

R 1662(S)
Report on a Visit to The Gambia to
Assess the Potential for
Collaboration on the Interaction
Between Nutrition and
Trypanotolerance
17 - 26 JULY, 1991

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SUMMARY

1. The main objective of the visit was to develop interdisciplinary proposals which would contribute to a research programme to develop viable nutritional interventions in the management of trypanotolerant livestock in West Africa.
2. The information required to draft the proposals was obtained through discussions with staff at ITC and DLS, visits to station and field sites and a revision of available reports.
3. Three distinct components of an overall nutrition programme were identified, and since the social science requirements for this work had wider implications for ITC, a strategy for social science inputs to the overall ITC programme was also discussed with staff resident in The Gambia.
4. The 3 components were:
 - a) a study of the current and potential on-farm research available to farmers in the region;
 - b) on-station trials to develop and evaluate hypotheses regarding the interactions between nutrition and response to trypanosomiasis in tolerant breeds;
 - c) field trials to quantify the response in productivity and the effects on grazing behaviour of proposed nutritional interventions.
5. The first component is recommended for NRED funding through the Livestock Production and Nutrition programme; the second proposal will be submitted for EEC DGXII funding, jointly by NRI, the University of Glasgow, the DLS and, probably, the Universitat Degli Studi di Milano. The third proposal may be considered by ODA, depending on their decision on future funding to ITC which will be made later this year.

RECOMMENDATIONS:

1. That NRI consider funding a modified version of the original project on utilisation of locally available feed resources (for outline proposal see Appendix 3 - component a), with a pulling together of existing information in a systematic way and addition of any missing data (October-November, 1991).
2. That NRI consider providing one month social science input to the nutrition programme, annually, over the next 3 years (funding sources to be investigated).
3. That NRI, The University of Glasgow Vet School and the Gambian Department of Livestock Services, possibly

with a partner University in Italy, develop a collaborative research proposal on the interactions between nutrition and response to trypanosomiasis in trypanotolerant cattle, for submission to the STD3 programme of the DGXII of the EEC (for outline proposal, see Appendix 3 - component b).

4. That proposals for field studies on the productivity responses to nutritional supplementation of ruminant livestock in areas of high tsetse challenge be put forward to ODA for possible funding (for outline proposal, see Appendix 3 - component c).

5. That links be maintained with Dr Hoste (UNDP/FAO project attached to ITC) regarding further social science inputs to ITC's programme of work.

ABBREVIATIONS

ADB	African Development Bank
APO	Assistant Professional Officer
COS	Corps of Specialists, NRI Department of Livestock Services European Economic Community
GARD	Gambia Agricultural Research and Diversification
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for research on Animal Diseases International Centre for Trypanotolerant Livestock
NRED ODA	Natural Resources and Environment Department, Natural Resources Institute Overseas Development Administration

ACKNOWLEDGMENTS

The authors are grateful to the Director General of ITC for extending the invitation to visit The Gambia and to Bakary Touray and his staff for the support given throughout our stay. We particularly appreciate the openness with which research staff discussed their work and issues related to the future of ITC, and the access we were given to documents under discussion or in draft form. In this connection, we wish to thank the Acting Director General in particular for allowing us to participate in wider discussions of future ITC research. Our thanks are also due to Omar Touray, of the Department of Livestock Services, who was not expecting us but nevertheless participated in our discussion of research protocols, and especially to Matarr Njie who agreed to accompany us on our field visit at very short notice. We appreciated the exchange of ideas with Christian Hoste of the UNDP/FAO Project and GARD project staff. Last but not least, we wish to extend our thanks to Max Murray and Anton Verhulst for stimulating discussions on wider interests.

1 BACKGROUND

1.1 Messrs Fox and Bennison from the Livestock section, NRI, visited The Gambia in January 1990. The aim of the visit was to investigate the potential for an NRI-funded project on the interactions between trypanotolerance and nutrition.

1.2 During this visit, through discussions held with Doug Little (ITC nutritionist), Jon Tanner and Sarah Holden (ODA-funded APO nutritionist and socio-economist, respectively) a number of social science research issues which would also need answering for successful uptake of the project were identified:

- a) crop residues and by-product marketing;
- b) socio-economic aspects of feed resources utilisation;
- c) on-farm testing of appropriate technologies and cost effectiveness of nutritional interventions

Since ITC had no staff position for a social scientist, a social science input was included in the proposed project.

1.3 A project entitled: "The utilization of locally-available feed resources in smallholder village husbandry conditions" was developed, with the wider objective of: developing guide-lines for interpretation and application of feeding strategies by extension services and aid organisations in the tsetse-infested areas of the sudano-sahelian and sub-humid zones of West Africa.

1.4 The anticipated life of the project was 3 years, with the proposed activities comprising socio-economic evaluation and nutritional research. The total sum of money requested was £108,280.

1.5 The project was signed by ITC in June 1990, but by that time, there was some doubt as to the maintenance of core funding for ITC. Mr Bennison wrote to Dr Touray on 27 September 1990 stating NRI's position, that "it would be unwise to proceed at present with this project, in light of the current uncertainty surrounding ITC's future funding and research direction".

1.6 Dr Gill paid brief visits to ILCA and ITC in December 1990, when it was confirmed that the ILCA staff on secondment to ITC would be relocated to other countries during 1991. After this visit it was decided to continue the delay in funding the proposed project until future nutrition inputs to ITC could be confirmed.

1.7 A new director (Prof George Urquhart) was appointed to ITC from 1 April 1991 and both during and subsequent to a visit to NRI in March 1991, he asked that NRI re-consider their decision not to support nutrition work at

ITC. In response to this request, a visit to ITC by a nutritionist and socio-economist was planned for July 1991.

1.8 At the Livestock Professional Co-ordinating Group meeting in March 1991, both Senior Animal Health and Production advisers at ODA and Mr Scott recommended that NRI complete its review of research requirements related to the interactions between nutrition and trypanotolerance. As a preliminary step in this process, Mr Nicholls (COS) was commissioned to compile a catalogue of existing information, involving a review of the main conclusions of NRI/ODA staff and consultants visits to ITC.

1.9 Mr Nicholls concluded that "...a comprehensive evaluation of the interaction between nutrition and genetic resistance to trypanosomiasis is required. Further studies are indicated on the socio-economics of nutritional intervention in village livestock in The Gambia. In addition there is a further need for in-depth research investigating the effects of nutrition on the pathogenesis of trypanosomiasis...." (Para 1.8).

1.10 It was therefore decided that the visit of Drs Okali and Gill should go ahead, with the overall objective of identifying collaborative, multidisciplinary projects between NRI, ITC and the Department of Livestock Services (DLS) in The Gambia, to assist in the continued development of livestock systems in the region.

1.11 This objective was to be met through discussions with staff of ITC and the DLS, visits to station and field sites and through a revision of available reports. The itinerary for the visit is given in Appendix 1.

2 TERMS OF REFERENCE

2.1 Identify local livestock systems in the region

2.2 Review available information on the importance of nutrition relative to the productivity of trypanotolerant livestock, identify and prioritise relevant research objectives.

2.3 Define the key socio-economic issues which need to be taken into consideration in the development of any proposed nutritional interventions.

2.4 Develop interdisciplinary proposals to meet these objectives, which are appropriate to the facilities and expertise available in The Gambia.

2.6 Detail the contributions/roles of the different institutions which might collaborate in these research programmes.

3 LOCAL LIVESTOCK SYSTEMS IN THE REGION

3.1 Local livestock systems within the present tsetse infested region are in general extensive, low input, low output systems with a variety of species and end products. In general they are not closely integrated with cropping systems although in most countries, resident livestock producers are also crop producers. The most common livestock species are small ruminants which are largely dwarf breeds said to be trypanotolerant. Some trypanotolerant cattle breeds are found in small numbers whereas in areas where there has been extensive bush clearing (Nigeria) and an apparent fall in tsetse challenge, zebu cattle are common.

3.2 The Gambia appears to be somewhat unique within the tsetse infested areas of the region. Not only does the country have one of the highest cattle densities in the region but it also has one of the largest herds of trypanotolerant cattle. In addition a large proportion of the farm households (dabadas) are mechanised: the country is characterised by integrated crop/livestock systems which make The Gambia a particularly valuable research location for the development, with farmers, of feeding strategies for testing within the region. This intense mechanisation can be closely attributed to the development of donkey traction which has facilitated the involvement of even relatively poor households. Animal traction in The Gambia has profited from the dynamism of this activity within Senegal where there has been considerable adaptation of equipment and an active sale of surplus machinery across the border. Senegal is also a source of equines. Studies show that high mortality and low fertility of equines in The Gambia lead to a constant demand for replacements. The recent introduction of cow traction in the North Bank of The Gambia also originates from Senegal.

3.3 Sheep and goat production deserves special mention in The Gambia as in the region as a whole. With the change in donor emphasis towards women and the poor, project attention has focused on the potential of sheep fattening for tobaski. Traditional tobaski sales were not based on a fattening programme. While conventional project wisdom supports such programmes, sound economic analysis is lacking.

3.4 Livestock densities in The Gambia have led to numerous programmes designed to address feed shortages which have not, nevertheless, been adequately demonstrated. Fluctuating livestock densities throughout the year as large numbers of cattle move from the north, including Senegal, to the riverine areas for dry season grazing, make accurate calculations of requirements difficult. Large scale annual burning definitely destroys grazing areas and it is suggested that control of burning alone would lead to a substantial improvement in the feed situation.

3.5 Nevertheless, what information there is suggests that livestock numbers have increased without projects designed to improve the feed situation. The deferred grazing project at Dankunku appears to be the largest improved grazing scheme at present and there are plans to replicate the scheme elsewhere although the scheme benefits have not been clearly demonstrated: livestock owners and managers continue to graze the fenced areas and attempts to grow fodder species have largely failed.

3.6 Considerable research attention has also focused on supplementary feeds, both by-products such as oil seed cakes, and crop residues. While it is acknowledged that livestock producers already feed supplements to specific categories of animals, largely traction animals, further improvements are considered to be possible. It is suggested in various documents for example that traction animals are overfed, that crop residues are left uncollected in the fields, that there is room for improvement in feed harvesting and storage and that present supplementary feeding habits could be extended to other livestock categories including goats and cows.

3.7 While there may be some truth in all these statements, any proposed interventions need to be developed with specific locations and potential target populations in mind and preferably to be developed jointly with the populations concerned. Researchers also need to bear in mind producer output objectives, alternative competitive non-feed uses of residues etc., differential access to feed resources and present grazing/feeding practices. The overall issue of producer nutrition objectives must be addressed from the outset: the fact that livestock owners already supplement the diets of specific livestock categories and in some cases prefer to sell any feed surplus rather than to feed it to other livestock categories suggests that additional supplementary feeding in areas where this is already common practice, is not interesting.

3.8 Much research on crop residues was done during the Mixed Farming Project (pre GARD) and needs to be looked at carefully before starting new work. This included studies of possible changes in harvesting techniques to improve hay quality. The GARD project is presently funding a small ruminant fattening programme based on the tobaski market using groundnut hay in addition to oil seed cake. Groundnut hay is the most valuable crop residue available and while the extent to which it is used varies by district, groundnut hay is managed as a high quality feed reserved in general for the most valuable animals. In the context of The Gambia at present, these are traction animals and horses. There is also an active market for the hay both in The Gambia and Senegal. Oilseed cakes have always interested nutritionists and with the recent addition of sesame cake, this interest appears to be growing. Other

supplements appear to be given on a more *ad hoc* basis, for example trees are lopped and domestic waste is fed when available.

3.9 As is true for the region as a whole, research has not to date played a major role in livestock production systems in The Gambia. Many nutritional "improvements" require a shift to more intensive production systems which largely depend on urban markets for their success. In The Gambia, the North Bank is the district where intensification is most evident and where, perhaps, research could more easily make a contribution. Since North Bank producers are themselves actively innovating in response to pressure on the system and the attraction of a lively market, there is the basis for an interesting farmer participatory research programme, possibly including introduced browse species as an alternative feed resource.

3.10 As noted above, within The Gambia and the region as a whole there are variations in livestock production systems. Some writers emphasize different producer objectives: livestock as investment and security versus livestock for milk and meat production, and manure and traction. Others emphasize differences between wealthy and poorer producers and related differences in species mix. "Poor" producers own smaller numbers of livestock, are more likely to own small rather than large ruminants and where they use animal traction, are more likely to use donkeys rather than oxen. In general, in The Gambia but also in other West African countries, livestock are an effective hedge against effects of devaluation of local currency (Itty) and offer one of the few investment possibilities not only in rural areas but also for urban populations. In these situations it is not clear how attractive any feed improvement strategy might be as against simply holding animals against some future unspecified time. On the other hand, the continued growth of urban and peri urban areas suggests that more attention might be given to tapping these markets.

4 SOCIO-ECONOMIC RESEARCH

4.1 ITC has never had a continuous social science input into its research programmes and social science input requests have largely been made by natural scientists on an *ad hoc* basis. One long term field study of Gambian producers (Sarah Holden through NRI); one across site comparison of production systems at 2 sites (ILCA funded consultant, P. Itty); and an analysis of the economics of tsetse control measures (ODA funded consultant, Shaw), have been completed by external consultants.

4.2 Apart from studies completed by the DLS of the groundnut hay market to which we had access, we saw little socio-economic information which might be directly relevant to a livestock nutrition programme. We did not, however, see any of the earlier studies completed under

the Mixed Farming Project. Sarah Holden collected information on availability of different feeds and their use but this is not yet accessible. In a summary of her findings, she refers to 4 possible options for nutrition work: fattening of draught oxen for sale; feeding of lactating goats; feeding of lactating cows; feeding of cows for draught. Cows are already being used as draught animals in the North Bank presumably following the example from the Sine Saloum area in Senegal where livestock owners have profited from the sale of fattened draught cows for some time.

4.3 Holden and Tanner suggest that nutrition programmes should focus on poorer producers to offset an expected inflationary effect on livestock numbers following strategies to which only wealthier producers can respond. However, given the large proportion of poorer producers, the effect on livestock numbers is likely to be the same regardless of target group. In addition, while it is impossible to justify ignoring the poor, it is not clear that research can make a significant contribution towards an improvement in their condition. Small ruminant and donkey research are the obvious possible exceptions and the first need is probably to reduce risk of mortality, possibly through better nutrition.

4.4 Given the variability in locations/zones, feed availability (bearing in mind alternative uses) and farmer situations already discussed, and the need to target interventions, the overall objective of the nutrition programme should be to provide a series of options to meet a range of requirements, rather than to seek to maximize feed use. Following this strategy, while the North Bank might be one focus, research should seek to provide options including different levels of investment in particular types of interventions, within this location type.

4.5 Little identified a number of socio-economic issues relevant to nutrition in addition to those included in the earlier project proposal, which might be relevant to any proposed changes in feeding strategies:

a) studies of the availability of crop residues and existing use including harvesting and storage techniques and wastage;

b) socio-economic constraints to improved use including seasonal labour availability (disaggregated by sex and age) and feed/livestock ownership issues;

c) studies of markets for crop residues and by-products distribution of livestock income within the family.

4.6 With reference to Little's proposals, we understand that Sarah Holden has some information on availability of

crop residues. This information plus research results from earlier studies (Mixed Farming Project etc.) need to be brought together and to be presented in the form of calendars, disaggregated by zones. Information on present use of these residues, including sales to the fodder market, needs to be placed within the same framework. Any proposed feed interventions should first be assessed against this background. There is no obvious need for more detailed marketing studies other than those already completed for groundnut hay, the most valuable feed. Again, as already noted, while feed availability is a key issue in determining technical viability of an improved nutrition programme, the fact that feed is available does not mean that specific livestock categories will be fed.

4.7 Independent labour studies should not be initiated. A number of detailed crop/livestock production studies have been completed in The Gambia and these should provide a baseline for looking at labour use patterns in general. Any further labour studies should be highly focused and relate to specific feed interventions.

4.8 In order to ensure that the issues raised above are incorporated into the nutrition programme, future research should be interdisciplinary: social scientists should avoid developing a separate social science agenda. The ideal way to implement this strategy is to do more on-farm research designed to develop rather than to test interventions. In this situation the task of the social scientist would not be to identify "socio-economic constraints to improved....." (See b) of Little above) which implies that technology already exists, but to work directly with the technical scientists and the farmers in the development of interventions.

5 NUTRITION STUDIES

5.1 The main emphasis of the nutrition studies undertaken at ITC has been on the effects of supplementation on the productivity of N'Dama cattle, the hypothesis being that protein supply is limiting.

5.2 The results of supplementing young cattle suggest that there is little economic return to supplementation of male cattle weighing less than 100kg with bonemeal/sesame cake (Little, Wassink, Riley, Agyemang, Badjie and Dwinger, draft publication). However, supplementation of heifers with groundnut cake decreased age at first calving by 12 months (Tanner, Little, Holden and Dampha, draft publication). The best economic return was obtained with 250g groundnut cake/hd/d during both the wet and dry season.

5.3 Supplementation of lactating cows with sesame cake in the dry season (Little, Badjie & Saho, draft publication) also improved reproductive performance, particularly when the supplement was given over a longer

period (January - June). Milk offtake (January - June) was increased equally whether the same total amount of supplement was given from January - April, April to June or January - June, although carryover effects into the wet season were only observed in the second two groups.

5.4 Supplementation of lactating cows with cottonseed cake (1 kg/hd 3 times/wk) enabled the animals better to withstand the effects of trypanosomiasis infection, with an improved ability to recover from anaemia (Little, Wassink, Agyemang, Leperre, Janneh & Badjie, draft publication).

5.5 However, it is not only present nutritional status which appears to influence resistance to infection: Little *et al.* (1990) observed that while supplementation with extra groundnut cake decreased the rate of decline in PCV after intradermal inoculation with *T. congolense*, the decline was greater in animals of medium, compared to low, initial body condition score.

5.6 Thus, both past and present nutrition appear to influence the response of N'Dama cattle to trypanosomiasis infection.

6 OTHER ITC PROGRAMMES

6.1 The nutrition work at ITC has been supported by the EEC, as part of the productivity programme, which was conducted in collaboration with ILCA and ILRAD.

6.2 Other programmes of work at ITC include: the Entomology programme, funded by ODA; the programme on Research on Animal Diseases currently funded by FAO; and the Helminthology programme funded by the Swiss Government.

6.3 In the short time available to the authors it was not possible to gain a detailed understanding of all the achievements of these programmes, therefore only the results which were considered to be of particular relevance to the proposed projects are considered here.

6.4 The Entomology programme has identified regions of differing degrees of tsetse challenge within The Gambia. 66% of the country has been recorded as having >5 flies per trap, the level above which N'Dama cattle show signs of infection. Missira (close to Bansang) has been identified as an area of high tsetse challenge, and numbers of flies, levels of infection, animal numbers and grazing patterns in villages in this area have been compared with similar parameters measured in areas of lower challenge (eg Kenaba). This work has been complemented by measurement of cattle productivity in the same areas. Differences in grazing patterns between areas of low and high challenge have been observed, in addition to expected differences between seasons. The effect of the out-migration of cattle increasing the rate of

infection of sheep, but diluting the degree of infection in the areas of in-migration is also noteworthy.

6.5 The Animal Diseases programme has looked in particular at trypanosomiasis and tick-borne diseases. Results have shown that N'Dama may be less susceptible to ticks, compared to Zebu cattle. Work on draught animals may be included as part of this programme in the future. The Italian government is interested in funding work under this programme and it is hoped that links will be established with Italian Universities.

6.6 The Helminthology programme is funded by the Swiss government and is managed by the University of Berne. The helminth work is based at Bansang and has been conducted with both sheep and cattle. There is some evidence that N'Dama cattle may be resistant to helminths, as well as to trypanosomes, but there is considerable variability within breed. The project is looking at seasonal epidemiology in small ruminants in the Bansang area and has close links with similar studies in Senegal. A particular interest of the team is the extent to which changes in management practice might influence the degree of worm burden. The work is to be reviewed in November 1991, but if continued the team would be keen to collaborate with future nutrition projects.

7 PROJECT PROPOSALS

7.1 One of the overall objectives of the NRED-funded Livestock Production and Nutrition programme, which is managed by NRI, is to develop and evaluate options to improve the efficiency and productivity of livestock production within a range of farming systems.

7.2 Poor nutrition has been identified as a major factor in increasing animals' susceptibility to disease and in decreasing livestock productivity in sub-Saharan Africa. Therefore quantification of the likely responses to improved nutrition strategies is an important aspect of the LPN programme, always bearing in mind existing systems and differences amongst producers.

7.3 There is sufficient evidence to suggest that animals in a poor nutritional state are more susceptible to some diseases. Thus improving the nutrition of animals under a high disease challenge is likely to increase productivity both indirectly through alleviating the negative effects of disease and directly through the effects of nutrition on production. The need to investigate these interactions has been highlighted by the Triennial Review of ODA-funded livestock research amongst other recent reviews and is thus accepted as a priority area for NRED funding.

7.4 Thus as part of the LPN programme NRI are interested in participating in a programme of work to develop viable nutritional interventions which will

increase the probability of survival of livestock in tsetse endemic regions, and, where appropriate, to increase productivity.

7.5 The nutrition trials already conducted at ITC, both off- and on-station, have suggested that supplementation of trypanotolerant cattle with protein improves their ability to withstand trypanosome infection. However, these studies also raised interesting questions as to the effects of previous nutrition (as assessed by body condition) on the response to infection. There is a need to confirm these results in further controlled on-station trials and to develop and test hypotheses to explain the interactions. A better understanding of the mechanism of the interaction is a prerequisite to predicting the response to different feed supplements in animals subjected to differing degrees of disease challenge in other countries in the region.

7.6 Successful uptake of research results by farmers, however, requires careful consideration of factors influencing their decisions. Thus, hypotheses developed on-station need to be developed into possible interventions in cooperation with the farmers themselves. On farm research, including field trials, is, therefore, essential both to develop and test the technical and economic viability of these interventions, as well as to assess their applicability in specific situations to particular categories of producers. This research needs to take into account actual availability of potential feed supplements and criteria used by farmers in allocating these amongst various end uses and between different classes of livestock. Since this research is of necessity site specific, particular attention has to be paid to identifying critical variables to be looked at when addressing these same problems elsewhere in the region.

7.7 Thus, in order to meet the objective of developing sustainable nutritional interventions, 3 distinct, but clearly inter-related research activities have been identified:

- 1) On-farm research to identify potential for increasing the use of supplementary feed resources, including trees that can be used as fodder, in the management of trypanotolerant livestock through studies of: present preferred options for actual and potential supplementary feed use emphasising locational and farmer differences; efficiency of present harvesting, storage and processing methods in terms of nutrient losses between harvest and feeding; possible ways of integrating trees into existing production systems. Since some information is already available on these issues, this work would involve synthesising this information and filling in gaps.

2) On-station trials to develop and evaluate hypotheses regarding the interactions between nutrition and response to trypanosomiasis in tolerant breeds;

3) Field trials to quantify the response in productivity and the effects on grazing behaviour of proposed nutritional interventions;

7.8 Given the current funding problems still experienced by ITC and the limitations on NRED funds, it is suggested that different sources of funds are sought for each of these components.

7.8 For the study of feed resources (1, above), a proposal has been drafted for consideration by the programme advisory committee of the Livestock Production and Nutrition programme. This would use ODA - NRED funds

7.9 For the on-station trials, it is recommended that a joint proposal be submitted to the STD3 programme of the DGXII of the EEC, including collaboration with the University of Glasgow Vet School and a University in Italy.

7.10 For the field trials, an outline of objectives and activities has been circulated to the Deputy Chief Natural Resources Adviser and the senior Animal Health and Production advisers at ODA.

7.11 NRI would be happy to provide inputs to all 3 components and to integrate the links between them, if felt appropriate by ITC.

8 CONTRIBUTION/ROLE OF DIFFERENT INSTITUTIONS

8.1 The proposed projects would require inputs from, and close collaboration between, ITC, DLS, Glasgow University, Italian University and NRI.

8.2 ITC: Has good laboratory facilities and laboratory staff for routine analysis, animals for experimental trials and field assistants for off station research. Financial inputs for construction of additional feeding facilities would be required.

8.3 DLS: Mattar N'Jai and Omar N'Jai are both DLS staff, although Omar N'Jai is currently seconded to ITC. They would be involved primarily in the feed resources and on-station trials. Mattar N'Jai has experience in the use of fistulated animals.

8.4 NRI: It is envisaged that NRI could have a co-ordinating role in relation to the nutrition programme. This would involve both short- and long-term visits to The Gambia and collaborative research being conducted in the UK. Similarly with the social science inputs, although it is possible that ITC may appoint a social scientist to their core staff, NRI could also provide 1 man month *per annum* subject to funding availability. Some training of NRI laboratory staff by NRI is envisaged and more complex laboratory analysis would be conducted at Chatham.

8.5 UNDP/FAO Regional Project: This project includes a full-time agricultural economist. Christian Hoste agreed that the appointee could assist in overseeing any social science input into the nutritional programme, on a routine basis.

8.6 Glasgow University Vet School: Experiments to develop hypotheses for the mechanisms of interaction between nutrition and response to trypanosome infection will require sophisticated diet formulation and appropriate animal feeding facilities. These are available in Glasgow.

8.7 Italian University: ITC has already proposed collaboration with the Universitat Degli Studi di Milano and the possibility of collaboration with this University in relation to the proposed DGXII programme is being investigated.

Appendix 1

Itinerary

17/7/91 pm Arrive Banjul

Discussions were held with:

18/7/91 ITC:

am Doug Little - work conducted under EEC-funded Animal Production and Health project

Bill Snow and Tim Wachter - work conducted under ODA-funded Entomology project

pm Raffaele Mattioli - work conducted under FAO-funded Disease project

Derek Clifford - currently on ITC core funding

19/7/91 am GARD project:

Emmett Schulte, Chief of Party - work conducted under USAID funding.

Bill Hargus - extension specialist

DLS:

Omar Touray, Director - courtesy visit

pm ITC:

Doug Little and Bill Snow - ideas for work on trypanotolerance and nutrition

20/7/91 am DLS:

Matarr Njie - work proposed on feeding strategies for ram fattening systems

Travel inland with Matarr Njie:

21/7/91 am Kenaba: met Omar N'Jai
Duto Fofana, Head of station

pm Dankunka: met Kabba M'Boge, Head of Station

YKB: met Ebou Drammeh, Head of Station

Arrived Sololo

22/7/91 am Discussions with: Jakob Zinsstag and Tobias
 Frisch, of University of Berne Helminth
 Project
 Visited Missira site with Kabba M'Boje
 pm Returned to Banjul

Discussions were held with:

23/7/91 am Amiatta Njie and Ebrima Bah - nutrition
 support staff, ITC
 Bakary Touray - Deputy Director General
 Hugh Hanley, Financial Controller, ITC
 Don Durga, USAID - funded DLS over 15 years
 pm Christian Hoste - UNDP/FAO project at ITC

24/7/91 am Max Murray, Anton Verhulst
 Reviewing documentation/preparing proposals
 pm Reviewing documentation/preparing proposals

25/7/91 am Mike Goodwin - British Embassy
 pm ITC senior staff (13) meeting to discuss
 comprehensive documentation to be
 submitted to donors
 specific Omar Touray and Mattar Njie to discuss
 proposals

26/7/91 am ITC meeting - presentation of draft
 programmes to be submitted to donors
 Depart ITC for Dakar/London

Appendix 2

REFERENCE MATERIAL

We were given access to a variety of documents, a number of which were in progress and unpublished. The material referenced below includes some of this documentation.

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Appendix 3 Proposals for the field studies on the productivity responses to nutritional supplementation of ruminant livestock in areas of high tsetse challenge.

(a) On-farm research

(b) On-station experimentation

Field monitoring and feeding strategies

On-farm research component (a)

Immediate Objective

1. To assess the potential for increasing the use of supplementary feed resources in the management of trypanotolerant livestock.
2. To provide recommendations on the establishment and management of multipurpose trees in smallholder farming systems.

Suggested inputs

Training of lab staff
Equipment - lab/small ruminant feeding facilities
Vehicle

2mm nutritionist - year 1)
1mm lab support in year 1)by NRI staff
1mm social science)
input/year)

Project Activities

1. Through the review of available literature and the collection of further data, summarise the present preferred options for potential and actual feed use, emphasising location differences and taking into consideration the different categories of farmer.
2. Assess the effects of different methods of feed harvesting, processing and storage (both conventional and innovative techniques being introduced within the region both by farmers themselves and projects) on the nutritive value of crop by-products and hence the efficiency of conservation of nutrients from field to animal.
3. Where possible, identify current patterns of browse use.
4. With farmers, identify and develop possible options for feed interventions including strategic use of browse, taking into consideration practical and economic considerations.
5. Establish a nursery on-station for the production of potential browse species for on-station feeding trials.
6. Carry out networking activities within the region to establish agreements on chemical analyses of feeds and exchange of information on results. Work especially closely with the all-India farming network, IITA and ILCA related work programmes.

Expected Outputs

1. Data on availability of potential feed supplements for feed back to field trials, together with recommendations on their use in specific situations
2. List of feasible options for feed interventions to be implemented in specific types of locations and amongst farmers with different resource endowment, varying management possibilities and output objective.
3. Publications and practical field guides on the effects of harvesting, processing and storage methods on nutritive value and comparative efficiencies.

On-station experimentation - component (b)

Immediate Objectives

1. To increase our understanding of the effect of previous nutrition, and interactions with current nutrient intake, on the response to trypanosomiasis.
2. To compare protein and energy supplementation in their efficacy at maintaining the ability of trypanotolerant livestock to resist disease.
3. To identify the digestive and physiological responses to trypanosome infection in trypanotolerant and trypanosensitive livestock.

Suggested inputs

2 Postgraduate students
10 fistulated steers
10 fistulated sheep and/or goats
Laboratory equipment and chemicals
Pens for individual feeding
Short-term inputs of technical assistance

Project Activities

The Gambia

1. Compare rates of passage, digestion and rumen NH_3 concentrations in N'dama and Zebu cattle with and without trypanosomiasis (and possibly helminth) challenge.
2. Determine the digestive responses (rates of digestion and passage and overall digestibility) to supplementation of locally available feeds in N'dama cattle using nylon bags and chromium markers.
3. Quantify the rates of digestion and passage of locally available feeds in rumen fistulated small ruminants.

Glasgow

- 4 Conduct controlled experiments in sheep to separate the effects of protein and energy levels in the diet on response to trypanosome infection.

Expected outputs

1. Specific publications on:
 - a) the interactions between nutrition and disease in trypanotolerant and trypanosensitive cattle.
 - b) the nutritive value of locally available feeds
- . Tables of feeding recommendations for trypanotolerant livestock

Field monitoring and feeding strategies - component (c)

Immediate Objectives

1. Monitor the effects of supplementation offered to small ruminants and cattle on foraging behaviour (including species selection), productivity and response to disease.
2. To study the effects of supplementation on the incidence of and resistance to trypanosomiasis in grazing situations.

Suggested Inputs

Experimental grazing herd
Long- term TCO
Vehicle
Computer
Satellite tracker
Field Assistants

Project Activities

1. From feed resource studies identify appropriate supplements for cattle and small ruminants.
2. Monitor grazing behaviour and species selection of animals supplemented in the evenings or mornings.
3. Identify other factors influencing grazing behaviour.
4. Collect livestock productivity data, including seasonal weight change, reproductive performance and lactation yields in response to supplementation.
5. Monitor the incidence of parasitaemia and PCV in the experimental herd.
6. Estimate the distance covered by grazing animals in different seasons possibly through satellite tracking.
7. Link with the animal health and entomology projects to correlate animal movement/tsetse challenge/nutritional status

Expected Outputs

1. Basic data for the development of supplementary feed interventions relating to particular ecological and management situations.
2. Feedback to on-station trials in terms of experimental design
3. Publications on:
 - a) the effect of supplementation/disease on foraging behaviour and implications for more strategic use of feed
 - b) the effect of supplementation strategies on productivity of trypanotolerant livestock