ITC Newsletter

International Trypanotolerance Centre
Banjul, The Gambia

Editorial

This issue of our Newsletter covers the first and the second quarter 2004 combined. As in its 2003 numbers, this Newsletter reflects major news and recent developments related to the work programme activities of the Centre.

As a highlight, two articles are dealing with applied genetics, one on the state of the ruminant pure breeding programme ten years after its start at ITC and in The Gambia, the other on the genetic characterisation of West African goat populations in The Gambia, Senegal, Guinea and Guinea Bissau. This article looks behind phenotypic appearances and discloses (or confirms) that there is a longer history of interbreeding and ingression of genes from the larger sahelian into the smaller trypanotolerant goat breeds.

We will see another ITC Newsletter later this year.

The Director General's Corner

It is yet another opportunity for me to share a few thoughts with the readership of our popular Newsletter. We are hopeful 2004 will bring new opportunities and resources for the Centre and partners to accomplish the remaining of our objectives and goals in our Medium Term Plan 2001 – 2004.

The Annual Work Programme Meeting which, brought Staff of ITC and representatives of collaborating institutions in January, was particularly significant, as additional resources for the regional EU-funded Project PROCORDEL for the packaging and dissemination of technologies developed or in the process of being developed had just been announced.

The successful take-off of the Extension phase of the Project in April, only few weeks after the ending of the main phase in March is a credit to the Project Leadership and Staff but also the commitment of the donor. We are much grateful to the European Union.

The Annual Meeting of the ITC Governing Council took place at the ITC Headquarters from 15 – 19 March 2004. The Council appreciated the achievements made during 2003 by the Centre Management and Staff, particularly the large number of persons from The Gambian and other mandate countries that received training, and also the successful extension of ITC-led research work into Sierra Leone. As usual the guidelines of the Council on current and future Research and Development in the region as well as management issues are appreciated and will be factored into the development of the Centre's new Long Term Strategy and Medium Term Plans planned to go into operation during first quarter of 2005.

Few important events are foreseen during the third and fourth quarters of the year. Notably the International Conference on Livestock Agriculture and the 20th Anniversary Celebration of ITC are both scheduled for November 2004. These events will be used to appreciate the continued support of our current donors and at the same time used to draw the attention to the need for support for Livestock-based agriculture Research and Development. We will need all hands at deck to pull off these events.

Once again I invite you to read and enjoy the news items and featured articles in this volume while joining me in thanking the Editor and all contributors for another job well done.

ITC Newsletter
No. 1/2, January-June 2004

ITC
A livestock-based Agricultural Research Institute dedicated to serve the West African Region

In this issue

Council members, guests and ITC staff during the Council meeting in March 2004

Developing a Long-Term Strategy for Livestock-based Agricultural Research and Development for West Africa: Participatory approaches to prioritise research needs

This year marks the end of the implementation of the Work Programmes outlined in the ITC Medium Term Plan 2001 – 2004. A new Medium Term Plan (MTP 2005 – 2008) is due. It is also appropriate that a new Long Term Strategy be developed as the Centre enters into its third 10 years of existence. In this era of participatory approaches to development, it is planned that a wider consultation with Stakeholders would be employed in identifying and prioritising research and development needs of the mandate region. Several approaches are being examined. Options that involve a wide range of Stakeholders from policy makers to grassroots actors and beneficiaries, and associated within least costs and time will be chosen. Whatever approaches are used in the elaboration of these two documents, work done in the past in the region by ITC and partners and others would be reviewed. The Research and Development results of our sister institute, CIRDES, in particular would need to be reviewed in order to identify areas where complementarities and synergies could be established.

Outcomes from consultations undertaken in the recent past, for example, a 2003 Review of Nutritional Research undertaken by experts from ILRI, CIRDES, ISRA, CIRAD, ITC and DLS will be incorporated into the process. Recommendations from PROCORDEL National Conferences in The Gambia, Guinea, Senegal held in 2003 as well as those from an IFAD, ILRI, ITC, IER workshop on Livestock Production Strategies held in Mali in May 2004 will be used to contribute to the analysis of the constraints and opportunities for livestock Research and Development for the region.

Finally, the November 2004 International/Regional Conference will provide an excellent opportunity to bring a broad range of Stakeholders and actors to a common forum to discuss R & D matters of importance to producers and customers. The guiding principle in all these processes and approaches is to answer the question "What will be the pre-occupation of West African producers, processors and consumers in the next 20 years ? ". Will food security issues, poverty reduction technologies/strategies or environmental sustainability or a combination of them drive the R & D agenda? We invite our Stakeholders to participate in these discussions.

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One year of extension of PROCORDEL to transfer research results to the beneficiaries

The four-year term of PROCORDEL was completed in March 2004. Since 2001, a large number of livestock research and development activities have been conducted in both low-input and market oriented systems in The Gambia, Senegal, Guinea, Guinea Bissau and Sierra Leone. The R&D agenda was defined through participatory processes that allowed to address genuine needs of the intermediate and ultimate beneficiaries. While the programme activities in the partner countries had generated a range of usable results, their transfer to beneficiaries could not be fully achieved. Though the transfer process had started as earlier as 2002 and continued over the following years, the external *Mission de Valorisation des Acquis* effected in October-November 2003 concluded that this process deserved more time and inputs, and therefore suggested a limited, targeted extension of the programme.

On the occasion of the PROCORDEL Management Committee Meeting held in November 2003 in Ouagadougou, a proposal for one-year extension to the Financing agreement was accepted and was later approved by the European Commission in Brussels.

The aim of the extension phase is to increase the sustainability of technology utilisation by beneficiaries and three results shall lead to its realisation: (1) Prototype technologies derived from laboratory, on-station, on-farm based R&D results of PROCORDEL have been selected, validated and adopted, (2) The prototype technologies have been adopted by the beneficiaries leading to qualitative and quantitative benefits and (3) Linkages with extension agents have improved and capacity at institutional and human resource levels has increased through greater availability and access to knowledge.

Within the framework of the extension phase, selected technologies developed during the main phase will be field and laboratory tested at an expanded scale, in close collaboration between ITC/CIRDES, NARS and extension organisations.

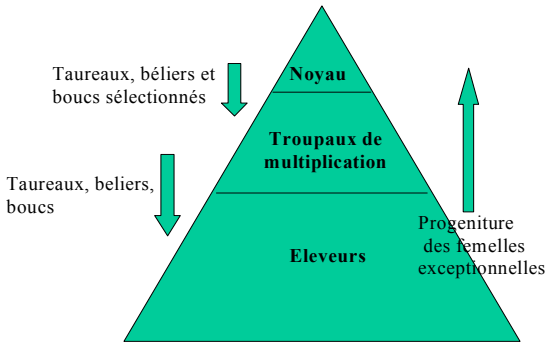
Adoption rates as well as the profitability of the technologies will be investigated during the extension phase. The analysis will also cover the delivery of key livestock support services (extension, credit systems, information and knowledge systems, and training services) so as to assess the conditions of success and failure of the tested innovations.

Achievements during the PROCORDEL main phase in terms of *networking* at the sub regional levels to disseminate research result and other useful information and *capacity building* at the institutional and personal levels will be consolidated. In connection with this, impact of the training already performed will be assessed and results will be conserved using appropriate media. These results will be further disseminated through regional dialogue and the Regional Conference to be organised later in 2004.

L'amélioration génétique des bovins et des petits ruminants trypanotolérants

Les systèmes de production à faibles intrants prédominant en Afrique de l'Ouest sont caractérisés par la variabilité saisonnière de l'offre alimentaire et un risque sanitaire élevé. Dans ce contexte, l'exploitation de l'adaptabilité des races locales constitue une stratégie pertinente pour améliorer les productions animales. L'investissement dans la sélection en race pure se justifie par les gains de productivité cumulatifs résultant de l'amélioration de l'efficience de la production. Cette stratégie d'amélioration des races adaptées aux conditions alimentaire et sanitaires locales est d'autant plus pertinente qu'elle va ultimement conduire a une meilleure compétitivité de ces races aujourd'hui menacées par les pratiques de croisement indiscriminées consécutives au changements de l'habitat des animaux, aux politiques inadéquates et à la méconnaissance de leur valeur économique. Dans le passé, la majorité des programmes de sélection mis en œuvre en Afrique de l'Ouest n'avaient pas réussi a cause du manque d'un appui technique et financier soutenu. L'absence d'objectifs de sélection clairement définis, le manque de personnel qualifiée et les difficultés de dissémination du progrès génétique avaient aussi contribué à la faiblesse des résultats obtenus.

Les programmes d'amélioration génétique du bétail N'Dama et des petits ruminants en Gambie ont été mis en



place en 1994-95. La conception des programmes est à créditer au Professeur Dempfle, ancien Directeur Général de ITC. Les points forts de ce programme émanent de sa conception et de ces modes opératoires qui ont pris en compte les contraintes des programmes de sélection mis en œuvre dans le passé. En Guinée, le programme de sélection des bovins N'Dama a été initié en 1981 au Centre d'Appui à l'Élevage de Boké mais était en veilleuse depuis 1996 avec l'arrêt du projet de la FAO qui le soutenait financièrement.

Les programmes d'amélioration génétique pour le bétail N'Dama et les petits ruminants cherchent a augmenter leur productivité, c'est-à-dire produire de manière plus efficiente à partir des ressources disponibles tout en conservant leur adaptabilité aux stress environnementaux. Le PROCORDEL a été une opportunité pour non seulement consolider les programmes de sélection en Gambie et réhabiliter celui de la Guinée, mais ce projet a aussi permis de faire des avancées remarquables en matière de diffusion du progrès génétique réalisé en station vers les troupeaux villageois.

Objectifs de sélection

Les objectifs de sélection fixés pour les bovins N'Dama sont l'augmentation de leurs aptitudes à produire de la viande et du lait sans compromettre leur résistance a la trypanosomiase et leurs autres caractères d'adaptabilité. Pour les petits ruminants, l'accent est porté sur leurs aptitudes bouchères. La définition de ces objectives de sélection s'est appuyée sur une analyse des profits marginaux et s'est aussi inspiré de l'apport des producteurs et des décideurs par des consultations.

Schéma de sélection

Le schéma de sélection a été conçu comme un système a noyau ouvert. La sélection se passe au niveau du noyau et se base sur l'estimation de la valeur génétique utilisant la méthode BLUP avec un 'modèle animal', exploitant les informations provenant des tous animaux apparentés. En plus, une opération de dépistage de femelles exceptionnelles (en matière de production laitier) est organisée régulièrement afin d'introduire leurs progénitures dans le noyau de sélection.

Estimation des paramètres et des tendances génétiques

Pendant la phase de conception des programmes de sélection à l'ITC, un progrès génétique d'environ 1% par an a été prédit (Dempfle, 1999). En l'absence de paramètres génétiques estimés, des valeurs déjà publiées ont été utilisées pour concevoir les programmes de sélection de l'ITC. Après 8 ans d'opération et de collecte d'information, il est maintenant possible de déterminer les paramètres génétiques pour les bovins et les petits ruminants et d'évaluer des tendances génétiques. Dans le cadre d'une étude conduite sous PROCORDEL, l'héritabilité et les corrélations génétiques ont été estimées et les tendances génétiques ont été évaluées pour le poids vif à différents âges et le gain de poids durant différentes saisons pour les bovins et les petits ruminants.

Diffusion du progrès génétique

Le mécanisme de diffusion du progrès génétique repose sur les troupeaux de multiplication qui reçoivent le matériel génétique amélioré provenant du noyau de sélection. L'évolution de ces troupeaux vers de véritables points de vente de reproducteurs males où peuvent s'approvisionner les autres éleveurs est le véritable défi à relever. D'importants efforts ont été consentis avec le PROCORDEL notamment dans le choix des éleveurs candidats multiplicateurs, leur formation et la recherche de stratégies de commercialisation, afin de mettre sur pied des troupeaux de multiplication qui remplissent leurs fonctions de distribution à large échelle du matériel génétique amélioré.

Réhabilitation du programme de sélection des bovines N'Dama du Centre d'Appui a l'Elevage (CAE) de Boké, Guinée

Une analyse du programme en 2001 avait révélé l'absence de contrôle de performance pour la sélection et des problèmes dans la gestion du troupeau. Cependant les infrastructures à Boké étaient bien maintenues. Les besoins de formation du personnel technique ont aussi été identifiés. A la suite de cette évaluation initiale, des mesures ont été appliquées pour redémarrer les activités de sélection. Il est maintenant possible d'utiliser les données disponibles pour évaluer les valeurs génétiques des animaux. A cet exercice d'analyse des données, fera suite la mise en place d'un système de diffusion des géniteurs à l'image du système mis en place en Gambie. Ceci fera l'objet des activités pour la phase d'extension du PROCORDEL.

Association des éleveurs et partenariat

En collaboration avec les services de l'élevage, ITC a facilité la formation de deux associations d'éleveurs propriétaires de troupeaux de multiplication: GILMA-Fuladu et de GILMA-Salum (Gambia Indigenous Livestock Multiplier Association). Les deux associations sont chargées de la commercialisation de bovins et de petits ruminants améliorés. Le système de crédit mis en place par les associations permet aux propriétaires de troupeaux de multiplication de vendre de bons animaux à des prix intéressants et aussi aux autres éleveurs d'avoir accès à de bons géniteurs avec des paiements échelonnés selon leurs capacités financières. La facilitation de l'accès aux services vétérinaires au profit de leurs membres est aussi une fonction assumée par ces associations.

La réussite des programmes de sélection s'appuie sur une forte collaboration entre les acteurs principaux des programmes de sélection, notamment ITC, Department of Livestock Services (DLS) et les éleveurs à travers leurs associations.

Conclusions

Le PROCORDEL a réussi à consolider les programmes de sélection mis en place par ITC depuis 1994/95 grâce a l'appui de GTZ/BMZ et à réhabiliter le programme de sélection de la race N'Dama en Guinée. Les paramètres génétiques de base pour les bovins N'Dama et les petits ruminants ont été estimés, les tendances génétiques et les progrès réalisés ont été évalués. Ceci va permettre une optimisation des programmes de sélection. Un accent particulier a été mis sur la diffusion du progrès génétique avec la mise en place et le bon fonctionnement des troupeaux de multiplication. Les producteurs se sont organisés pour prendre en charge des fonctions essentielles comme la commercialisation du matériel génétique amélioré grâce à l'appui du PROCORDEL. La durabilité de ces programmes va nécessiter un appui continu des associations au plan technique, organisationnel et financier, mais aussi une plus forte mobilisation des ressources pour non seulement former les personnel technique qui puisse gérer ces programmes au niveau national mais aussi pour sécuriser les moyens financiers pour le bon fonctionnement des noyaux de sélection.

Diversity and admixture in West African goats

After their original domestication in Asia ± 10,000 years ago, goats were imported into Africa about 5000 BC, where several types of indigenous goat types evolved, each adapted to specific stresses and ecological conditions of the continent. At present, the goat population in sub-Saharan Africa (SSA) is estimated at 140 million and they play an important role in human nutrition, income generation, as a source of security and for ceremonial purposes.

In SSA an area of approximately 10 million km² is infested by tsetse flies and trypanosomosis is one of the major constraints to animal production. In the West African region two basic types of goats occur and their distribution is associated with their tolerance or susceptibility to the disease. The first type is the long-legged Sahelian goat, which is found in the Sahel belt south of the Sahara and north of the forest. The second type is the West African Dwarf (WAD) goat (see picture), predominantly found more southwards in tsetse-infested humid and forested areas. Crossbreeding between the WAD goats and the Sahelian goats is taking place though, resulting in admixture. Movement of the Sahelian goats into traditionally WAD-dominated areas and resulting crossbreeding can be accidental but also intentional when farmers adopt it as a strategy to improve productivity.

The pattern and extent of crossbreeding remains unknown so far and it is also not very clear if the WAD (or Sahelian) goats of the study area are one homogenous type or if possible absence of gene flow between populations has resulted in genetically distinct populations.

Genetic characterisation of West African goats

Seventeen West African goat populations from The Gambia, Senegal, Guinea, Mali and Guinea Bissau - and one out-group population from East Africa (SEA) - were genotyped for 15 microsatellites (**Fig. 1**). Microsatellites are very useful in the scope of this study since they can quantify genetic variation within and among populations and they can show genetic admixture between populations.

Microsatellites are short repetitive elements in genomic DNA; at every locus polymorphism is a result

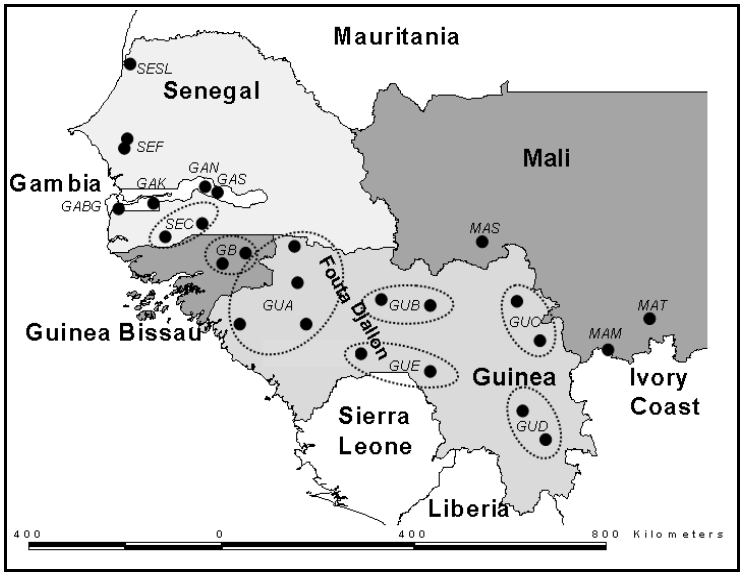


Fig. 1: geographic location of sampled West African goat populations; for Senegal: SESL = St-Louis, SEF = Fatick, SEC = Casamance; for Gambia: GABG = Brikama-Gunjur, GAK = Keneba; GAN = Niamina, GAS = Sololo; for Guinea Bissau: GB; for Guinea: sites A, B, C, D and E; for Mali: MAM = Manankoro; MAS = Sagabory; MAT = Tousséguéla. SAH is a Sahelian population imported from north Senegal into The Gambia and is not represented.

of a different number of repeats of the building unit so that alleles at loci can vary in length. After amplification of the specific DNA region by using specific oligonucleotide primers flanking the repeat region, the length of each allele is determined by visualising the amplified DNA using electrophoresis.

Results

Correspondence analysis and population structures:

Figure 2 illustrates the mean population structure results with the assumption that two types of goats are present in the West African study region. The populations GABG, GAK, GB, SEC, GUA, GUB and GUE are situated at one extremity an represent the sampled WAD genotypes, whilst MAM, MAT, SAH and SESL can be characterised as populations of the Sahelian genotype. The populations GAN, GAS, SEF, MAS, GUC and GUD are labelled as the crossbred populations.

The principal components values of genetic variation were calculated and PC-1 versus PC-2 was plotted (Fig. 3). Regression

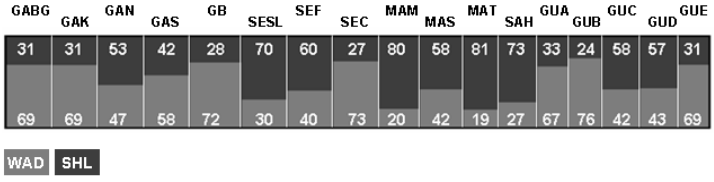


Fig. 2: Mean population structure results

analysis showed a strong and positive correlation between increasing WAD genotype percentages from the mean populations structure results and PC-1 values, implying that at one side of the plot

we find the predominantly Sahelian populations, whilst at the other end are situated the predominantly WAD populations.

Genetic variation

Over the 15 loci, 120 different alleles were observed in the 17 West African populations (Mean Number of Alleles per locus = 8.00). Gene diversity of the populations was low: MNA ranged from 4.20 to 5.40, whilst MNA_{23} (MNA for constant

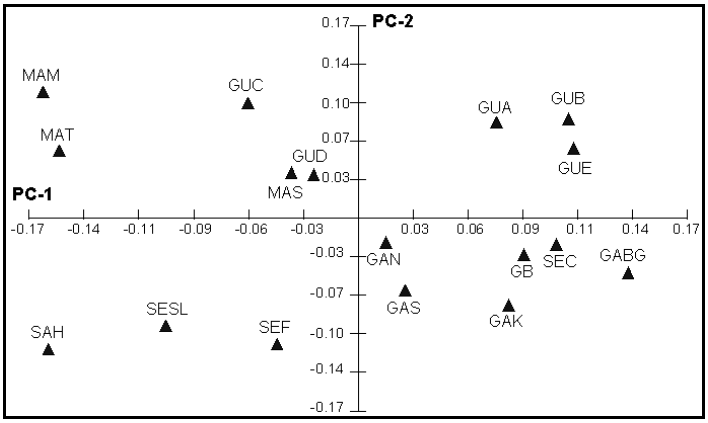


Fig. 3: Principal Components Analysis: PC-1 (X-axis) vs. PC-2 (Y-axis) projec-

sample n = 23) varied between 4.05 and 5.03; expected and observed heterozygosity ranged from 0.51 - 0.57 and 0.47 - 0.59 respectively.

According to the results obtained in the previous section, all 17 populations can be assigned to three groups: West African Dwarf, Sahelian or crossbred. Genetic diversity was generally lower for the WAD populations than for the Sahelian or the crossbred populations. For example, figure 4 represents MNA_{23} and all seven WAD populations show lower values than the Sahelian or crossbred populations, indicating that WAD type populations have a lower allelic diversity.

Most of the observed genetic variation is caused by diversity occurring within populations. Multi-locus G_{ST} and θ values are very low indicating that only a small proportion of the variation can be attributed to between population variation (6.0% for G_{ST} and 4.9% for θ). If the out-group East African

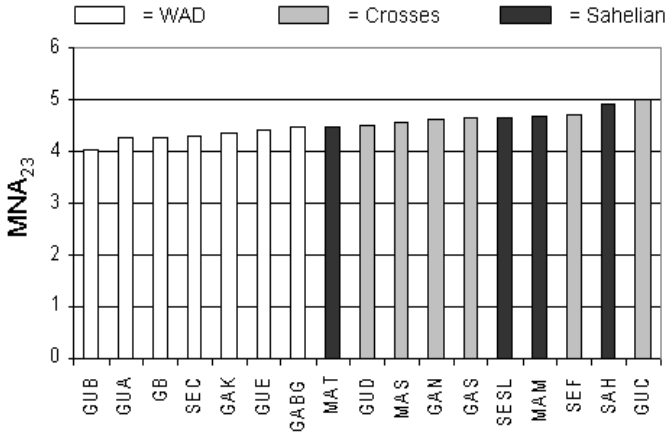


Fig. 4: Mean Number of Alleles (MNA) per locus (n = 23 individuals). Colours of bars correspond to goat type (WAD, Sahelian or crossbred)

population is excluded from analysis the values are reduced further, to 5.2 and 4.0% respectively. The reason for the low inter-population differences could be the proximity of some of the sampled populations and gene-flow and admixture between the populations.

Genetic distances and relationships between populations

From calculated Standard Genetic Distances, indicating the relationships and distances between all pairs of populations, a phylogenetic tree (excluding the crossbred populations) was constructed (Fig. 5). The WAD populations are separated from the Sahelian populations and furthermore it is possible to identify two different clusters within each goat type, as the Sahelian populations from Senegal are distinct from the Malian and the Dwarf populations from Guinea are different from the ones from The Gambia, Casamance and Guinea Bissau. Phylogeny and clustering is remarkably consistent with geographical locations and distances.

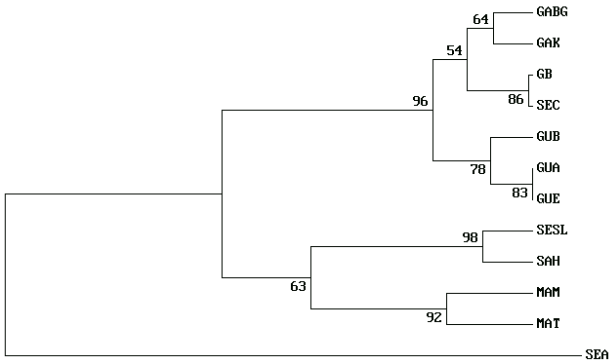


Fig. 5: UPGMA phylogenetic tree showing genetic relationship between the 11 non-crossbred populations (SEA = out-group)

Introgression patterns

Based on the described results, two separate gradients of Sahelian introgression into West African Dwarf goat populations can be distinguished from left to right on figure 3, respectively below and above the PC-1 axis, and both routes are correlated with geographical location of the populations.

For the first route there is a strong correlation between longitudinal positioning and PC-1 values (and hence population Structure results) as PC-1 values increase from north to south, starting with the populations of north Senegal (SAH and SESL) and ending with the Dwarf populations from Casamance and Guinea Bissau. The crossbred populations are situated mainly in The Gambia. All sampled Gambian populations are more or less at the same longitude, although crossbreeding seems more intense in GAN and GAS, the populations from the Central River Division. This is in accordance with the pattern of seasonal *transhumance* of Sahelian goats into The Gambia. The second route is correlated with latitudinal positions, as PC-1 values increase from east to west, starting with the Sahelian populations from Mali and ending with the Dwarf populations in west & central Guinea. The Malian population MAS and the populations from east Guinea, GUC and GUD, are situated in the crossbreeding zone.

Figure 6 represents a map of the study region and population structure percentages show both introgression routes, as well as the northern fringes of *Glossina* spp. distribution, indicating that crossbred populations are found in tsetse infested areas. The difference in trypanotolerance between the Sahelian and the WAD goats might not be as pronounced as is the case for cattle and sheep breeds, allowing Sahelians to migrate into traditionally WAD-dominated and tsetse infested areas and establishing crossbred populations close to the distribution border separating both breeds. Probably more important though, are indications that trypanosomosis is becoming a less important constraint to livestock production, as distribution and abundance of tsetse flies decreases, a result of rapid human population growth and increasing land utilization in the region, which is associated with deforestation and destruction of tsetse habitat. Furthermore, improved chemo-prophylactic practices and veterinary care in general also contribute to a reduction of the trypanosomosis risk. More factors even play a role: first of all, as a result of urbanization there is a rapidly increasing demand of city dwellers for meat and milk, which might encourage small ruminant producers to further develop a crossbreeding scheme with the physically larger Sahelian goats. Secondly, compared to bovines, goats (and sheep) are a very mobile species and the influx and demand in the region for goats of the Sahelian type is considerable, especially during periods of Muslim festivities.

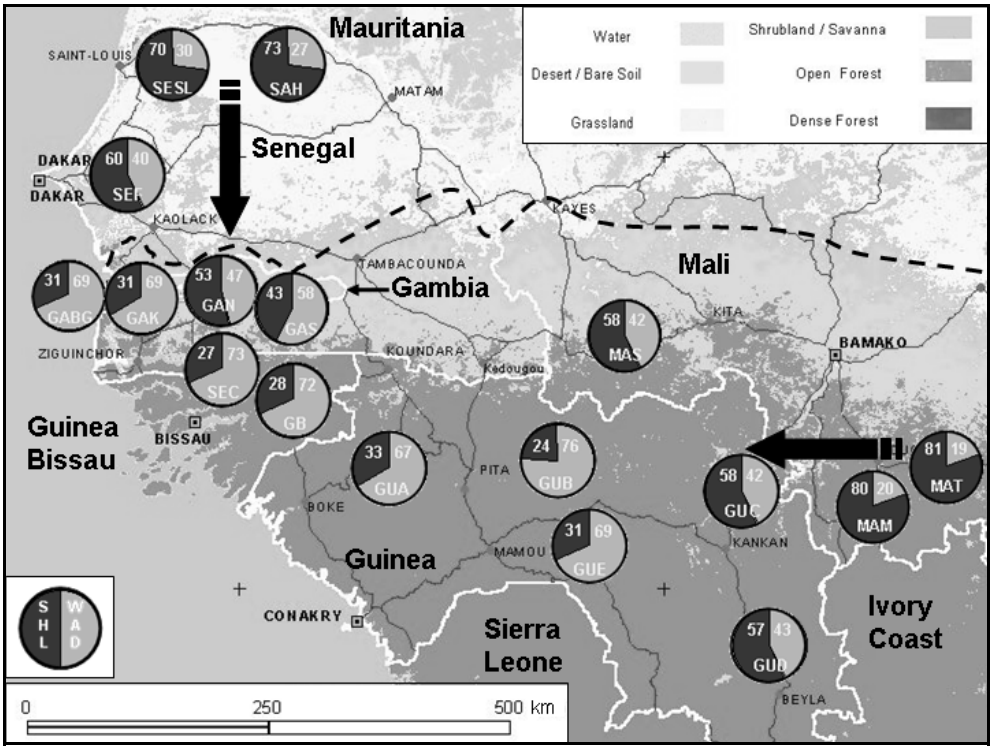


Fig. 6: Patterns of Sahelian introgression into WAD populations based on population Structure results (%); WAD = West African Dwarf; SHL = Sahelian.

entire package of adaptive traits. They are facing a continuous treat of introgression and dilution from the north and the east, and this trend is likely to persist along the identified routes. Dwarf goats are still found in the Western and Lower River Divisions of The Gambia, Casamance, Guinea Bissau and in west & central Guinea and it is important to acknowledge the value of this breed by creating awareness and by setting up protection and pure-breeding programmes.

Conclusion

For small-holder farmers WAD goats are an extremely valuable genetic resource, not only because of their trypanotolerance, but for their entire package of adaptive traits. They are facing a continuous treat of introgression and dilution from the north and the east, and this trend is likely to persist along the identified routes.

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Acknowledgements

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ITC becomes member of EU-funded ICTTD-3 and INCO STREP Projects

ITC has opened a new chapter in its international research collaboration by becoming a member of two EU-funded projects: (1) Coordination Action (CA) entitled, "*Integrated Consortium on Ticks and Tick-borne Diseases*" (ICTTD-3) and (2) a "Specific Targeted Research Project" (STREP) on the epidemiology and new generation vaccines for *Ehrlichia* and *Anaplasma* infections of ruminants under the acronym EPIGENEVAC. The lead scientist at ITC is Dr. Bonto Faburay who is working on a PhD affiliated to Utrecht University, The Netherlands, in the framework of PROCORDEL. Preparatory activities for the commencement of the two projects will start later this year.

The ICTTD-3 project is coordinated from Utrecht University by Prof. Frans Jongejan. The project will support research programmes on tropical tick-borne diseases jointly executed by a network of scientists involving a consortium of 55 institutions in 31 countries. In the project five working groups are formed: 1) Tick database and Biosystematics forum, 2) Molecular Diagnostic Network; this group will promote the use of molecular diagnostics to conduct comparative epidemiological studies on tick-borne diseases; 4) Genomics and Vaccine Design Group - will exploit genomics and proteomics data for ticks and tick-borne pathogens to design novel integrated vaccine strategies targeting ticks and pathogens; 4) Study group on Tick-Host-Pathogen Interactions - will be concerned with differential gene expression studies in ticks, hosts and pathogens; 5) Tick-borne zoonoses group - will deal with tick-borne zoonoses which are now gaining importance, esp. in Europe & USA. ITC will work actively in working group 1, 2 and 3. Notwithstanding, it will work and interact closely with other working groups within the consortium in order to achieve the main objective of "Coordination Action".

The STREP project entitled EPIGENEVAC is coordinated from CIRAD by Dr. Dominique Martinez. This INCO STREP project also brings together a network of scientists working on various thematic areas at various research institutions and laboratories in Europe, Africa and Latin America. Like ICTTD-3, the STREP/EPIGENEVAC project will last 48 months. However, it is more research-focused and work basically on anaplasma and ehrlichial infections with the objective to study their epidemiology and generate new vaccines against these infections. The project will collaborate with other research teams and laboratories working on other tick-borne diseases. ITC will implement a research project that was submitted and favourably evaluated. The general implementation strategy is based on the formation of Work packages (WP): WP1 – Genomics (concerned with annotation, comparative genomics and functional genomics); WP2 - Immune Screening (will be concerned with high throughput gene expression and immune screening especially of recombinant antigens); WP3 – Delivery of Antigens (study of various antigen delivery systems); WP4 – Integrated Diagnostics (concerned with multi-pathogen molecular detection and the study of intra-specific genetic diversity); WP5 – Epidemiology and Impact of Control (study of vector population dynamics, molecular epidemiology and the effect of control). Specifically, ITC`s involvement will be with WP2, WP4 and WP5.

The involvement of ITC in both projects is expected to bring the institution to the vanguard of advanced scientific research, facilitate closer collaboration with scientists in advanced research centres and laboratories, and keep the institution up-to-date with the latest innovations in scientific research

Investigations on zoonoses to continue in The Gambia and Guinea

ITC and the Department of Livestock Services (DLS), The Gambia, and the Direction Nationale de l'Elevage (DNE), Guinea, have agreed to implement a sero-epidemiological study to estimate the prevalence of brucellosis due to *B. melitensis* and of Rift Valley Fever in small ruminant livestock in selected parts of the two countries. Both infections have a potential impact on the productivity in traditional livestock farming systems and pose also a risk to human health. Consequently, a survey in humans at risk of contact with positive animals will also be carried out in collaboration with national health authorities. Specialists from ISRA and the Pasteur Institute in Dakar are providing backstopping diagnostic support. The project will be coordinated by Dr. Fred Unger of ITC in collaboration with Dr. Eunice Forster (DLS) and Drs. Alphonse Goumou and Fodo Yattara (DNE/IRAG).

This study will expand on previous investigations on consumer safety and public health risk deriving from selected zoonotic diseases, e.g. brucellosis due to *B. abortus* in cattle, done by researchers of ITC and DLS/PACE in The Gambia, and DNE in Guinea.

Bovine brucellosis has been confirmed previously to a various extend in cattle herds and milk samples collected from selected regions, esp. in Guinea. However, no information for small ruminants is available. From the epidemiological point of view it is important that cattle and small ruminants are often kept in close contact and infections (including brucellosis) can be easily transmitted between the species. Although the amount of milk consumed from SR in the region is much lower than from cattle it can still poses a risk for the consumer as milk is usually consumed not heat treated.

RVF is a viral disease that affects various animal species as well as man (major zoonosis). The virus is transmitted through blood-sucking mosquitoes as biological vectors. In West Africa, the disease has been declared for many years, but with irregular virulence and frequency. The Gambia has reported confirmation of foci of RVF in several sites in 2002 and in 2003, where cases of abortion and mortality in small ruminants were reported.

The 12-month study is receiving targeted funding from the German Government through BMZ/GTZ and its Advisory Service on Agricultural Research for Development (BEAF). The expected outputs are representative prevalence estimates of brucellosis and RVF in small, decision-supporting information for control and preventive strategies, and increased public awareness of abortion-causing infections in livestock.

Launching of the Forum for Urban and Peri-Urban Agriculture in The Gambia

The Forum for Urban and Peri-Urban Agriculture (FUPAG) in The Gambia was officially inaugurated on 8th May 2004 at Paradise Beach Hotel. The Forum aims to provide a space for dialogue and reflection among stakeholders engaged in agriculture and related activities, particularly livestock and horticulture, within the urban and peri-urban corridor of the Greater Banjul Area. Urban Agriculture (UA) practitioners have mooted the idea of an institutionalised body as a response to the increasing need to strengthen the interaction among UA stakeholders.

In his welcome address, Dr Abdou Fall, who represented the Director General of ITC, acknowledged the importance of institutionalising UA in the policy dialogue and development agenda. Opening remarks were also made by Dr Omar Touray of NAOSU, Mr. Omar Dibba, Chairman of the ME, Mr. Musa Jawneh, President of the National Farmers Platform, and Dr. Yemi Akinbamijo, who chaired the meeting. The highlight of the event was the discussion and adoption of the draft constitution of the Forum and the inauguration of its Executive Committee.

Some of the issues and arguments that have led to the creation of FUPAG are:

- ◊ Need for greater recognition of UA as a legitimate activity
- ◊ Need for effective communication which can be facilitated through a network
- ◊ Potential to improve urban food security and nutrition, income generation and poverty reduction
- ◊ Improved sanitation solutions and waste recycling

Individual urban farmers tend to be marginalized and not adequately supported, especially by funding agencies. Government and donors need to pay attention to the individual urban farmers that require diverse assistance.

It was also noted that UA is happening but in an unguided manner. Although agricultural transformation is taking place, UA should not be dissociated from general agriculture but rather perceived as a continuum with significant interactions and linkages along various nodes of the rural-urban chain.

FUPAG Executive Committee

Front row from left: Dr Baba Njie, Livestock Commodity Rep; Mr. Omar Dibba, President; Mr. Modou Ceesay, Treasurer
Back Row from left: Dr Yemi Akinbamijo, Partnerships relations; Dr Bakary Touray, Vice President; Mr. Joseph Faye, Secretary

Moringa - So Much Potential

The introduction of *Moringa oleifera* in the farming system context of The Gambia has a considerable potential for reduction of poverty and food insecurity. The cutting edge of Moringa is its robust applicability in both human and animal nutrition.

Moringa is well known in many parts of Asia, sub-saharan Africa, and Latin America. Indigenous knowledge of the plant in West Africa informs that Moringa is a very popular agro-forest resource that furnishes culinary and medicinal resources. In the Senegambia region and indeed in most sahelian ecologies, the leaves are relished in many forms of the human diet. Although the plant is not entirely strange in tropical farming communities, the agronomic modalities for the establishment of a Moringa fodder gardens are new in West African communities.

Based on emerging characterization work on the nutritive evaluation conducted at ITC and elsewhere, it is clear that *M. oleifera* has the potential to not only improve feed resource base but also provide affordable source of good quality vegetative material for human nutrition especially for post weaning children.

In view of the demonstrated potential of the plant, ITC has initiated three years ago a systematic investigation into the agronomy and nutritive values of *Moringa oleifera* as feed resource base. The preliminary investigations were aimed at the systematic investigation of the nutritive evaluation and the modalities of establishing *Moringa oleifera* in the context of different farming systems.

The plant *Moringa oleifera* is very popular (locally known as 'Never die') in the Senegambia region where it exists principally in scattered uncultivated forms. Until recently, the plant is a common tree in the West African ecology growing in uncultivated stands in and around villages. It is a time-tested delicacy in Senegambian kitchens known as '*mboum*' and also used in diverse ways in the kitchens. It is mainly consumed in

High density cultivation of Moringa at ITC, Banjul. This form of cultivation can yield over 15 tonnes dry matter per ha

Crossbred animals have responded very positively to Moringa-supplementation

various forms as food in the region although a few extra-culinary attributes have been suggested.

In collaboration with the Gambian National Nutrition Agency (NaNA), another initiative has been launched more recently, testing Moringa as a human food and feed security strategy.

Considering the potential contribution as supplementary food/fodder plant that is adapted to the agro-ecological characteristics of the sub-region, the plant will be further investigated and modalities of integration into the various farming systems examined.

From the preliminary assessments on Moringa, it is clear that it is endowed with exceptional physico-chemical properties with the possibilities of high biomass yield. The plant is known contain at least 25% protein with no known anti-nutritive factors. Compared with other conventional ruminant feedstuffs in The Gambia, it has very high biological value and considerable potential for adoption as food for humans as well as ruminant fodder resource.

Agronomy

The Moringa plant was cultivated by ITC in The Gambia in a high density mode, with three approaches adopted for an evaluation of *Moringa oleifera* in the West African farming system context. The first step was the agronomic assessment of biomass yield under diverse production and harvesting regimes. Following the encouraging results obtained from a pilot study on *Moringa oleifera* establishment and yield with a planting density of 15 cm x15 cm, a next step was the determination of the optimum cutting height and time intervals that would provide the best quality of fodder as well as retain the biomass yield at a high level. The most ideal of the three cutting heights – 20, 30 and 45 cm tested in three cutting interval cycles of 50, 100 and 150 days after planting was 30 cm and 50 days for cutting height and cutting interval respectively.

Biomass yield obtained by estimation of dry matter content of the materials recovered in a one sq meter quadrate indicated the potential of obtaining between 15 and 20 tonnes DM/ha in a 60 day growing cycle. With a cutting interval of only 60 days, the nutritive value of the fodder is very high with low chances of lignification. **It must be stated however that optimum growing conditions such as continuous irrigation, high planting density and a fertiliser regime of 50 kg/ha/month are imperative before such high biomass yields can be obtained.**

In the context of peri-urban dairying based on the continuous F1 scheme, Moringa can conveniently replace 'hard-to-access' supplements like oilseed cakes. Offered at 40% inclusion of groundnut hay diet, crossbred bulls gained up to 1kg per day. Compared with conventional concentrate offered at 20% inclusion in groundnut hay diet on dry matter basis, growing crossbred animals performed just as well as their counterparts offered conventional concentrate of groundnut cake and rice bran.

In conclusion, apart from the dramatic response of crossbred animals, growing Moringa will enhance good quality protein intake at the household level especially where young children are most vulnerable to malnutrition. The findings obtained at ITC show that Moringa can truly be the 'Miracle Tree' in cattle nutrition that it promises to be if fed at between 20-40% inclusion in a groundnut hay-based diet.

Study visits and attachments (Jan. - June 2004)

Name	Affiliation & type of study	Subject	Period
Mr. Alpha Madiou Barry	BMZ/ILRI Project "Improving the management of trypanocide resistance in the cotton zone of West Africa"	Evaluation de la chimiorésistance des trypanosomes et proposition des stratégies de contrôle du phénomène chez le bétail trypanotolérant en Haute Guinée	Five months, from April 2004
Ms. Chris Bodaan	Research traineeship as final year vet. student of Utrecht University	Participation in field and laboratory investigations on Cowdriosis (Heartwater) in small ruminant livestock in The Gambia	11 March - 24 June 2004
Mr. Douadeu Bleu	CIRAD; Internship for DESS	Catégorisation des exploitations bovines laitières à métis en Gambie (GBA)	4 1/2 months, from May 2004
Mr. Demba Jallow	Univ. of The Gambia - BSc Hons degree thesis work	Small ruminant feeding trial – effects of *Moringa oleifera* and concentrate supplementation on the growth and body condition of West African Dwarf goats	From April onwards
Mr. Alagie Bah	Univ. of The Gambia - BSc Hons degree thesis work	Quality control of pasteurised milk and yoghurt produced by dairy cooperatives in Kombo North and Kombo Central	From April onwards
Mr. Poulo Joof	Univ. of The Gambia - BSc Hons degree thesis work	Trypanosomosis in cattle - general description of the disease and selected aspects of testing for trypanocidal drug resistance	From April onwards

Farewell to Dr. Stephen Leak

On 18 June, a farewell party took place to say Good Bye to Dr. Stephen Leak, his spouse Susan and the children Melissa and Tim, who were about to leave The Gambia. Dr. Leak had served the Centre for over four years as agricultural zoologist and Project Manager of the Belgium-funded ITC Small Ruminant Research Project, which had come to an end in December 2003. His expertise and guidance as a scientist, and commitment as senior staff member were greatly appreciated by the ITC "family". Dr. Agyemang, DG of ITC, expressed his hope to welcome Dr. Leak again at the Centre in a not too distant future.

New *Research Working Paper Series* of ITC and *Proceedings* of PROCORDEL National Conferences that can also be downloaded from the ITC website (Please visit www.itc.gm)**:**

Title	Authors	Series
Risk associated with Mycobacterium bovis infections detected in selected study herds and slaughter cattle in four countries of West Africa	Unger, F., S. Münstermann, A. Goumou, C.N. Apia, M. Konte	Animal Health Research Working Paper No. 1. ITC (2003), 25 p.
Risk associated with bovine brucellosis in selected study herds and market places in four countries of West Africa	Unger, F., S. Münstermann, A. Goumou, M. Konnte, M. Hempen	Animal Health Research Working Paper No. 2. ITC (2003), 37 p.
The hygienic status of raw and sour milk from smallholder dairy farms and local markets and potential risk for public health in The Gambia, Senegal and Guinea	Hempen, M., F. Unger, S. Münstermann, M.T. Seck, V. Niamy	Animal Health Research Working Paper No. 3. ITC (2004), 54 p.
A contribution to the epidemiology of *Ehrlichia ruminantium* infection (Heartwater) in small ruminants in The Gambia	Faburay, B., S. Münstermann, D. Geysen, F. Jongejan	Animal Health Research Working Paper No. 4. ITC (2004), 36 p.
Développement des cultures fourragères dans le bassin de l'arachide au Sénégal: typologie des paysans, production de fourrages	Morou, I., G. Rippstein	Animal Production Research Working Paper No. 1. ISRA/ITC (2004), 53 p.
Développement des cultures fourragères dasn le bassin de l'arachide au Sénégal: typologie socioéconomique des exploitation et rentabilité de ces cultures	Diouf, A., G. Rippstein	Animal Production Research Working Paper No. 2. ISRA/ITC (2004), 68 p.
Développement des cultures fourragères dasn le bassin de l'arachide au Sénégal: motivations et facteurs d'adoption des sols fourragères par les paysans	Rippstein, G., A. Diouf, M. Sao	Animal Production Research Working Paper No. 3. ISRA/ITC (2004), 34 p.
Socio-economic characterisation of smallholder dairy systems in The Gambia: milk production, marketing and consumption	Somda, J., M. Kamuanga, S. Münstermann, A. Bittaye	Socio-Economic Research Working Paper No. 1. ITC (2003), 61 p.
Characteristics of the smallholder dairying farmers in West African countries: Economic viability and paths for improvement	Somda, J., M. Kamuanga, S. Münstermann, K. Keita, A, Mendes	Socio-Economic Research Working Paper No. 2. ITC (2004), 55 p.
Diagnostic des systèmes d'élevage péri-urbain en Moyenne Guinée: Analyse socio-économique des exploitations en production laitère dans la commune urbaine de Labé	Somda, J., K. Keita, M. Kamuanga, M.B. Diallo	Socio-Economic Research Working Paper No. 3. IRAG/ITC (2004), 44 p.
Caractéristiques socio-économiques et performances économiques des élevages laitiers en Guinée Bissau: Cas des régions de Bafata et Gabu	Somda, J., M. Kamuanga, A. Mendes, J. Gomes	Socio-Economic Research Working Paper No. 4. INPA/ITC (2004), 48 p.
PROCORDEL National Conference - The Gambia. Livestock Research for Development. 13-14 Nov. 2003	S. Münstermann (Ed.)	Proceedings - DLS/NARI/ITC (2004), 104 p.
PROCORDEL National Conference – Actes de l'Atelier de Restitution des Résultats du Projet PROCORDEL en Guinée Conakry. 4-5 Déc. 2003	M. B. Diallo, M. Cardos (Eds.)	Proceedings - IRAG/ITC (2004),127 p.
PROCORDEL National Conference - Actes de l'Atelier de Restitution des Résultats du Projet PROCORDEL au Sénégal. 22 Déc. 2003	M. Diop, M. Cardos (Eds.)	Proceedings - ISRA/ITC (2004), 84 p.

Scientific Seminars at ITC

11 June 2004: Dr. Susanne Münstermann, ITC: PROCORDEL Extension - What is it about?
11 June 2004: Mr. Erik Hoeven, ITC: Genetic characterisation of West African goat populations
18 June 2004: Mr. C. L. Kelley, Ancom Technology Inc., N.Y., USA: Rapid methods for fibre and fat analyses
25 June 2004: Dr. Simplice Nouala, ITC: Comparison of plant cell wall degrading community in the rumen of N'Dama and N'Dama x Jersey crossbred cattle in relation to in-vivo and in-vitro cell wall degradation

Visitors to ITC (January-June 2004)

15—19 March (ITC Council Meeting):
Prof. Stanny Geerts (Chairman), ITM, Antwerp, Belgium
Prof. Peter Holmes, Glasgow University, UK
Dr. Momodou Sompo-Ceesay, Independent Consultant
Dr. John McIntire, World Bank Representative (Dakar)
Dr. Badara Loum, Deputy PS, DOSA, The Gambia
Dr. Safiétou Touré Fall, Director ISRA-LNERV, Senegal
Prof. Ola Smith, Exec. Secretary, GFAR, Rome
Dr. Musa Bojang, DG NARI, The Gambia
Prof. Karl-Hans Zessin, Free University Berlin
Dr. Mamadou Diallo, Director DNE, Guinea
Observers:
Dr. Mamadou Boye Diallo, DNE Guinea
Dr. Mamadou Diop, ISRA Senegal
Dr. Jalloh Abdul Gudush, MAFS Sierra Leone

21-23 January:
Mr. Simao Gomez, Mr. Antonio Roberto da Silva, Mr. Quintino da Costa, Dr. Hipolito Djata: DGP, INPA, Guinée Bissau
23 January - 13 February:
Prof. Dieter Mehlitz, Consultant, GTZ Germany
25-28 February:
Prof. Pangui, EISMV, Dakar
28 February:
Mr Lowell Fuglie, CWS, Dakar
11-14 May:
Prof. Andrew Reed, Univ. Edinburgh, & Prof. Dave Barry, Univ. Glasgow
19 May (12 weeks):
Mrs. Patu Jume & Mr. Tek B. Thapa, FAO Consultants for FAO/TCP/GAM/2802 (Training, Capacity building - Village Milk System)
23-30 May:
Mrs. Gertrude Buyu, FFS Consultant, ILRI Nairobi
14-18 June:
Mr. Christopher L. Kelley, Ankom Technology, N.Y., USA

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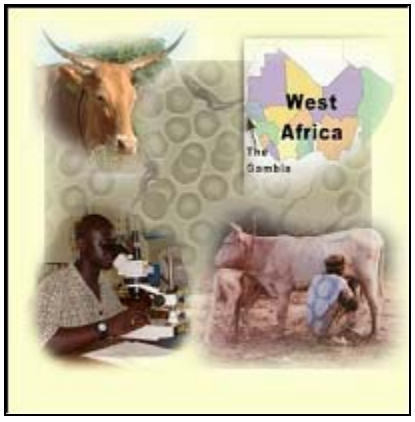

About ITC

The International Trypanotolerance Centre (ITC) is a sub-regional research institution located in The Gambia, West Africa, with livestock rearing and research facilities at Headquarters in Kerr Serigne (Greater Banjul Area) and Stations at Keneba and Bansang. Thus, ITC has access to diverse agro-ecological settings, disease risk areas and livestock production systems in the sub-region.

The mission of ITC is to *contribute to livestock productivity and utilisation in the West African region through the optimal and sustainable exploitation of the genetic resistance of indigenous breeds of livestock for the welfare of the human populations.*

The general objective focuses on the *formulation, implementation and introduction of sustainable socio-economically and environmentally acceptable integrated packages at farmer level, for improved livestock health, production and exploitation.*

A livestock-based Agricultural Research Institute dedicated to serve the West African Region