ADAPTATION TO TROPICAL ENVIRONMENTS

Adaptación a ambientes tropicales

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The introductory presentation of the equivalent Round Table at the 1st World Congress on Genetics applied to Livestock Production (Rendel, 1974) indicated that nearly half the world's 1200 million cattle live in the tropics while sheep and goats are largely concentrated in the semi-arid zones just north and south of the Tropics of Cancer and Capricorn and pigs are more common in the temperate regions. It was of course recognised that the many reasons for the low animal productivity in the tropics related to management and feeding as well as to breeding and animal health. As the topic was very large, the first Round Table focussed its discussions on issues concerning increased productivity through breeding in cattle only and in fact more specifically in dairy cattle.

In summing up the problems for the future, Rendel (1974) first emphasised how little was known about the production potential, under various conditions, of the very many local strains of livestock in tropical areas. He especially indicated that further research was needed on the nature of the specific adaptability shown by animals and strains to various stress factors, e.g. the tolerance to trypanosomiasis shown by N'Dama and some other non-humped cattle strains in West Africa and the high degree of resistance of many zebu strains to tick infestations as well as their superior ability to repel or tolerate certain internal parasites.

He secondly noted that considerable research was required on the magnitude of genotype-environment interactions, when similar genotypes were subjected to greatly different environments. Where these were very important, it would mean that rather than import breeding stock and semen from temperate areas, tropical countries should pay more attention to building up facilities for production recording so that selection might be based on records obtained under local conditions.

Today, eight years later, in planning increased animal productivity in tropical environments, the principal requirement is for information allowing the usefulness of major animal types to be confidently predicted for different ecological zones, production systems, management levels, disease situations, nutritional resources, etc. A major problem is that in this day and age the setting up from

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scratch of operations to collect this information on the ground is prohibitively expensive. Accepting this, any alternative ways of gaining information on how to use available genetic resources for optimal productivity must be investigated - the use of simulation techniques being an example.

Therefore this Round Table is focussed almost entirely on work carried out since the 1st Congress that contributes towards answering some of the questions on how to increase productivity through breeding in the tropics. Again, as the topic is so large, the discussions are limited to cattle, this time beef cattle.

ADAPTIVE AND PRODUCTIVE COMPONENTS OF PRODUCTIVITY

Frisch and Vercoe (1982) deal with relationships between environmental stresses and production potential, using information from experimental work in Australia. They emphasize how the genetic improvement of beef cattle in the tropics depends on understanding that realized productivity is a consequence of two groups of factors, one related to production potential, the other related to resistance to environmental stresses. They report on aspects of their work at Rockhampton with a range of cattle types from *Bos indicus* to *Bos taurus* together with crosses between them, measuring the responses of contrasting genotypes to the improvement of factors suspected of affecting production. They elegantly show interactions between the effects of climatic, nutritional and disease stresses, and the different breed types, with regard to the important traits of reproductive performance, growth and viability.

HETEROSIS, CROSSBREEDING AND COMPOSITE BREED UTILIZATION

Gregory et al (1982) review the challenge of synchronizing germ plasm resources with the other production resources in the tropics. They emphasize that economic and technological considerations generally do not permit modification of natural environments in the tropics to realize as high a percentage of the genetic potential as can be exploited in temperate zones. They review the use of cattle possessing the most nearly optimum additive genetic composition for a reasonably improved environment through both organized crossbreeding and formation of composite populations or breeds. They stress the importance of characterization of candidate breeds of both *Bos indicus* and *Bos taurus* cattle for major economic traits in the ecological zones of interest. This is necessary both for effective selection among breeds for use in crossbreeding systems and as contributors to composite breeds.

TRYPANOTOLERANCE

Murray and Trail (1982) evaluate the current situation on exploitation of the specific adaptability to African trypanosomiasis exhibited by certain West African cattle breeds. They suggest that past failure to make more use of N'Dama and

West African Shorthorn types was because their smaller size suggested they were not productive, and because it was believed that their trypanotolerance had been acquired only through exposure to local tsetse challenge. A recent major survey of trypanotolerant livestock in 18 countries of West and Central Africa (ILCA, 1979) strongly suggested that the productivity of trypanotolerant cattle relative to other breeds was much higher than previously assumed, and there is now evidence indicating that trypanotolerance is an innate characteristic. This has led to a considerable revival of interest in the use of trypanotolerant breeds in tsetse infested areas of Africa. The fact that this genetic resistance to trypanosomiasis can be reduced by a variety of stress factors and supplemented by previous exposure, indicates the importance of identifying the main environmental influences and quantifying their effects.

HERD LEVEL MODELLING

Cartwright (1982) discusses the use of herd level models to supplement conventional research. While only a limited number of production system practices can be examined experimentally, modelling offers the possibility of examining large numbers of alternative practices through simulation. To use this research tool, one needs appropriate models and sufficient quantitative information to establish the correct parameters for a given set of cattle in a specific production settling. The animal science systems group at Texas A&M University has developed a computer-based cattle production systems model suitable for use in tropical countries. This model can be adapted to predict or simulate animal and herd productivity for specific breeds and nutritional resources under a variety of management regimes in diverse environments. Biological and economic analyses can then be made based on these predictions. Cartwright (1982) indicates examples of the use of this model in tropical situations in North and South America and Africa in recent years, and discusses both the achievements and limitations.

CONCLUSIONS

It is apparent that since the 1st World Congress, considerable work has got underway in evaluating the production potential of local strains of livestock in tropical areas; in measuring the nature of specific adaptabilities to various stress factors; and in pushing forward with research on relevant genotype-environment interactions.

In tropical Africa, for example, during the past 8 years, in addition to continued national and bilateral supported research programmes and expanded performance recording schemes, there have been some other significant inputs. FAO in the area of evaluation, conservation and utilization of animal genetic resources has launched a number of operations. The Consultative Group on International Agricultural Research has established its International Laboratory for Research on Animal Diseases (ILRAD) and its International Livestock Centre for Africa (ILCA). An important approach of ILCA is to complement and link together national research operations in specific fields. A current example is a

network of trypanotolerant livestock situations being built up in West and Central Africa, where ILCA is coordinating a study over the next five years involving 10 nationally operated situations where work is in progress and where more definitive data can be collected with relatively little additional input.

All such efforts that are contributing towards the building up and tying together of information necessary to achieve increased animal productivity in tropical environments, need to be maintained.

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