

# The trypanotolerant livestock network in West and central Africa\*

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## Summary

THIS PAPER describes the background to the problem of trypanosomiasis in Africa. The exploitation of trypanotolerant breeds of cattle such as the N'Dama and the West African Shorthorn is presented as one of the most important approaches to the use of tsetse-infested areas of Africa. ILCA is coordinating a network of trypanotolerant livestock situations throughout West and central Africa in cooperation with national research organisations, other international bodies and a number of donor agencies. The sites used cover a range of trypanotolerant and trypanosusceptible livestock breeds under different levels of risk and under different management regimes. The aims of the network activities are described and the parameters and techniques used in data collection are outlined. The paper concludes by summarising the current network activities in Zaire, Gabon, Nigeria, Ivory Coast, Togo, Benin, Congo, Gambia and Senegal.

## Background

The exploitation of genetic resistance to infectious diseases is being given increasing attention in developing countries, where conventional disease control measures are often not effective, do not exist, or cannot be implemented because of lack of finance or trained manpower. However, in animal breeding programmes disease resistance can be only one of many aspects of production that have to be considered. In the vast majority of selection programmes practical breeders usually select on overall viability, which is one of the least clearly defined characters in livestock breeding work. A major problem in making progress from such selection decisions is that the heritability of overall viability is generally low, mainly because of the large environmental variance component. In contrast the heritability of well-defined resistance to specific diseases, or of traits correlated to disease resistance, is likely to be higher than that of overall viability. Controlled challenge conditions would also be expected to increase heritability by reducing environmental variation.

Trypanosomiasis is found over about 10 million km<sup>2</sup>, or roughly over one third of Africa. The disease occurs in nearly every country between the deserts of southern Africa and the Sahara. Approximately 7 million km<sup>2</sup> of this area is tropical savanna which could support an estimated 125 million additional cattle without environmental stress. Traditionally many African livestock producers used to bring their herds and flocks into tsetse infested areas in search of grazing during the dry season when there were few tsetse flies, and moved quickly back to drier, disease-free areas when the rains began. As populations increased and grazing land was used

for farming, this type of herding system became less practical, resulting in high grazing pressures in the drier, disease-free areas.

## Trypanotolerant breeds

### *Bos taurus* types

The exploitation of trypanotolerant breeds of cattle such as the N'Dama and West African Shorthorn is one of the most important approaches to the utilisation of tsetse-infested areas in Africa. The ILCA/ FAO/UNEP report on trypanotolerant livestock in West and central Africa (ILCA, 1979) emphasised the importance of trypanotolerance by indicating that West African taurine breeds are at least as productive as other indigenous African breeds in areas of low or medium trypanosomiasis risk. In areas of high trypanosomiasis risk, comparative data are not available because only trypanotolerant breeds can exist there. The report illustrated the major effects of different levels of trypanosomiasis risk for which only rather subjective measurements had been available in the past; and the effect of management and nutrition as indicated by ranch or village production systems. Major interactions exist between breed type, the level of trypanosomiasis risk and other physiological, disease, nutritional and management factors.

Many small-scale experiments carried out in West Africa indicate similar dramatic differences between N'Dama and Zebu cattle in susceptibility to natural infection when judged by mortality levels and associated prevalence, and level and duration of parasitaemia and anaemia. Similarly, evidence is available on the effects of level of challenge on subsequent anaemia. Using animals that had never before been exposed to trypanosomes, it has been confirmed that N'Dama cattle are significantly more resistant than Zebu to experimental challenge with infected tsetse caught in the wild (Stephen, 1966; Roberts and Gray, 1973), to natural field exposure (Toure et al, 1978; Murray et al, 1981), and to trypanosomes inoculated by syringe (Murray et al, 1979; Saror et al, 1981). The resistance of the West African Shorthorn appears to be intermediate between that of the N'Dama and the Zebu (Roberts and Gray, 1973).

Further evidence that trypanotolerance has a genetic basis and is not due only to acquired resistance to local trypanosome populations has been provided by the successful establishment of cattle from West Africa in distant tsetse-infested areas of West and central Africa. Examples are the introduction of Lagune cattle in 1904 and N'Dama cattle in 1920 into Zaire, and more recently that of N'Dama into the Central African Republic, Gabon and Congo (ILCA, 1979).

On the basis of this knowledge, N'Dama heifers and bulls are now being imported by several countries in West and central Africa to form the nucleus of livestock development programmes in tsetse-infested areas.

### *Bos indicus* types

There are now several reports from Kenya and Upper Volta that differences *in* resistance to trypanosomiasis have been found in certain *Bos indicus* types. However, as the animals in these studies had all previously been exposed to trypanosomiasis, it is not possible to assess the relative contribution of innate and acquired resistance. While critical comparative studies on the differences in susceptibility and productivity remain to be carried out, the degree of genetic resistance in *B. indicus* types is probably significantly less than in the recognized trypanotolerant breeds.

## Level of innate resistance

While there is evidence in cattle that the innate levels of resistance may be increased by exposure to trypanosomiasis, it must be emphasised that trypanotolerance is reduced under certain adverse conditions. In order to realize the full potential of trypanotolerant breeds, it is essential that the main factors affecting the stability of trypanotolerance be identified and the extent of their impact quantified. For example, it is known that as tsetse challenge increases the productivity of N'Dama cattle falls (ILCA, 1979) as a result of stunting, wasting, abortion and even death. Therefore, the ability to quantify tsetse-trypanosomiasis risk critically is required in order to determine at what level of risk the N'Dama ceases to be productive. Similarly, factors including the stress of overwork, pregnancy, parturition, lactation, suckling, poor nutrition and intercurrent disease have been identified as affecting the susceptibility of cattle to infection with trypanosomes. Such factors are reviewed by Murray et al (1982).

## The network

A network of trypanotolerant livestock situations is therefore being built up throughout West and central Africa in cooperation with national research organisations and with the help of a number of donor agencies. Within this network ILCA is coordinating in-depth investigations at up to 10 sites. These sites cover a range of trypanotolerant and trypanosusceptible livestock breeds under different levels of tsetse-trypanosomiasis risk and different management regimes. Additional work in East Africa by ILRAD and ILCA has led to similar studies being developed on sites in four countries of this region. The technical training and supervision of the network's scientists is being provided jointly by ILCA, ILRAD and ICIPE. By defining the parameters to be measured and through well organised training and supervision it is hoped to standardise the technology being used throughout Africa in order that the results obtained in different study areas can be critically compared.

## Objectives

The objectives of the network activities are to evaluate the productivity of different breeds of domestic ruminants living under different levels of tsetse-trypanosomiasis risk, under different management systems, and in different ecological zones. The results should allow a critical evaluation of genetic differences in susceptibility to trypanosomiasis between breeds throughout Africa. In addition they should permit critical evaluation of the role played by acquired resistance in field situations and allow between-breed comparisons of the rate at which such resistance develops.

Once these essential baseline data are established and meaningful productivity indices based on production, economic, health and tsetse data are computed, it should be possible:

1. to predict the productive capacity of different breeds of domestic ruminants living under different levels of tsetse-trypanosomiasis risk, leading to more efficient use of different breeds and, consequently, to increased livestock production; and
2. to evaluate the cost-effectiveness and impact of the introduction of current or new methods of control, e.g. the strategic use of chemotherapeutic or chemoprophylactic drugs, tsetse control, trypanotolerance, improvements in management and nutrition and, possibly, immunotherapy and genetic selection.

## Parameters and techniques in data collection

A training manual (Murray et al, 1983) has been produced jointly with ILRAD and ICIPE, describing the parameters and techniques used in the collection of data on animal health, tsetse-trypanosomiasis risk and animal productivity in different areas, and indicating how relevant information is extracted, analysed and interpreted. The manual will be revised after 18 months to include additional experience gathered in field operations and during training sessions.

### Animal health

The most reliable indication that a herd is affected by trypanosomiasis is the detection of parasites in the blood, commonly accompanied by anaemia. In field situations anaemia may arise from causes other than trypanosomiasis, and it is therefore necessary to identify any other anaemia-producing pathogens that may be present. Thus, this manual describes the basic techniques for estimating anaemia, detecting trypanosomes and diagnosing other anaemia-producing diseases.

### Animal productivity

The important performance traits are reproductive performance, viability, growth and milk production. These are then amalgamated into suitable indices of overall animal productivity. To allow concurrent evaluation of animal productivity, health and the prevailing tsetse situations requires recording of all animal numbers, dates of parturition, birth, death, sale, movements in or out of herd etc., and sampling at appropriate intervals of body weights and milk production. Economic evaluations aim to provide useful information to development project planners and managers on production potentials and the cost-effectiveness of introduction of improved practices.

### Tsetse situation

The collection of concurrent data on degrees of risk from tsetse infestations is essential for the appraisal of livestock production, and entails general surveys of the location of foci of infestation infringing on the study areas, and the monitoring of seasonal alterations in tsetse density distribution and infection rates.

## Current network situation

Following staff training in Nairobi, work has commenced at sites in Zaire, Gabon, Nigeria, Ivory Coast and Togo. Further sites will include Benin, Congo, Gambia and Senegal. At some of the network's sites attempts are being made to improve the productivity of trypanotolerant breeds by the use of chemotherapeutic or chemoprophylactic drugs.

In **Zaire** implementation focuses on the N'Dama breed raised both on ranches and in metayage-village operations under various levels of trypanosomiasis risk. The field operations started in November 1982. Recording is operating at full scale in the ranches and will be operating in the *metayages* by the end of September 1983.

In **Gabon** the ranch of the Office Gabonais d'Amélioration et de Production de Viande at Okouma maintains N'Dama and Nguni cattle and their crosses under two levels of trypanosomiasis risk, with a range of trypanosomiasis control interventions. In October 1982 herds were organised, and data collection according to ILCA's protocol commenced.

In **Nigeria** ILCA's Humid Zone Programme in 1981 extended its existing production recording with small ruminants to collect matching data on trypanosomiasis risk and incidence. A veterinarian from ILCA's Nigeria team spent 4 weeks in Nairobi in April 1982 in specialised training while three other researchers were trained in February and March 1983. ILCA's Humid Zone Programme will monitor an importation of Gambian N'Dama cattle in cooperation with the Federal Livestock Department and the Western Livestock Company. Heifers from low, medium and high trypanosomiasis risk situations in Gambia are being maintained in low and medium risk ranching situations in Nigeria, with and without initial prophylaxis. Comparison is also being carried out with progeny (born in Nigeria) of previous importation.

In **Ivory Coast** work on sheep in the SODEPRA-Nord operations was extended with support from ILCA during 1981 to cover all the recording requirements in a village situation in the semihumid savanna around Korhogo. The work is being carried out in collaboration with SODEPRA (Ministry of Animal Production), the Veterinary Laboratory of Korhogo and an FAO project on tsetse control. A project document has also been presented to GTZ in Germany and to the Ministry of Animal Production in Ivory Coast, proposing the extension of the operations to a higher tsetse challenge area and to cover both sheep and cattle (Zebu, Baoule, N'Dama). Agreements have now been signed and the project became fully operational in January 1984.

**Togo** and GTZ proposed an extension of the activities of CREAT at Avetonou to carry out comprehensive work involving the station cattle and *metayage* operations. The latter have been enlarged to cover 300 N'Dama females in village herds around the station. ILCA will provide technical advice, training for local scientists and carry out the data analysis. The same recording scheme will be applied also to a continuing village cattle project working with Somba and Borgou cattle, which was funded by Togo and GTZ in the Centre Region. Two Togolese scientists have recently completed the training course in Nairobi, and field operations started in December 1983.

In **Benin** a package of six small livestock development projects has been proposed by FAO for funding by UNDP. Two of them concern the creation and development of a unit of veterinary and animal production research, having as an important goal the study of the trypanotolerant breeds and their potential. The first phase will last 3 years. The operations will focus on three farms: Samiondji (Lagunes), M'Betecoucou (Borgou) and Okpaha (Somba, Zebu), together with surrounding village herds. It has been agreed that ILCA will organise necessary training and provide technical supervision and data analysis. The project is currently delayed due to lack of funds.

In **Congo** contacts have been established with the Dihesse ranch where N'Dama cattle are raised under low and medium trypanosomiasis risk. Currently arrangements are under way to allow the analysis of production and health data collected on the breeding herds since 1975, through a 4-month fellowship to a Congolese scientist.

In **Gambia** a recent major development in the exploitation of N'Dama cattle is that the Government is establishing an N'Dama Centre which will cooperate with ILCA and ILRAD. The main objectives of this centre are first to provide channels for marketing and export of stock, and

second to undertake epidemiological studies to evaluate the productivity of N'Dama cattle exposed to different quantified levels of tsetse-trypanosomiasis risk.

**Senegal** has requested ILCA to organise and support similar research work on Djallonke sheep and N'Dama cattle in Casamance and Senegal Oriental which encompass different ecological zones and tsetse challenges. This proposal has been linked to the request submitted to EEC for funding of work in Gambia. The two research projects will therefore constitute an integrated operation and are expected to start in November 1984.

## Initial data analysis

Data covering the initial 12 to 18 months of operations in Gabon, Ivory Coast, Nigeria and Zaire are currently being prepared for analysis. It is expected that preliminary interpretation of these analyses will lead to more precise protocols being devised in all situations.

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