therefore, efforts are needed to better control *Salmonella* infections and eliminate *Salmonella* in food which remains the major route of contamination to humans. A system of continuous surveillance to monitor antimicrobial resistance in bacteria associated with humans and animals should be established. To better meet these points, it is necessary to explore other research areas such as the environment, human-to-human transmission, relation between malaria and NTS infection, and the characterization of genetic determinants of antimicrobial resistance.

Outlook 2010

All field and laboratory works have been completed.
Three restitution workshops have been planned in early 2010 in Ziguinchor and Kolda (Senegal) and The Gambia.
One article was published in 2009 and four more are in the process of publication in 2010

The first draft of my PhD is almost finish and expecting to defend it before the end of the project in May 2010.

IP9: Socio-economics and Policy Dimensions of Livestock-based Agriculture

The overall objective of this Institutional Project is to provide stakeholders in the livestock-based agriculture with information that can be used to define appropriate policies, develop suitable technologies, and facilitate transfer to the users. This includes the socio-economic characterization and profitability studies of livestock enterprises and intervention schemes.

No research activity was undertaken under this institutional project during the period under review.

IP10: Training, Capacity Building and Information Exchange

Training, capacity building and information exchange activities were pursued in 2009. Table below shows the details of the completed and ongoing trainings. A regional capacity building and institutional development expert was recruited by AfDB under the PROGEBE project for ITC. He took up his position at ITC in April 2009, initiated some institutional developments at ITC, and coordinated the capacity building activities of the regional PROGEBE project.

Staff Name	Training Title	Institution	Status
Sidat Trawally	French Course (DELF/DALF)	Alliance Franco Gambienne	Completed in 2009
Sidat Trawally	Accounting Training (ACCA preparation)	Jollof Tutors	Completed in 2009
Nerry Corr, LA, Station Manager	MSc in International Animal Health	Edinburgh University Online	Completed in 2009
Modou Lamin Ceesay, Tsetse Entomologist	MSc in International Animal Health	Edinburgh University Online	Completed in 2009
Modou Gaye livestock assistant	BSc Agriculture (livestock)	University of The Gambia	Ongoing, until 2010
Anani A Bankole Research associate	PhD Medical science	University of Antwerp, Belgium	Ongoing, until 2010
Arss Secka Research associate	PhD Medical science	University of Antwerp, Belgium	Ongoing, until 2010
Michel Dione Research associate	PhD Medical science	University of Antwerp, Belgium	Ongoing, until 2010

Dr Arss Secka attended a conference on cysticercosis organized by the Cysticercosis Working Group for East and South Africa (CWGESA) at ILRI, Nairobi, Kenya on 21-23 October 2009 on the occasion of their 6th General Assembly Meeting. He presented the results of researches conducted on porcine and human cysticercosis in The Gambia and Senegal.

Dr Michel Dione presented a poster entitled *Prevalence and antimicrobial resistance of Salmonella isolated from broiler farms, chicken carcasss and street-vended-restaurant in southern Senegal* at the 3rd American Society for Microbiology conference on salmonella: biology, pathogenesis and prevention at Marseille, France on 5-9 October 2009