

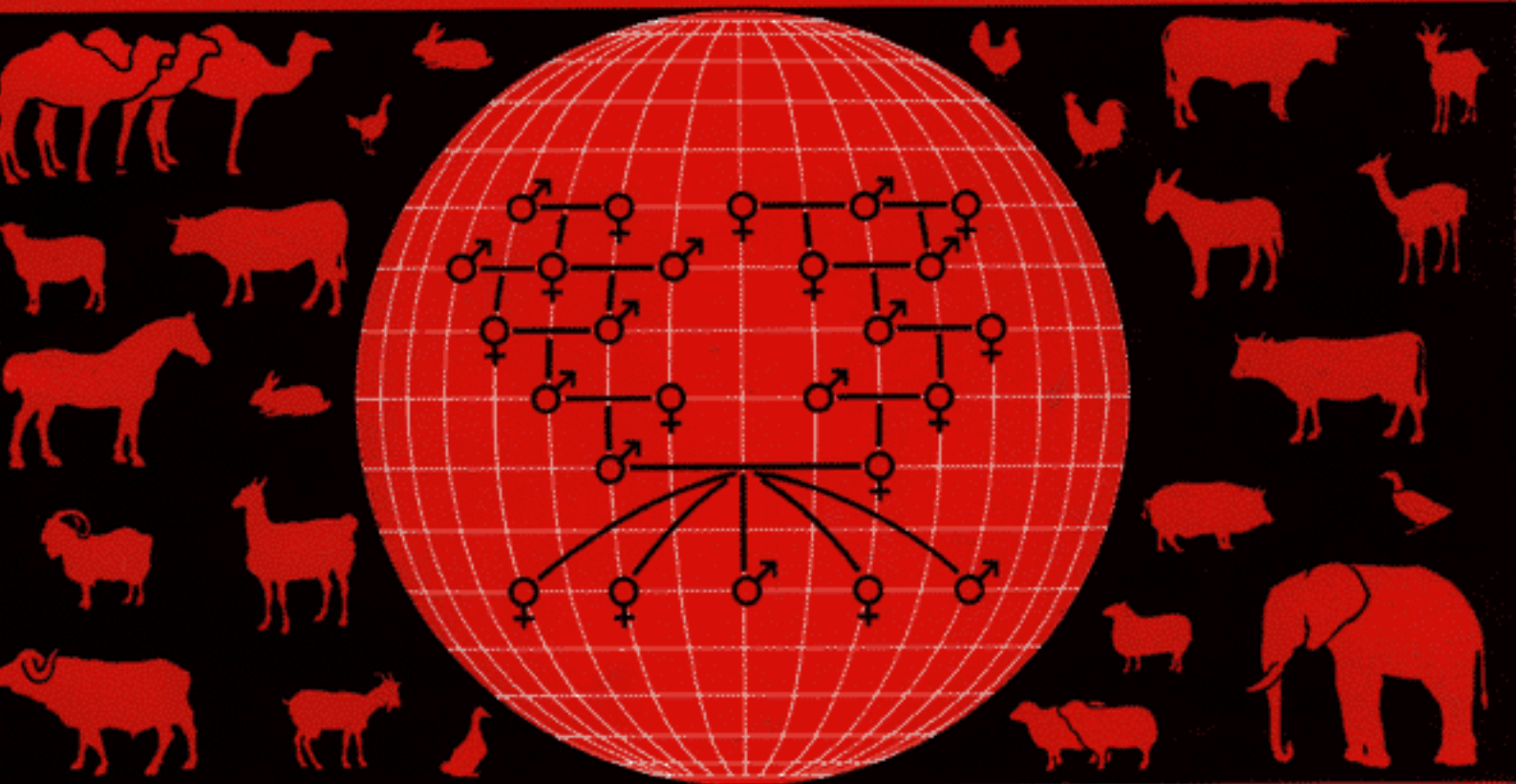
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ANIMAL GENETIC RESOURCES INFORMATION

BULLETIN D'INFORMATION
SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

BOLETIN DE INFORMACION
SOBRE RECURSOS GENETICOS ANIMALES

1990



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El Boletín de Información sobre Recursos Genéticos Animales se publica bajo los auspicios de la organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO) y del Programa de las Naciones Unidas para el medio Ambiente (UNEP). Se edita en el Grupo de Recursos Genéticos de la Dirección de Producción y Sanidad Animal de la FAO. Se puede obtener directamente de la FAO o a través de sus agentes de venta habituales.

Editor-Editeur: John Hodges

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El editor desea agradecer al Profesor V. Buvanendran y a la Sta. T. Farina por su contribución en la redacción de este número.

GUIDE TO CONTRIBUTORS

Animal Genetic Resources Information will be pleased to receive contributions up to 3000 words long in English, French or Spanish. If accepted, they will be published in the original language. Reports, news and notes about meetings, conservation and evaluation activities, and techniques would be appreciated. Manuscripts should be typed in double space and accompanied by a summary of not more than 5 percent of the original length. Photographs are acceptable but only high quality black and white prints. AGRI will also review new books on animal genetic resources. Correspondence is invited.

All contributions should be addressed to:

The Editor, AGRI, AGAP, FAO,
Via delle Terme di Caracalla,
00100 Rome, Italy.

Le Bulletin d'information sur les ressources génétiques animales souhaite recevoir des articles en anglais, en français ou en espagnol, de 3000 mots, au 'tront dans la langue originate. Les maximum. Les communications publiées paraîtront dans la langue originale. Les rapports, informations et notes concernant les réunions et les activités de conservation et d'évaluation et les techniques seraient particulièrement appréciés. Les manuscrits devront être dactylographiés en double interligne et accompagnés d'un résumé ne dépassant pas cinq pour cent de la longueur originale. Le Bulletin accepte les photographies à condition qu'il s'agisse de bonnes et de preuves en noir et blanc. Le Bulletin rendra également compte des ouvrages nouvellement parus sur les ressources génétiques animales. Un échange de correspondance est le bienvenu.

Adresser toutes les contributions à l'adresse suivante:

L'Editeur, AGRI, AGAP, FAO,
Via delle Terme di Caracalla,
00100 Rome, Italie.

El Boletín de Información sobre Recursos Genéticos Animales recibirá con mucho gusto colaboraciones de hasta 3000 palabras de extensión en español, francés o inglés. Si son aceptadas, las contribuciones se publicarán en el idioma original. Interesa recibir informes, noticias y notas sobre reuniones, actividades de conservación y evaluación, y cuestiones técnicas. Los originales deberán presentarse mecanografiados a doble espacio y acompañados de un resumen que no supere el 5 por ciento de la extensión original. Se aceptan fotografías, pero únicamente en blanco y negro y de buena calidad. AGRI también publicará reseñas de libros sobre recursos genéticos animales. Se solicita correspondencia.

Todas las contribuciones deben dirigirse a:

El Editor, AGRI, AGAP, FAO,
Via delle Terme di Caracalla,
00100 Roma, Italia.

ANIMAL GENETIC RESOURCES INFORMATION will be sent free of charge to those concerned with the conservation, management or utilization of domestic livestock. Anyone wishing to receive it regularly should send their name and address to The Editor, at the address on page v.

BULLETIN D'INFORMATION SUR LES RESSOURCES GENETIQUES ANIMALES sera envoyé gratuitement aux personnes intéressées par la conservation, l'élevage ou l'exploitation du bétail domestique. Les personnes souhaitant recevoir cette publication régulièrement voudront bien faire parvenir leurs nom et adresse l'éditeur, à l'adresse indiquée en page v.

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES será enviado gratuitamente a aquellos quienes están interesados en la conservación, gestión o utilización del ganado doméstico. Si se desea recibirlo regularmente, se ruega comunicar nombre, apellido y dirección al Editor a la dirección indicada en la página v.

EDITORIAL

We are pleased to resume publication after a gap of nearly three years. The last issue of *Animal Genetic Resources Information* was in 1987 (no. 6). The suspension was caused by budgetary restrictions which affected other publications within FAO including the *World Animal Review*. However, with this issue we resume publication of *AGRI* and bring a larger than normal issue to our readers.

During the recent past some important initiatives for Animal Genetic Resources have taken place. It is expected that they will have a positive impact on the future use and conservation of animal genetic resources throughout the world.

many readers will know that in 1980 FAO and UNEP held a joint Technical Consultation for animal genetic resources in Rome which designed an agenda of technical activities which were considered essential steps towards a global programme. During the decade 1980-90 all these topics have been completed. As a consequence, in 1989 the FAO Committee on Agriculture reviewed the animal genetic resources programme and found it scientifically sound and with appropriate infrastructures in place. They recommended expansion of the programme to a fully operational level to serve all countries in the world. They also recognised that animal genetic resources are part of the world's biological diversity and are being threatened by human development activities. They therefore recommend the establishment of a global system which will promote sustainable development of animal genetic resources which makes efficient use of them today while ensuring that the needs of future generations are not at risk.

During the last two years FAO has established regional animal gene banks in Africa, Asia and Latin America which are operating at modest levels. They are located, with the cooperation of the governments, in Argentina, Brasil, Mexico, Ethiopia, Senegal, China and India. In addition, a global animal genetic data bank has been established in Hannover, Federal Republic of Germany. This centre is beginning to offer an information service to those concerned with improved use and conservation of domestic animals.

As a result of the recommendations of the FAO Governing Body, these existing facilities are to be fully developed, together with new components into a Special Action Programme. This will include a World Watch List of endangered breeds, an Early Warning System to governments indicating breeds requiring attention, closer links with wildlife, live animal preservation programmes to supplement cryogenic storage of germplasm, and evaluation of under-utilized species.

Readers of *Animal Genetic Resources Information* will be up-dated in future issues with developments in the proposed Special Action Programme.

STAFF CHANGES IN THE ANIMAL GENETIC RESOURCES GROUP AT FAO, ROME

The Editor of AGRI, Dr. John Hodges, who has been Senior Officer (Animal Breeding & Genetic Resources) at FAO since 1982, leaves FAO in July 1990. His successor is Dr. Fernando E. madalena of Brazil.

Dr. H.-G. Wagner, who was Animal Production Officer (Artificial Insemination and Breeding) moved to a field appointment with FAO at the end of 1989. His successor is Dr. Daniel Chupin of France.

Drs. madalena and Chupin expect to take up their appointments in FAO, Rome shortly.

RECENT PUBLICATIONS

THE CATTLE OF THE TROPICS. John P. Maule. Published by University of Edinburgh, Centre for Tropical Veterinary medicine, Easter Bush, Roslin, Midlothian EH25 9RG, UK. (1989). 225 pages. ISBN 0 907146 05 8.

This is the first book to describe all the breeds of cattle - over 300 in the tropics. It sets out a simple classification of the main types, Zebu, Sanga, humpless and crosses between them and gives a short description of each breed. This is followed by an account of the development of some of the tropically adapted breeds and the success and limitations of some of them.

There is a lack of accurate information on the performance and ability of indigenous breeds to respond to better management. The book emphasizes the need for proper evaluation of potentially useful breeds and describes some projects that give detailed comparisons of promising beef breeds in Southern Africa. A feature of the book is the author's emphasis on the potential value of a number of indigenous breeds hitherto not fully appreciated. Ways of improving production and breeding efficiency are discussed.

The book is intended for students, both at degree and postgraduate level and should prove useful to all those interested in cattle improvement in the tropics.

UTILIZATION OF ANIMAL GENETIC RESOURCES IN LATIN AMERICA. Published as a supplementary volume to Revista Brasileira de Genetica, (Brazilian Journal of Genetics), Vol. 12 No.3, Supplement, September 1989. Editorial and business office: Prof. Dr. F.A. Moura Duarte, Departamento de Genetica, Faculdade de Medicina de Ribeirao Preto, 14.049 Ribeirao Preto, S.P. Brasil. 330 pages.

The publication comprises the proceedings of a Symposium held in September 1989 in Brasil. The contents cover Strategies in Genetic Resources Use; Evaluation of Dairy and Beef cattle; Breeding plans for Cattle; Sheep breeding programmes; Improvement of Camelids and Capybara; Criollo breeds and uses; New breeds; National Animal Genetic Resource programmes and the Improvement of Holsteins.

GENETIC CONSERVATION OF DOMESTIC LIVESTOCK. Edited by Lawrence Alderson. Published by Commonwealth Agricultural Bureau, International, Wallingford, Oxon, OX10 8DE, UK, on behalf of the Rare Breeds Survival Trust, UK. (1990). 242 pages., ISBN 0 85198 669 2.

This book is the proceedings of the First International Conference on the Conservation of Rare Breeds of Domestic Livestock. The Conference was held in September 1989, at the University of Warwick, UK. It was opened by HRH the Prince of Wales.

There are three main parts: First Regional Programmes, with contributions from Canada, Australia and New Zealand, France, Spain, Federal Republic of Germany, Norway, Hungary, Latin America and the UK. Then Philosophy and Methodology of Conservation, with contributions covering different programmes for a variety of species and also a paper by FAO outlining the global approach at the governmental level. Part three covers Research and Biotechnology and includes papers on assessment of genetic variation in rare breeds, blood group frequencies, AI and the likely future impact of embryo transfer and other aspects of reproductive manipulation.

WORLD DICTIONARY OF LIVESTOCK BREEDS, Third Edition. Ian Mason. Published by Commonwealth Agricultural Bureau International, Wallingford, Oxon, OX10 8DE (1988). 349 pages. ISBN 085198 617 X.

This invaluable book is now updated in a third edition by the author. It is the only and the

authoritative work on the subject. It contains nearly 3 000 new entries and revisions of many old ones. The dictionary lists names that have been applied to groups of cattle, sheep, horses, pigs, goats, buffaloes and asses on the basis of common origin, similarity of appearance or geographical proximity. It indicates which are synonyms and recommends the form for English use. The information, given in an easily followed abbreviated form, includes place of origin or present distribution and economic use of various breeds, types and varieties, their inter-relationships, a description of the “breed characters” least affected by the environment, such as colour and horns, and the origin of the name. There are also references to Breed Societies and Handbooks, both in the country of origin and abroad.

EVOLUTION AND ANIMAL BREEDING - REVIEWS ON MOLECULAR AND QUANTITATIVE APPROACHES IN HONOUR OF ALAN ROBERTSON (1989). Edited by William G. Hill and Trudy, F.C. Mackay. Published by Commonwealth Agricultural Bureau International, Wallingford, Oxon OX10 8DE, UK. 313 pages. ISBN 0 85198 639 0.

This book is dedicated to the memory of Alan Robertson and to Meg Robertson. Alan Robertson was Honorary Professor of Edinburgh University, and worked for most of his life in the ARC Unit of Animal Genetics, in the Institute of Animal Genetics, of the University of Edinburgh, UK. Sadly he died in 1989 after a long period of declining health.

The book covers four main sections, which reflect the great breadth of Professor Robertson’s interest and significant contributions. They are population genetics, quantitative genetics, and both quantitative and molecular approaches to animal improvement. The beginning of each section provides a chapter which reviews his contributions to the field, followed by a series of minireviews covering up-to-date developments and prospects in topics in which he was interested. The authors have all been associated with-@Professor Robertson in some way, as colleagues, students or visitors at the Institute of Animal Genetics.

THE MANX LOGHTAN STORY - The Decline and Revival of a Primitive Breed. Peter Wade-martins. Published by Geerings, Cobbs wood House, Ashford, Kent, UK, in association with the Rare Breeds Survival Trust, UK (1990). E16.95. 110 pages. ISBN 0 9513042 7 5.

Recently there has been a revival of interest in rare breeds of sheep and this enthusiasm is reflected in “The Manx Longhtan Story” which traces the decline and revival of this primitive breed. This absorbing volume, written by archaeologist Peter Wade-martins is clearly a labour of love. It also serves to make the work of the Rare Breeds Survival Trust more widely known. Twenty three British breeds of pigs, sheep, cattle and horses became extinct during this century prior to 1974. Since then none have been lost, largely thanks to the Trust. This surely must strike a chord in a more conservation minded society.

The book is fascinating tale of how the Manx Loghtan breed was sustained by a group of people determined this piece of-Isle of Man history would survive. It demonstrates scholarship and dedication, painstaking research and enthusiasm woven into a story of human endeavour. Entertainingly written, it should prove to be worthy of a place in any country lovers bookshelf. It is to be hoped Geerings maintain their support for these specialist but very worthwhile publications and develop a series on rare or minority breeds.

PRACTICAL RARE BREEDS. Valerie Porter. Published by Pelham books Ltd., 27 Wrights Lane, London W8 5TZ, UK. 1989. E15.95. 274 pages. ISBN 0 7207 1746 9.

This book would be of value to anyone with a special interest in the rare breeds of the UK. It does, however, include a few other exotic breeds which have found or are likely to find a place in the UK. It is a book which will particularly concern those with an interest in practical aspects of keeping rare breeds and on their historical background. It draws upon the experiences of many

individuals with access to or special information on old breeds which have now become rare or endangered in the UK. The book explores the history and folklore of old breeds and describes the experiences of many people who have kept them and endeavoured to save them from extinction. There are specific sections on cattle, sheep, pigs and goats' with many photographs.

A HISTORY OF THE JACOB SHEEP. Araminta Aldington. Published by Geerings Cobbs Wood House, Ashford, Kent, UK, for the Jacob Sheep Society (1989). E17.50. 116 pages. ISBN 0 9513042 5 9.

This is a lavishly illustrated and entertaining readable history of the Jacob Sheep. Penned by Araminta, Lady Aldington, founder of the Jacob Sheep Society, the work explodes many of the myths surrounding this popular biblical breed of pied sheep.

Lady Aldington, in a work demonstrating both scholarship and research, not only traces the geographic origins of this popular breed, but walks her reader through the pastures of Britain's great houses where flocks of Jacobs have left their mark over many a generation. Witty, graphic, at times puckish Lady Aldington's history provides the ideal gift for all interest in the revival of Britain's rare and threatened breeds of domestic livestock.

POULTRY BREMING AND GENETICS. Edited by R. Crawford, Elsevier, Amsterdam-oxford-New York-Tokyo, 1990. 1123 pages, tables, figures and photographs. ISBN 0 444 885579.

Since the publication of Hutt's classic book "Genetics of the Fowl" in 1949, no attempt has been made to summarize advances in poultry genetics comprehensively. It may be speculated that the enormous speed of development in this field beginning in the late 1950s, and still continuing today, has discouraged poultry geneticists from undertaking such a task. The development of poultry genetics not only resulted in more publications on the subject but also in interaction with other disciplines such as poultry physiology, immunology, behaviour, and finally in recent years with molecular genetics and genetic engineering. It was F.B. Hutt again who in 1985 stressed the need for a reference work on the present state of poultry genetics. This idea was endorsed by the Poultry Science Association, and Dr. Ray Crawford was entrusted with the task of editor of the new book which has now been published.

The book written by 37 well-known poultry geneticists, is comprised of five parts: Poultry biology, Qualitative genetics, New directions in poultry genetics, Quantitative genetics and selection, and Applied breeding and selection. It covers in detail the whole range of specialized topics from, for example, recent archaeological findings which throw light on the origin of the domestic chicken to the present achievements of genetic engineering and cytogenetics. It includes the theoretical hypothesis on evolutionary processes and genetic diversity as well as a detailed analysis of the genetic basis of growth, egg production and resistance to diseases, and describes, for example, selection for non-commercial traits for hobby breeders and scientists as well as applied genetics for the developed and developing countries.

Apart from the domestic fowl (*Gallus qallus domesticus*), the morphological traits, growth rate, egg production, physiology and behaviour of the other main species of poultry, such as ducks, geese, turkeys, Japanese quail, guinea fowl and pheasants, are also described.

Despite the numerous authors involved in this publication and the diversity of its subject matter, the book is well structured and the whole field of poultry genetics is dealt with very systematically. The authors, points of view and approaches, however, vary according to the status of development in the various disciplines. While the classic fields of qualitative and quantitative genetics are presented as a critical post evaluation of results over several decades, the newer fields of investigation are covered by an aggregation of information of present knowledge and scope for further developments.

This book shows clearly that poultry genetics is in transition from classic qualitative and

quantitative genetics to molecular genetics. It is an Almanac of Poultry Science for both students and scientists.

RECENT FAO PUBLICATIONS IN THE ANIMAL PRODUCTION AND HEALTH SERIES ON ANIMAL GENETIC RESOURCES.

- No. 65 Animal Genetic Resources of the USSR (198 9)
- No. 66 Animal Genetic Resources - Strategies for improved use and conservation (1987)
- No. 67/1 Trypanotolerant cattle and livestock development in West and Central Africa4 Vol. I.
- No. 67/2 Ditto Vol. II
- No. 68 Crossbreeding *Bos indicus* and *Bos taurus* for milk production in the tropics (1987)
- No. 76 Ex situ cryoconservation of genomes and genes of endangered cattle breeds by means of modern biotechnological methods (1989)
- No. 77 A training manual for embryo transfer.in cattle (1989)
- No. 80 Animal Genetic Resources - a Global Programme for sustainable development (1990).

NEW FAO PUBLICATIONS ON ANIMAL GENETIC RESOURCES CURRENTLY IN PRESS

- Reproduction in the Camel
- Open Nucleus Breeding Systems for Dairy Cattle and Buffalo (jointly with Institute of Cattle Breeding, Poland)
- Yellow Cattle of China (jointly with Institute of Animal Science, Beijing, China)
- manual on Embryo Transfer
- Embryo Transfer for Buffalo
- Reproduction and A.I. Manual for Sheep and Goats
- Animal Biotechnology for Asian countries (jointly with University of Malaya).

THE CRIOLLO CATTLE PROJECT OF THE BRITISH TROPICAL AGRICULTURAL MISSION AND EL CENTRO DE INVESTIGACION AGRICOLA TROPICAL AS A MODEL OF INVESTIGATION AND DEVELOPMENT

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1. INTRODUCTION

The British Tropical -Agricultural Mission (BTAM) is a unit of the overseas Development Administration and consists of a group of eight to ten specialists in the fields of soil management, agronomy, plant protection, sociology, ecology, economics, animal production, pasture production and agro-forestry, working in a supportive and training capacity with the Bolivian Centro de Investigación Agrícola Tropical (CIAT), since its formation in 1976.

The animal production section of CIAT/BTAM has always worked closely with the pasture production and agricultural economics sections and in recent years has become intensively involved with all other specialist components in determining alternative systems to slash and burn agriculture. In particular, the step-by-step development of one of the livestock programmes demonstrates methods of problem identification, investigation to determine solutions, development to make solutions feasible and monitoring to ensure that the effects achieved are those desired.

2. PROBLEM DIAGNOSIS

At programme commencement in 1976 very few livestock production data were being recorded and none were subject to analysis. There was, therefore, a complete absence of information on performance and no knowledge of any constraints on cattle production. It was therefore decided to initiate a cattle performance recording project that would last two years and, would absorb a high percentage of the time of the team of three staff (two nationals and one expatriate) who had to identify, register and record data on nearly 2 000 cows on some 30 farms for two years. The results were published (Wilkins *et al.*, 1979) and among the findings was the need to conserve and improve a local dual-purpose breed to use in systematic crossbreeding programmes with European dairy breeds. This was because crossbred cattle of European dairy breeds and zebu or Criollos were shown to have lower calf mortality, higher fertility and higher annual milk production than cattle of pure European dairy breeds in the Bolivian lowlands. This result agrees with other studies undertaken in the humid tropics (i.e., Wilkins 1986) and can be explained by the lower resistance to tropical parasites and disease of pure European cattle and low digestibility of the abundant forages of the humid tropics that are not suitable for maintaining high milk yields. There were few examples of dairy zebu breeds in Bolivia at that time but a relatively large population of Criollo cattle (defined as animals that are only descended from cattle imported from the Iberian peninsula during the colonial era, Wilkins 1984). The limited information collected on Criollo cattle in the recording programme suggested that average performance was modest but variation high, thus indicating the possibility of improvement by selection. Prior to publication of the results of these investigations, Criollo cattle were generally thought by farmers to be inferior to exotic breeds and as such best rapidly replaced by other genotypes.

3. INVESTIGATION

It was necessary to investigate two concepts:

- determining the performance of selected Criollo cattle under controlled management in order to determine their potential with some degree of confidence; and
- determining if the use of Criollo bulls in a European dairy breed herd would result in an improvement in productivity. The crossbred cows in the data recording programme were the result of mating zebu or Criollo cows or crossbred zebu/Criollo cows with a pure Brown Swiss or Holstein bull. It was desirable to test this reverse cross because the European bulls that had been used were likely to have higher genetic potential than the average Brown Swiss or Holstein cows and would likely be superior to pure Brown Swiss cows, even though the progeny of Brown Swiss bulls from zebu/Criollo cows had proved to be more productive than the pure European breed.

Two parallel investigations were initiated in 1978 to clarify these concepts.

- i. A group of 50 superior Criollo cows was identified and purchased, a task that involved overcoming floods and landslides and many hours of riding horses and mules. Great difficulty was encountered in identifying superior Criollo bulls, so semen was imported from six selected dairy Criollo bulls belonging to the Tropical Agricultural Research and Training Centre (CATIE), Costa Rica. The performance data of the cows and their progeny were recorded until 1982, when the results were analysed.
- ii. At the same time, a group of Brown Swiss cows was divided at random and one group inseminated with the semen of four proven USA Brown Swiss bulls and one group with the semen of six Costa Rican Criollo bulls. The performance of the female progeny of these matings was compared from birth to the second parturition.

The results of this study showed that the crossbred cattle had lower calf mortality, a higher growth rate, an earlier age at first service and first calving and much shorter first calving intervals. First lactation milk yield was not, statistically, significantly different but overall productivity was highest in the crossbreds. The performance of the Criollo cows and their progeny was also promising (Wilkins *et al.*, 1984).

The Criollo bulls produced were sold to farmers who had been informed of the preliminary results. Some were used for crossbreeding with cows of European breeds but others were used with zebu and Criollo cows in adverse environments that would not support cattle crossbred with European breeds. The number of calves produced, and their low mortality, were noted and their vigour and rapid growth were measured in the few remote locations where it was possible to record weight. The data resulting from the investigations carried out on the experimental station and on private farms, in various environments, provided the basis for an economic evaluation and a cost-benefit analysis of a proposed scheme whereby the Criollo herd would be multiplied to a size that would permit progeny testing. This proposal was accepted by the overseas Development Administration, London, the UK, which provided finance for all necessary capital investment in infrastructure and livestock while CIAT provided the land and staff. The programme was planned to be self-financing once the herd had reached its final size and all infrastructure, land clearance, and pasture establishment had been completed. Income generated through the sale of bulls, culled cattle and milk would exceed all maintenance and running costs, including supervisory staff salaries.

4. DEVELOPMENT

The multiplication phase will be completed by 1991 when 300 adult females will be on the station, managed using methods similar to those of the system designed by meyn (meyn and Wilkins, 1974). only 110 cows were bought to minimize the risk of importing disease into the herd but a large number of bulls are being used to ensure a wide genetic base. These include bulls acquired in Bolivia and semen from Cuba, Nicaragua and Brazil, in addition to the original importations from Costa Rica.

5. EXTENSION

The productivity of Criollo cattle on the experimental station and on private farms has been widely publicized through field days and the mass media and this has stimulated a great demand for Criollo bulls. The project had sold 148 bulls by the end of 1988 and there is a waiting list for more animals. From 1991 onwards, the project will be able to provide 90 bulls per year, plus semen from proven bulls, for farmers able to practise artificial insemination. This, however, is unlikely to satisfy demand. A further problem is that the department of Santa Cruz, with an area of over 370 000 km, has several different ecological zones, ranging from the semi-arid thorn forest of the Bolivian Chaco, with 500 mm of annual rainfall, to the forest clearings in the north of the department, with 2 000 mm, where waterlogging and seasonal flooding are common. There is an equally diverse range of social and management systems in which the Criollo bulls are being utilized. To date, the bulls produced on the central station have adapted well to these different environments, but in order to overcome adaptation difficulties and to increase the breeding population, individuals and institutions are being encouraged to maintain their own stud herds of Criollo cows and use bulls from the central breeding herd. Some of these herds have their own bulls and superior examples have been lent to the project for semen collection. However, the majority purchase their bulls from the central herd and thus multiply genetic material from that herd and then sell male progeny to their neighbours. Some of these herds are on large ranches with up to 400 Criollo cows in their breeding herds but others belong to institutions involved in rural development work for small-scale farmer communities. The communities manage their cattle communally and bulls from the project have been sold, both to the co ities and to the assisting institutions directly, for use on the Criollo cows in the institutions, herds in order to produce more bulls for distribution; Technical advice is given to the institutions and the communities by project staff who also collect performance data on the bulls and their progeny in the area. The first co ity of peasants involved in the project, who previously were not cattle owners but essentially subsistence farmers with small ruminants, have recently produced the third generation of Criollo cattle and will now produce bulls for neighbouring communities and ranchers. One notable aspect of this project is the close and friendly cooperation between the parastatal and non-government charitable organizations involved.

A Criollo cattle breeders, association was formed in 1988 in order to formalize the registration and inspection of Criollo cattle in Bolivia. The association has the aim of assisting prospective buyers in identifying herds from which they may purchase Criollo cattle bred in an appropriate environment. The rules and regulations of the association were drawn up by the staff of the Criollo project and the establishment of this association, that will register over 2 000 head in its first year of operation, is seen as a further logical step in the programme that:

- i. initially identified a valuable genetic resource that was in risk of being lost;
- ii. determined the breed's high commercial value in various management systems;
- iii. established a selection programme to further improve the breed's performance;
- iv. promoted the breed through the publication of production data and the dissemination of this information to farmers; and
- v. continues to produce bulls (and semen) for the farmers of the Bolivian plains, ensuring continuous genetic improvement in the cattle that are sold each year.

REFERENCES

- Meyn, K. and Wilkins, i.V. 1974. Breeding for milk in Kenya with particular reference to the Sahiwal stud. *World Animal Review, FAO.* 11: 24-30.
- Wilkins, i.V., Pereyra, G., Ali, A. and Ayala, S. 1979. Milk production in the tropical lowlands of Bolivia. *World Animal Review, FAO.* 32: 25-32.
- Wilkins, i.V. 1984. Criollo cattle of the Americas. *Animal Genetic Resources Information, FAO.* 1.84: 1-19.
- Wilkins, i.V., Rojas, F. and Martinez, L. 1984. The Cri6ilo Cattle Project of Santa Cruz, Bolivia. *Animal Genetic Resources Information, FAO.* 2.84: 19-30.
- Wilkins, i.V. 1986. Productive and reproductive performance of cattle in the tropics. *Nuclear and Related Techniques.in Animal Production and Health. International Atomic Energy Agency (IAEA), viema. 1986.* 31-40.

GANADO CRIOLLO DEL BRASIL: ORIGEN Y CARACTERISTICAS ZOOTECNICAS

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SUMMARY

This paper describes the origin of one of the most recent Criollo cattle herds in Brazil (approximately 600 head). A description is given of its zootechnical characteristics and habitat, where the herd is bred. It includes some results on weight at birth, development prior to weaning of heifer calves and weight fluctuation of cows in distinct periods of the year.

RESUME

On présente dans ce travail une description sur l'origine d'un des derniers troupeaux Créoles en Brésil (environ 600 bétail) et une description des caractéristiques zootechniques et l'habitat où le troupeau est créé. Ensuite, on présente quelques résultats sur le poids de naissance, le développement avant d'être sevré des jeunes vaches et le poids des vaches en périodes distinctes de l'année.

RESUMEN

Describe el origen de uno de los últimos rebaños de ganado Criollo existentes en Brasil (aproximadamente 600 cabezas). Después, se describen las características zootécnicas y del habitat, donde es criado este ganado, presentándose en seguida algunos resultados sobre el peso al nacimiento, desarrollo durante el periodo previo al destete de las terneras y el peso de las vacas en distintas épocas del año.

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1. INTRODUCCION

El ganado Criollo es motivo de estudio en el Brasil, por sus grandes cualidades productivas y por representar una gran riqueza genética. según Garriz *et al.* (1982), el Criollo es el *Bos taurus* con mayor adaptación a climas tropicales y subtropicales, y consti por ese motivo un valioso recurso genético como raza pura o para cruzamiento.

Por otro lado, la preservación de razas indígenas o nativas es de inequívoca importancia para la humanidad, ya sea para la manutención del equilibrio ecológico como para las tradiciones culturales, siendo una reserva de genes que podrán ser utilizados para el aumento de rusticidad y productividad. Entretanto, para la preservación de germoplasma animal, existen grandes obstáculos en su concretización, a causa del elevado costo de manutención, especialmente de los animales de grande y medio tamaño. El costo elevado no debería ser obstáculo a la preservación de estos animales, porque los beneficios socio-económicos que advienen son de mayor envergadura, resultando de ahí, gran ventaja para la sociedad.

2. ORIGEN

Los bovinos Criollos de América Latina provienen, posiblemente, de los antiguos bovinos hamíticos, caracterizados por sus largos cuernos-, domesticados en Egipto aproximadamente 4000 años AC e introducidos al Sur de España, procedientes de Africa del Norte, con las migraciones que poblaron el Sur de la Península Ibérica (Inchausti & Tagle, 1964).

Cuando Cristóbal Colón llegó por la segunda vez a América, en 1493, trajo los primeros bovinos, los cuales eran parte del ganado todavía en formación en España. Aparentemente, el mayor recurso genético bovino se recibió de Andalucía (Salazar & Cardozo, 1981). Según los mismos autores, tres arquetipos generados originaron la ganadería latinoamericana: los bovinos de perfil cóncavo y cara morena; de perfil convexo y cara roja; y de perfil convexo y cara rubia. Siendo, desde el punto de vista cuantitativo, los últimos los que más contribuyeron en la formación del ganado Criollo de América Latina.

Descubierto y colonizado el Brasil por los portugueses, fueron por consecuencia sus razas bovinas las que fueron introducidas allí. En dicha época las cinco principales razas bovinas portuguesas eran: la raza del Alentejo o Transtagana, la raza Rubia o minhota, la raza mirandesa, la raza Brava y la raza Maroneza o Barrosa (Neves, 1918).

Según lo expuesto, se puede concluir que el ganado Criollo existente actualmente en el Brasil es el resultado de la fusión del ganado introducido por los españoles y portugueses, durante la época de la conquista y colonización del Nuevo Mundo.

3. CARACTERISTICAS ZOOTECNICAS

El ganado Criollo existente en el Brasil es descendiente directo del ganado introducido por los colonizadores españoles y portugueses, el cual se desarrolló exclusivamente a través de la selección natural, proceso que duró más de cuatro siglos, obteniéndose una gran cantidad de ganado bovino que se caracteriza por su adaptación y calidad biológica para las condiciones ambientales preponderantes en la región de la sierra de Santa Catalina. En dicha región se encuentra uno de los últimos rebaños de ganado Criollo del Brasil (aproximadamente 600 cabezas).

La vaca Criolla es de tamaño mediano, de conformación angulosa, con peso adulto entre 400 - 550 kg, se caracteriza por tener una cola alta y adelantada, lo que le da una mayor anchura de canal de parto, motivo por lo cual se desconocen problemas de distocia en estos bovinos. La vaca Criolla muestra destacada habilidad materna, característica fundamental para la sobrevivencia del ternero, es de temperamento y mirar dócil, sobresaliendo por su agilidad, lo que es característico de los animales Criollos. El toro es de mayor tamaño, presentando un cuerpo cilíndrico, con peso adulto entre 600 - 800 kg.

Los bovinos Criollos del Brasil generalmente presentan perfil rectilíneo o subconcauíneo; la cabeza es corta y la frente proporcional; en la nariz se pueden ver las mucosas, normalmente pigmentadas. Los ojos son vivos y el mirar dócil; las orejas cortas; los cuernos bien desarrollados, siendo dirigidos hacia los lados, al frente, hacia arriba y para atrás. La piel es gruesa y cubierta de pelos que varían de tonalidad, desde el blanco hasta el negro (Camargo, 1987).

El cuerpo es de tamaño mediano, espalda inclinada y poco musculosa. El tórax es un poco estrecho y no muy profundo, con costillas poco arqueadas, dirigidas hacia atrás, anca bien conformada; vientre levantado; esqueleto fuerte y masas musculares no muy desarrolladas, lo que es una consecuencia del medio y de la falta de selección; cola descarnada, saliente y adelantada.

4. RESULTADOS

Los resultados que siguen, fueron obtenidos en una hacienda de propiedad privada (Hacienda Canoas), localizada en el municipio de Ponte Alta, en la región sur del Estado de Santa Catarina - Brasil.

La hacienda Canoas está situada a 30° L. Sur, a aproximadamente 900 m sobre el nivel del mar. El clima de la región clasifícase segu Kopen, como sub-templado. Con respecto a los datos medios de temperatura y pluviometría, pueden ser visualizados en la Tabla 1.

El suelo es profundo, oscuro, arenoso y bien drenado, presentando un relieve ondulado. Presenta también acidez elevada (pH 4.5), alto contenido de aluminio intercambiable, bajo en materia orgánica y bajo en fósforo (Ritter & Sorrenson, 1985).

El pasto dominante en la referida hacienda es considerado de baja calidad, pues la gramínea dominante es *Andropogon lateralis incanus*, que presenta marcada estacionalidad, en cuanto al crecimiento y calida pasto, secándose durante el invierno (mayo a septiembre) y permaneciendo verde durante el verano (octubre a mayo).

4.1 Peso al nacer

El peso al nacer es económicamente importante debido a su relación con la dificultad de parto y el subsecuente desarrollo de los terneros. Con respecto a ese parámetro, pueden ser vistos algunos datos en la Tabla 2.

Con respecto al peso al nacer, los resultados presentados por Salazar (1976) para la raza bovina criolla colombiana, ellos son similares a aquellos que aparecen en la Tabla 2. Plase (1976), presenta datos de peso al nacer para el ganado Criollo de Venezuela de 25,9 y 24,9 kg, para machos y hembras, respectivamente. Ferrando (1984), examinando bovinos de raza Criolla en la Argentina obtuvo los siguientes pesos medios al nacer: 27,6; 28,7; 27,2 y 28,0, kg, para los años de nacimiento de 1978, 1979, 1981 y 1982, respectivamente. Resultados similares también fueron obtenidos por Camargo et al. (1988) con el ganado Criollo del Brasil.

4.2 Desarrollo de hembras predestete

Con respecto al crecimiento predestete de las terneras pueden ser vistos algunos resultados en la Tabla 3. Según los datos en la Tabla 3, verificase que dichos animales presentan un peso razonable al destete y una buena tasa de crecimiento diario, pues son criados de manera extensiva, sobre un suelo pobre y Scido, lo cual presenta una pastura natural de baja calidad, siendo la gramínea dominante el *Andropogon lateralis incanus*.

4.3 Peso de las vacas

Debido a la marcada estacionalidad de los pastos naturales de la Isieral Catarinense, ocurre una alternancia de ganancia y pérdida de peso de los animales en el transcurso del año. Resultados preliminares, relacionados a la ganancia y pérdida del peso de las vacas pueden ser observados en la Tabla 4.

Verificase, según los datos en la Tabla 4, que las vacas sin ternero al pie, pierden en promedio aproximadamente 11% de su peso vivo durante el periodo de invierno (mayo a septiembre), lo cual es admisible en nuestras condiciones. Según Rovira (1973), las vacas sin ternero al pie

pueden perder hasta 18 a 20% de su peso vivo durante el invierno sin causar daños al rebaño, siempre que, en la Primavera y verano esos animales sean mantenidos sobre buenos pastos, recuperando así el peso, en corto espacio de tiempo.

En cuanto a las vacas con ternero al pie, se verifica (Tabla 4), que esos animales se mantuvieron estables durante todo el año, debido al mal manejo, pues esas vacas deberían ganar peso durante el periodo en que estaban amamantando (octubre a mayo), época del año en que los pastos naturales de la región son de buena calidad.

Debido al mal manejo de las vacas paridas, el índice de repetición de cria (12 a 18%) es bajo, causando serios daños al criador.

5. CONCLUSIONES

Hasta el momento, se ha realizado poco esfuerzo en examinar sistemáticamente las razas Criollas en Brasil, lo cual aumenta el riesgo de perder este valioso recurso genético.

El ganado Criollo existente actualmente en el Brasil es originario de la fusión del ganado aquí introducido por los colonizadores portugueses y españoles.

Según los datos presentados, se concluye que el ganado Criollo presenta buena adaptación al medio, teniendo bien en cuenta la baja calidad de la pastura.

El bajo índice de natalidad (40-55% aproximadamente) es debido al manejo deficiente que es aportado a esos animales.

El ganado criollo es un ganado de precocidad media, bien adaptado a las condiciones de clima adverso, suelos pobres y cíclicos, produciendo reproduciéndose económicamente. Tiene además alta capacidad para transformar un pasto de baja calidad en carne y leche, alimentos de los cuales la nación brasileña es altamente deficitaria.

BIBLIOGRAFIA

- Camargo, A.H.A. 1987. Raza e/ou tipos de gado Crioulo do Brasil - Uma Revisão. (Em preparação).
- Camargo, A.H.A., Dias, C.T. dos S., Camargo, A.A. & Camargo, J.M.A. 1988. Efeito de touro sobre o peso ao nascer de terneiros da raga Crioula. Anais da XXV Reunião Anual da Sociedade Brasileira de Zootecnia. Vigosa - MG., p. 289 (Resumo).
- Ferrando, C.A. 1984. La raza Criolla en La Rioja: Algunos resultados preliminares. Primera Jornada Nacional de Ganado Bovino Criollo. Instalaciones: Sociedad Rural de JesiGs Maria, malabrigo; INTA, Octubre. 31-43.
- Garriz, C.A., Parodi, J., Garcia, P., Tardioli, M.G. de, Gambaruto, M., Artuso, C. & Sal Paz, A.R. de. 1982. Evaluación, de la aptitud carnicera en reses de novillos de raza Criolla: rendimientos en cortes comerciales, calidad de la carne y composición química del músculo y de la grasa. Rev. Técnica, INTA, 2 (2): 37-78.
- Inchausti, Di & Tagle, E.C. 1964. Bovinotecnia I. Librería El Ateneo; Editorial Buenos Aires, 4ª Ed. 556 pp.
- Neves, A. da S. 1918. Primeira conferencia nacional de pecuária. Secretaria da Agricultura, Comércio e obras Publicas do Estado de Sao Paulo - SP. 149 pp
- Plase, D. 1976. Cruzamiento de razas cebú, nativas y europeas en Venezuela y otros países de América Latina., Koger, M., Cunha, T.J. & Warnick, A.C. Cruzamientos en ganado vacuno de carne. Traducido por Inés Pardal. Editorial Hemisferio Sur, Montevideo, Uruguay. 559 pp.
- Ritter, W. & Sorrenson, W.J. 1985. Producción de bovinos no Planalto de Santa Catarina - Brasil. Situación Actual e Perspectivas. GTZ - EMPASC Eschborn. 172 pp.
- Rovira, J. 1973. Reproducción y manejo de los rodeos de cria. Editorial Hemisferio Sur, Montevideo, Uruguay. 293 pp.

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- Salazar, i.i. 1976. Efectos del cruzamiento de toros Brahman y Charolós con razas nativas de Colombia. Koger, M., Cunha, T.J. & Warnick, A.C. Cruzamientos en ganado vacuno de carne. Traducido por Inés Pardal. Editorial Hemisferio Sur, Montevideo, Uruguay; 559 pp.
- Salazar, J.J. & Cardozo, A. 1981. Desarrollo del ganado Criollo en América Latina: Resumen Histórico y Distribución Actual. Muller-Haye, B. & Gelman, J. Recursos genéticos animales en América Latina: ganado Criollo y especies de altura. FAO, Roma. 168 pp.
- Wilkins, i.V. 1984. Criollo cattle of the Ameritas. Animal Genetic Resources Information, FAO, Rome. 1: 1-19.

TABLA 1. Climatología del área geográfica donde se encuentra el referido rebaño de ganado Criollo.

	Meses											
	Ene.	Feb.	Mar.	Abr.	May.	Jun.	Jul.	Ago.	Sep.	Oct.	Nov.	Dic.
Temperaturas												
Máxima (°C)	26,6	26,3	24,8	21,6	19,0	17,2	17,1	18,5	19,3	21,1	23,4	25,6
Mínima (°C)	15,8	15,8	14,7	8,8	7,1	6,6	7,8	9,6	11,3	12,7	14,4	11,4
Precipitación												
Media (mm)	145	140	114	93	95	110	107	129	144	156	114	132

Fuente: RITTER & SORRENSON, 1985.

TABLA 2. Peso medio al nacer de bovinos de raza Criolla.

Año de nacimiento	Peso al nacer (kg)				Media
	Machos		Hembras		
1984	27,1	(19)*	27,5	(54)	27,3
1985	27,4	(59)	26,3	(52)	26,8
1986	28,8	(45)	26,9	(44)	27,8
1987	29,4	(41)	26,1	(67)	27,7
Media/Total	28,2 (164)		26,7 (217)		

* El número entre paréntesis refiérese al número de animales nacidos en los respectivos años.

TABLA 3. Peso al destete (208 días) y tasa de crecimiento predestete de terneras de raza Criolla.

Año de nacimiento	Total terneras	Peso al destete	Tasa de crecimiento (kg/an./ófa)
1984	24	160,8	0,650
1985	52	155,0	0,625
1986	44	160,5	0,604
1987	67	144,3	0,596

TABLA 4. Peso de vacas de raza Criolla, en condiciones de pastos naturales y manejo extensivo en diferentes épocas del año en la Sierra Catarinense - Brasil.

Categoría Animai	Fecha de las pesajes					
	02/04/85	03/09/85	25/04/86	09/09/86	29/04/87	08/10/87
	kg	kg	kg	kg	kg	kg
S/TP*	463,2 (71)	406,1 (60)	467,7 (37)	407,8 (89)	460,3 (77)	411,3 (27)
C/TP	427,5 (39)	392,4 (42)	392,1 (81)	402,3 (19)	397,0 (54)	381,2 (37)
Medias/ Total	445,3 (110)	399,2 (102)	429,9 (118)	405,0 (108)	428,6 (131)	396,2 (64)

* S/TP - Vacas sin ternero al pie. C/TP - Vacas con ternero al pie.

** El número entre paréntesis refiérese al número de animales que fueron pesados en las respectivas fechas.



Toro Criollo, sobre campo nativo en período de invierno. Municipio de Ponte Alta, Estado de Santa Catarina - Brasil.



Vaca Criolla característica. Hacienda Canoas, Ponte Alta, Santa Catarina - Brasil.

CREATION OF CONSERVATION AREAS FOR HU SHEEP IN JIANGSU PROVINCE

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SUMMARY

A conservation area in Jiangsu Province, China, has been established for the conservation of the Hu sheep, famous for its early sexual maturity and high reproductive rate as well as its beautifully patterned white-wool coat. Local farmers well experienced in raising these sheep are responsible for pure breeding under the control of administrative and technical units which have been specially created for this purpose. The conservation area is in the main orange and loquat-growing district of the Province. Manure is used to fertilize the trees and together with the production of meat from culled sheep and the sale of lambskins, the enterprise is economically viable.

1. INTRODUCTION

The Hu sheep, a world renowned multiple-pregnancy sheep breed, originates from the Taihu (Tai Lake) District in China. It is characterized by early sexual maturity, high reproductive rates, the ability to breed throughout the year and to give birth twice a year with two lambs per lambing. It is known for its rapid growth, good tolerance of high temperatures and humidity and adaptability to indoor feeding all year round. In addition, it produces a particular white-wool lambskin with a beautiful woven pattern, suitable as raw material for luxury clothing. The Hu sheep, which represents a valuable genetic resource among Chinese animal breeds, is in danger of disappearing. The number of purebred Hu sheep in its original breeding area has been greatly reduced owing to the unplanned introduction of fine-wool and semi-fine-wool sheep for crossbreeding with the aim of economic benefit. To preserve this valuable genetic resource, conservation areas for Hu sheep in Dongsan Township in Wu County, Jiangsu Province, have been set up by the Provincial Agriculture and Forestry Department with the support of the Federal ministry of Agriculture, Animal Husbandry and Fisheries. This article describes progress achieved since 1983 when these conservation areas were established.

2. CONSERVATION METHODS AND MEASURES OF HU SHEEP IN THE REGION

Present methods of animal and poultry genetic conservation are focused often upon maintaining frozen semen and embryos in cryogenic stores. In view of the technology required and maintenance costs in China, conservation areas for live Hu sheep have been selected in the original breeding area. Based on the farmers' long experience in managing Hu sheep, individual families are responsible for raising the sheep according to established management methods under authorized control. The breeding of Hu sheep is combined with fruit production and the farmers receive a small allowance. They also earn income from the sale of lambskins and manure which is used to fertilize fruit trees. This combination of animal breeding and fruit production has, in practice, proved valuable both in breed maintenance and economic viability.

The conservation region is divided into two areas, the central and the buffer zone. For strict conservation purposes, 50 rams and 150 ewes are purebred in the central area while the buffer area is utilized mainly for feeding and managing the sheep, and avoiding the introduction of foreign sheep. In total, there are presently over 10 000 Hu sheep in the whole region. Although the Government invests annually about 10 000 yuan for sheep breeding (an average of one yuan

per sheep), the economic return far exceeds this investment owing to the successful combination of sheep raising and orange growing.

3. MANAGEMENT OF HU SHEEP IN THE CONSERVATION REGION

3.1 Special administrative and technical units have been created and they are active in establishing regulations and plans, and in providing technical training and extension to the farmers. In addition, two managers are responsible for supervising the day-to-day work in sheep breeding.

3.2 A special conservation law has been promulgated for the region. It was published by the People's Government of Wu County in 1984 and states: (1) Dongsan Township in the county is designated as the conservation region for Hu sheep in Jiangsu Province; and (2) the introduction by any unit or person of any other breed of sheep into the region is prohibited.

3.3 A contract for sheep raising has been signed by the administrative unit in the conservation region and the tasks, responsibilities, rights and benefits of the farmers are taken into account as follows: (a) the farmers must follow the standards for raising Hu sheep formulated by the administrative unit, e.g., marking sheep, grouping, completing records and breeding according to the central mating plan; (b) the sheep cannot be sold, exchanged or slaughtered without the permission of the administrative unit otherwise the farmers must reimburse the cost incurred; (c) when a sheep has to be culled, there must be a reserve sheep available and culled sheep are owned by the farmers; and (d) the farmers will receive an annual allowance from the authorities.

3.4 A reference system has been established to keep individual records on sex, age, physical condition and appearance, origin and performance, as well as on the identity of rams or ewes used in breeding to permit correct identification of progeny. Records and data are checked regularly and analysed to improve the future planning of sheep breeding.

4. TECHNICAL MEASURES FOR SHEEP PRODUCTION

4.1 Choice of conservation region

4.1.1 The geographical position of the region, a peninsula surrounded by Tai Lake to the east, west and south, has the advantage of isolating the breed and thus prevents crossbreeding.

4.1.2 The region is the major fruit-growing area of oranges and loquats in Jiangsu Province. Conservation of the sheep benefits fruit growing through the supply of manure as fertilizer, which is also economically beneficial to sheep production.

4.1.3 There is a well-qualified sheep flock in the area. Plenty of grass and fruit-tree leaves are available for feeding.

4.1.4 Farmers have historically raised sheep on their own and have always exported rather than imported sheep to the region.

4.2 Number of sheep required

According to some theoretical calculations, the minimum numbers of sheep required for preservation purposes are 12-25 rams and 100-250 ewes. However, it is not practical to maintain these small numbers in the long term as some artificial or natural factors can adversely affect breeding. A better alternative is to extend the conservation area through an enlarged flock in order to avoid any breakdown of the breed when changes in animal numbers due to management, occur within the conservation region. There are presently 10 000 sheep in an area of approximately 13 330 hectares in Dongsan Township. In this manner, when the flock population size is changed, it could be supplemented with sheep from the buffer area. This system would clearly be more reliable and effective as the actual population in the central area could thus maintain a low inbreeding coefficient as supplements would be made from the buffer area.

4.3 System of breed selection and breeding

Breed selection is based on the method of keeping a son from a ram and a daughter from a ewe. when multiple offspring are available for selection, the guiding principle is to keep the best lambs and to cull the rest. Individual lambs should be selected on the basis of the quality of their lambskin, their reproductive rate, physical development and the extent to which they manifest the true characteristics of the pure breed in physical shape and appearance. Similarly, those sheep with the poorest performance in terms of these criteria are culled. This method of selection not only conserves the main characters of the sheep but also continuously improves them. For breeding, ewes are divided into groups of equal number and rams are randomly mated with the same number of ewes in the groups, to avoid inbreeding and maintain a long-term balance of genes and gene frequency. In order to prevent inbreeding of sheep kept by the same farmer, breeding rams raised by one family are exchanged with rams raised by another, before weaning, with the help of the administrative unit. Differences in live weight are economically compensated. All rams not used for breeding purposes are castrated.

4.4 Maintenance of relatively stable ecological conditions in the region

From an overall ecological point of view, the prosperity of the human population depends on balanced environmental conditions for both humans and sheep. Variations in sheep numbers might occur unless the environment required by the breed is maintained. It is, therefore, essential that the integrated system of agriculture-forestry-animal husbandry in the native habitat of Hu sheep be maintained and that the feed required by the sheep for their growth and development be regularly supplied, sufficient both in quantity and quality. In conclusion, the conservation of the Hu sheep breed will lead gradually to the improved ecological conservation of the whole region.



HU SHEEP. These animals are kept indoors in orange orchard districts. A typical stable is also shown.

INTERSPECIFIC HYBRIDIZATION OF THE CYPRUS MOUFLON (AGRINON) WITH DOMESTIC SHEEP

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SUMMARY

All interspecific hybrids, both male and female, resulting from crosses between the wild sheep of Cyprus (known locally as Agrinon) and domesticated sheep breeds (*Ovis aries*), Cyprus Fat-tailed (CFT), Chios and Awassi, were found to be fertile. The chromosome complement of both species and of the hybrids was $2n=54$. The survival rate of hybrid lambs up to 105 days of age increased with a higher percentage of domesticated sheep inheritance. F2 hybrids had the lowest survival rate.

The birth weight of F1 and first backcross to domestic sheep (B₁) lambs was higher than that of F2 and F1 x B₁ lambs, but much lower than that of domesticated sheep.

Most of the evidence available suggests that the wild sheep of Cyprus originates from either the European (*ovis musimon*) or the Asiatic' (*Ovis orientalis*) mouflon.

1. INTRODUCTION

Rupicaprids (goat-antelopes) are most likely the ancestors of modern breeds of sheep and goats (Herre and Rohrs, 1955; Thenius and Hofet, 1960; and Geist, 1971), although *Ammotragus lervia* has also been suggested (Geist, 1971) as the living representative of this sheep-goat ancestor.

On the basis of chromosome number, the genus *ovis* has been divided into four cytogenetic groups: $2n=52$ (*O. nivicola*); $2n=54$ (*O. aries*, *O. canadensis*, *O. dalli*, *O. musimon*, and *O. orientalis*); $2n=56$ (*O. ammon*); and $2n=58$ (*O. vignei*) Schmitt and Ulbrich 1968; Wurster and Benirschke, 1968; Nadler, 1971; Nadler, Lay and Hassinger, 1971; and Korobitsyna et al., 1974). All members of the genus *Capra* have $2n=60$ chromosomes (Wurster and Benirschke, 1968).

The wild sheep of Cyprus (known locally as Agrinon) is a rather small animal. The male (approximately 45 kg) possesses large spiral horns, while the female (approximately 30 kg) is usually polled. The coat is short, hair-like and reddish-brown in colour. The ears are small and erect and the tail is very short (approximately 50 mm long) and thin. Domestication of this wild sheep is extremely difficult, because it fails to adapt to confined conditions. Even when accustomed to seeing people on a daily basis, it reacts violently to the slightest disturbance.

Two questions were considered: firstly, whether Agrinon could successfully hybridize with domesticated sheep and produce viable and fertile offspring and, secondly, whether the chromosomal maps of domesticated and wild local sheep could be used to classify Agrinon.

¹The authors wish to acknowledge the kind cooperation of the Director of the Public Garden of Limassol and of Dr. G. Papadopoulos, the Department of Veterinary Services.

2. MATERIALS AND METHODS

To obtain interspecific (F₁) hybrids, ewes of three breeds of sheep (namely, Chios, Awassi and CyprusL Fat—tailed) in oestrus were transported from the experimental farm at Athalassa, to the Zoological Garden of Limassol (85 km distant), where a small flock of wild sheep is kept. Semen was collected from two males and was used (undiluted) to inseminate the ewes, which were then transported back to the experimental farm on the same day. All inseminated ewes were kept together and were surveyed for oestrus for at least 21 days following insemination.

Ewes not exhibiting oestrus symptoms during this period were considered pregnant and were fed and managed together with other sheep in a similar production phase.

Sterile blood samples (4.5 ml) were obtained from the jugular vein and were mixed with Vetren (0.5 ml) in a syringe. Many precautions were taken for the safe and timely transfer of the samples from Cyprus to Frankfurt airport (Federal Republic of Germany) within 24 hours. The samples were processed at the laboratories of the Justus-Liebig University at Giessen by the Veterinamedizinische Genetic and Cytogenic working team. Chromosome preparations were established from 72-hour leucocyte cultures and chromosome numbers (2n) were determined by microscopical examination of several intact metaphase spreads from domestic sheep, wild sheep and hybrids (see Table 1).

Field data on the survival rate, birth weight, growth rate and fertility of F₁, F₂ and various backcrosses (see Table 2) were collected from 1977 to 1982.

3. RESULTS AND DISCUSSION

A total of 112 ewes of various breeds of sheep were inseminated with fresh semen from wild sheep (Agrinon) from 1977/78 to 1980/81. Only 26 percent of these ewes conceived in terminated pregnancy, producing 34 live and six dead F lambs (see Table 1). The low conception rate can probably be attributed to the effects of stress suffered during the transportation of the ewes before and after insemination. The conception rate of crossbred females mated with rams or crossbred F₁ males on the farm was much higher (100 and 91 percent, respectively).

All hybrids, both male and female, were fertile. Hybrid ewes were more precocious than wild sheep, but only moderately so considering the precocity of Chios sheep (13-month mean age at first lambing). F ewes produced their first litter at the age of 21.2 mo (those lambing in 1981 at 15.2 mo).

F₁ x S and F₁ x (F₁ x S) crossbreds were more precocious (lambing at 16.3 and 14.3 months, respectively). Similar findings have been reported by Bunch and Foote (1977) for Argali-mouflon hybrids.

The prolificacy of Agrinon x sheep (A x S) and F₁ x S matings, represents actually the prolificacy of domesticated sheep, and in the first case, the average of one prolific (Chios) and two non-prolific (Awassi and CFT) breeds. From the F₂ and F₁ x (F₁ x S) matings it is clear that prolificacy has improved, reaching an intermediate value between the Chios and wild sheep. Improvement in the prolificacy of hybrids has also been reported by Bunch and Foote (1977). The survival rate of hybrid lambs up to 105 days of age increased with a higher percentage of domesticated sheep inheritance (see Table 1). However, F₂ lambs had a very low survival rate (26.3 percent).

The birth weights of lambs of different inheritance are presented in Table 2. Singles were always heavier than twins and males were heavier than females, regardless of inheritance. F₁ and B₁ (first backcross to sheep) lambs were heavier than F₁ and F₁ x B₁ lambs at birth. Hair colour was more or less uniform in F₁ lambs resembling the coat colour of wild sheep. The tail was thin and much shorter than that of sheep. The colour pattern of F₁, B₁ and F₁ x B₁ lambs was variable, ranging from greyish-white to black. Other similarities between F₁ hybrids and the wild sheep were their long legs and great agility. An interesting feature of the hybrids was their calm constitution before weaning, and their reversal to wildness after weaning.

The karyotypes of most cells with metaphase chromosomes showed a chromosome complement of $2n=54$ (see Figures 1 to 4). There was, however, a number of cells with $2n=53$ chromosomes (see Table 3). The chromosome count of both domesticated breeds showed only a $2n=54$ chromosome complement. There is prior cytogenetic evidence (Nadler *et al.*, 1973; and Bunch and Foote, 1976) that strongly suggests the European (*O. musimon*) or the Asiatic (*O. orientalis*) mouflon ($2n=54$) is the most likely progenitor of domestic sheep. However, Bunch and Foote (1977) reported a $2n=56$ chromosome complement of the cross between the Urial and Chios domestic sheep. When Chios sheep were crossed with the wild sheep of Cyprus most hybrids possessed $2n=54$ chromosomes, but never more.

As both the purebreds and hybrids in this study possessed either $2n=54$ or $2n=53$ chromosomes, the possibility of the wild sheep of Cyprus originating from *ovis ammon* should be excluded. Most of the evidence available tends to suggest that the wild sheep of Cyprus originates from either the European (*O. musimon*) or, more probably so, the Asiatic (*O. orientalis*) mouflon.

The presence of karyotypes with $2n=53$ chromosomes cannot be explained adequately on the basis of the karyotypes obtained from all purebreds. A possible explanation might be an impairment during the mapping process, but not owing to deletions or translocations (see Figures I to 4).

TABLE 1
REPRODUCTIVE PERFORMANCE OF HYBRID EWES

Mating design ¹	Number mated	Number lambed	Conception rate	No. of lambs at birth		105 days
				live	dead	
A x S (F ₁)	112	29	25.9	34	6	24
F ₁ x S	56	37	66.1	57	2	49
F ₂	14	14	100.0	15	4	5
F ₁ x (F ₁ x S)	1	10	90.9	14	0	13

¹ A = wild sheep and S = domesticated sheep. The first letter of the mating design indicates the male.

TABLE 2
LIVE WEIGHT OF HYBRID LAMBS AT BIRTH

Class	Lamb inheritance ¹			
	F ₁	F ₂	F ₁ xS	F ₁ x(F ₁ xS)
Males	3.9(18)	3.7(12)	4.1(23)	3.6(9)
Females	3.7(19)	2.8 (6)	3.7(33)	3.6(5)
singles	4.2(21)	3.4(12)	4.4(17)	3.9(6)
Twins	3.4(16)	3.3 (6)	3.6(39)	3.4(8)

¹ A = wild sheep; and S domesticated sheep. Numbers in parentheses indicate number of observations.

TABLE 3

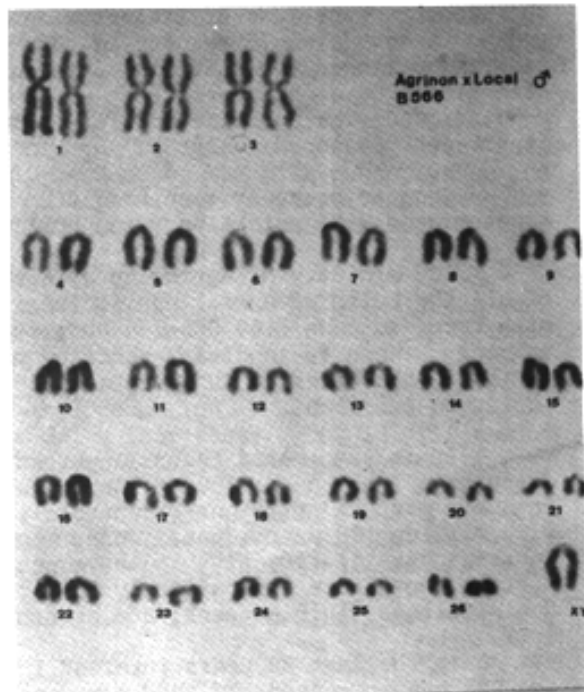
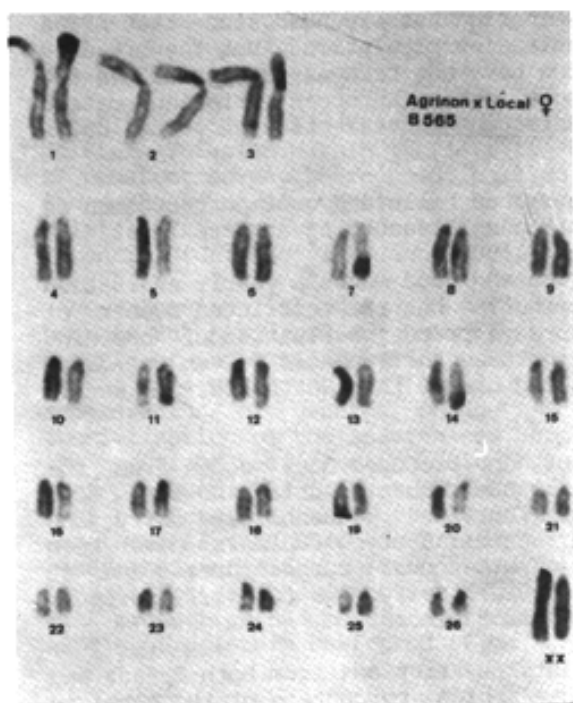
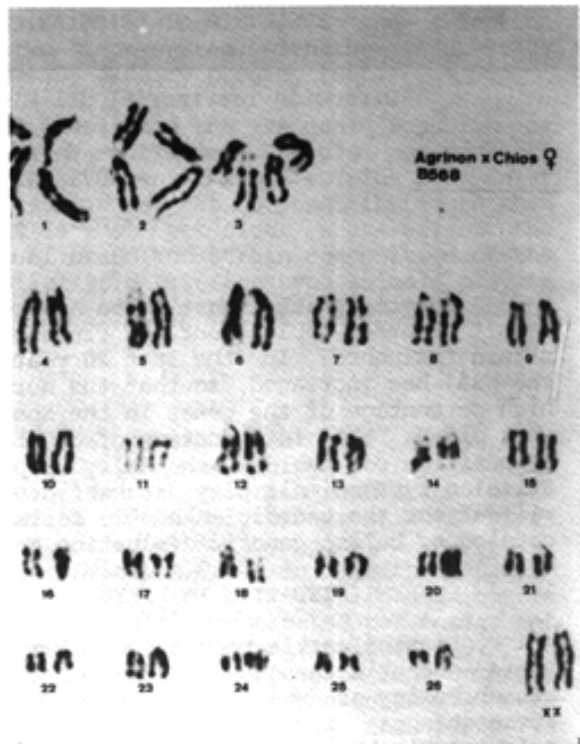
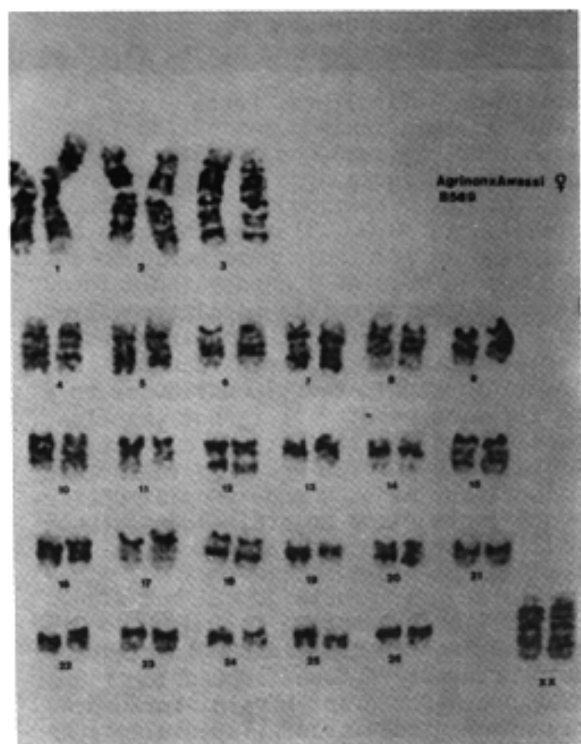
BLOOD CULUM MMER, MMER OF CELLS WITH METAPHASE CHROMOSOMES AND CHROMOSOME NUMBER (2n) OF WILD AND DOMESTICATED SHEEP

Species	Breed	Sex culture number	blood with metaphase chromosome	Number of cells	2n chromosome number
ovis aries	Chios	0	590	3	54,XY
	CFT ¹	0	589	7	54,XY
				"	2
ovis orientalis (A)		0	658	10	54,XY
		0	657	9	54,XX
Hybrids	A x CFT	0	592	3	54,XY
			"	2	53,XY
		0	566	4	54,XY
		0	565	7	54,XX
A x Chios		0	953	4	54,XY
			"	1	53,XY
		0	568	3	54,xx
A x Awassi		0	569	6	54,Xx
			"	1	53,Xx

¹ CFT - Cyprus Fat-tailed.

REFERENCES

- Bunch, T.D. and Foote, W.C. Chromosomes, haemoglobins and transferring of 1976. Iranian domestic sheep. *Journal of Heredity*. 67: 167-170.
- Bunch, T.D. and Foote, W.C. Evolution of the 2n=54 caryotype of domestic 1977. sheep. *Am. Genet. Sel. Anim.* 9: 509-515.
- Geist, V. Mountain sheep: a study in behaviour and evolution University of 1971. Chicago Press, Chicago/London.
- Herre, W. and Rohrs, M. Uber die Formerunannigfaltigkeit des Gehorns der Caprini 1955. (Simpson, 1945). *Der zoologische Garten, N.F.* 22: 85-110.
- Korobitsyna, K.V., Nadler, C.F., Vorontsov, N.N. and Hoffmann, R.S. chromosomes 1974. of the Siberian snow sheep, *ovis nivicola*, and implications concerning the origin of Amphiberingiin-wi s eep (subgenus *Pachyceros*). *Quarterly lies*. 4: 235-345.
- Nadler, C.F. Chromosomes of the dall sheep, *ovis dalli* (Nelson). 1971. *J. Mammal.* 51: 461-463.
- Nadler, C.F., Lay, D.M. and Hassinger, J.D. Cytogenetic analysis of wild sheep 1971. populations in Northern Iran. *Cytogenetics* 10: 137-152.
- Nadler, C.F., Hoffmann, R.S. and Woolf, A. G-band patterns as chromosomal 1973. markers and the interpretation of chromosomal evolution in wild sheep (*ovis*). *Experientia* 29: 117-119.
- Schmitt, J. and Ulbrich, F. Die Chromosomen Verschiedener Caprini. 1968. Simpson, 1945. *Z. Saugtierk.* 33: 180-186.
- Thenius, E. and Hofer, H. Stammesgeschichte der Sangetiere. Springer Verlag, 1960. Berlin/Heidelberg/New York.
- Wurster, D.H. and Benirscheke, K. Chromosome studies in the superfamily 1968. *Bovoidae. Chromosoma* 25: 152-171.



Figures 1 - 4 show caryotypes of crosses.

EVOLUTION OF FRIESIAN CATTLE POPULATIONS IN SPAIN

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SUMMARY

Genetic changes have taken place in the Spanish cattle population as a result of breed replacement and crossbreeding as well as from Holstein-Friesian strain influence. In the last 20 years interest in the Holstein (Canada, and the USA) has increased, so that the North American strain today contributes to a high percentage of the genes in the Spanish Friesian herd. It is not yet clear what effect the introduction of quotas will have on the breed and strain composition of the Spanish dairy population, but in view of the role that Friesian type animals play in beef production, any major change in milk price will affect the genetic make-up. Estimated percentages of Holstein genes (bull catalogue, bulls, genetic evaluation and utilized semen doses) are given.

1. CURRENT SITUATION IN SPAIN

Spanish cattle populations have been changing steadily in the last twenty years. Genetic changes are taking place as a result of breed replacement and crossbreeding as well as from imported Holstein-Friesian strain influence. These changes originate in economic and technological trends, specially the relationship between milk and barley prices during the 1970s and continuing to the present. The use of artificial insemination has expanded since the 1960s and now covers over 75 percent of the Friesian cow population. But the breeding programmes linked to artificial insemination have not been as successful as the selection programmes operating within some other European Friesian cattle populations. The annual round of progeny testing and selection of young bulls is not yet developed fully.

Genetic progress resulting from the use of bulls and/or imported semen is supplemented with selection among bull dams by milk recording at farm level.

The Ministry of Agriculture, Fisheries and Food makes a yearly evaluation of all the bulls used for artificial insemination but the restricted number of milk-recorded cows (60 000-70 000) prevents a proper evaluation of breeding values. There is a clear tendency to increase the emphasis given to dairy traits in the Friesian European strain, making use of the North American strain (Holstein-Friesian).

It is estimated that 71 percent of home-produced beef comes from the dairy herd. At the census in September 1985 the number of dairy and beef cows in Spain was 2.7 million, of which 1.9 million (70.4 percent) were dairy and 0.8 million (29.6 percent) were beef. Friesian type animals have been increasing until recently at the expense of other dual purpose breeds and at present constitute approximately 70 percent of all dairy cows (Swiss, 9 percent; Rubia Gallega, 10.5 percent; and crossbreeds 10.5 percent).

In the last 20 years interest in Holsteins-Friesians from both Canada and the USA has increased and they now contribute a high percentage of the genes in the Spanish Friesian population (Calcedo, 1986).

Although crossing with beef bulls is increasing in Spain, the selection of dairy cattle theoretically involves a two-stage system, with the first stage being based on a performance test, followed by a dairy progeny test.

Unlike the Netherlands (Kuipers, 1984) and the Federal Republic of Germany (Niebel and Fewson, 1985) Spain, for the moment, should not seek to change breeding objectives in view of the current market surplus of dairy products in EEC countries. Spain has no surpluses, has not contributed to them and supplies itself. Nevertheless, it is not yet clear what effect the introduction of quotas will have in terms of breed and strain composition of the Spanish dairy herd. In view of the essential role Friesian type animals play in beef production, any major change will have a significant effect on the amount of beef produced from the dairy herd.

2. HOLSTEIN PENETRATION

With the effect of technological developments since 1966, cheap feed prices during the 1970s and the 1980s and the encouraging policy of the government over the past 12 years or so, the Spanish Friesian population began to exploit the higher worth of milk production of the Holstein-Friesian strain.

An indication of the influence of the Holstein-Friesian into the Spanish population is obtained from assessing the demand for artificial insemination (imported bulls or semen doses). Table 1 shows the estimated percentage of Holstein genes in the bull catalogue of the Ministry of Agriculture (1973 to 1985); a change is evident, since Holstein genes now are 78.15 percent compared with 55.15 in 1973. Table 2 gives the same percentage in the bulls, genetic evaluation (1977 to 1985); the rise to 70 percent during the 1980s is significant. Table 3 shows the estimated percentage according to the number of semen doses produced by each bull in recent years (1979 to 1983); between 50 and 70 percent of Holstein-Friesian blood has been introduced each year within the Friesian population.

The Spanish Friesian population will be close to 100 percent Holstein-Friesian within 15 years if the present tendency continues. The rate of penetration may be reduced, particularly because of the milk quota system and the emphasis on compositional quality, in addition to the negative effects of Holstein-Friesian use on beef output as a consequence of its inferior beefing potential (Calcedo, 1980 and 1986).

Spanish field data show the difference of 800-1 300 kg of milk per cow between European and North American Friesian strains. Spain is also a good example of the extensive effects of galloping, strain substitution, in the same way as some EEC countries (Cunningham, 1985), and demonstrates the same rate of acceleration of genetic change in milk production. Consequently, the specialization of the Spanish cow herd for dairy increases; but it will reduce the amount of beef from the dairy herd by a decrease in head and the quality of beef produced. At present, the surplus Holstein and crossbred calves reared for beef production in the Torrelavega cattle market fetch between 6 000 and 8 000 pesetas less than European Friesian (including British Friesian). On the other hand, the inferior beef conformation of Holstein-Friesian animals is very important since the price is related to carcass classification. Nevertheless, milk production has been so attractive that the farmers have till now thought little of Holstein beef production.

3. MILK QUOTA PROBLEMS

Spain has recently become a member of the EEC. The question of milk quota arrangements is important.

The result of penetration of Holstein-Friesian genes has been to increase milk yield together with fat and protein yield, but there are other aspects to be taken into account. The negative effects of Holstein-Friesian use on beef output have been mentioned above. This strain is also less efficient in terms of gain per kg- and has poorer saleable meat yields than the Friesian (Swanson and Steane, 1985). The reflection of differences in beef value and in the value of calves produced within northern areas (Cornisa Cant&brica) could have greater influence on small-scale farmers, response under a quota system, where increasing milk'outputs is difficult. (Steane and Swanson, 1985).

On the other hand, 50 percent of the cows, with 50 percent of the Spanish milk yield, are in the north (Cornisa Cant&brica). There, it is possible to produce more cheaply on grasslands, without much concentrated feed. To limit the cost of milk production by restricting the feed bought off farm, the present-day Friesian type (with Holstein blood) or F 1 crossbred are more suitable than pure Holstein-Friesian.

Finally, there has been a change in the relationship between beef and dairy insemination in the dairy herd. The level of beef insemination has gone up during recent years (Charolais, Limusin, Asturiana, Pirenaica and Rubia Gallega are the bulls breeds). For instance, this level has changed to 15 percent for 1985 in the autonomous community of Cantabria yet it was insignificant 5 years ago.

TABLE 1

ESTIMATED PERCENTAGE OF HOLSTEIN-FRIESIAN GENES IN MINISTRY¹ FRIESIAN HOLSTEIN BULL STUDS (1977 to 1985)

A.I. year	Mean percentage of Holstein genes
1973	55.15
1977	55.15
1980	70.55
1982	58.70
1985	78.15

¹ Ministry of Agriculture, Fisheries and Food.

Source: Calcedo, 1982 and 1984 and Calcedo, 1986, unpublished data.

TABLE 2

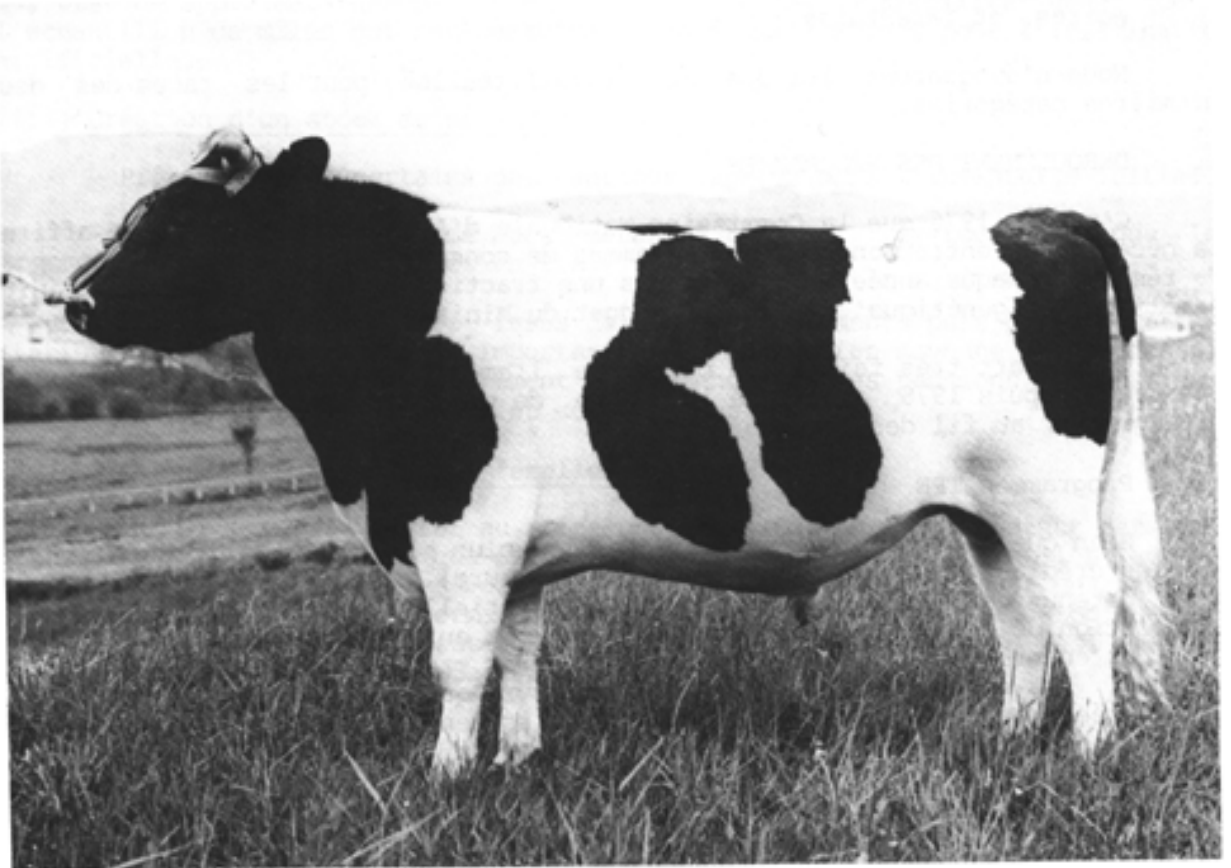
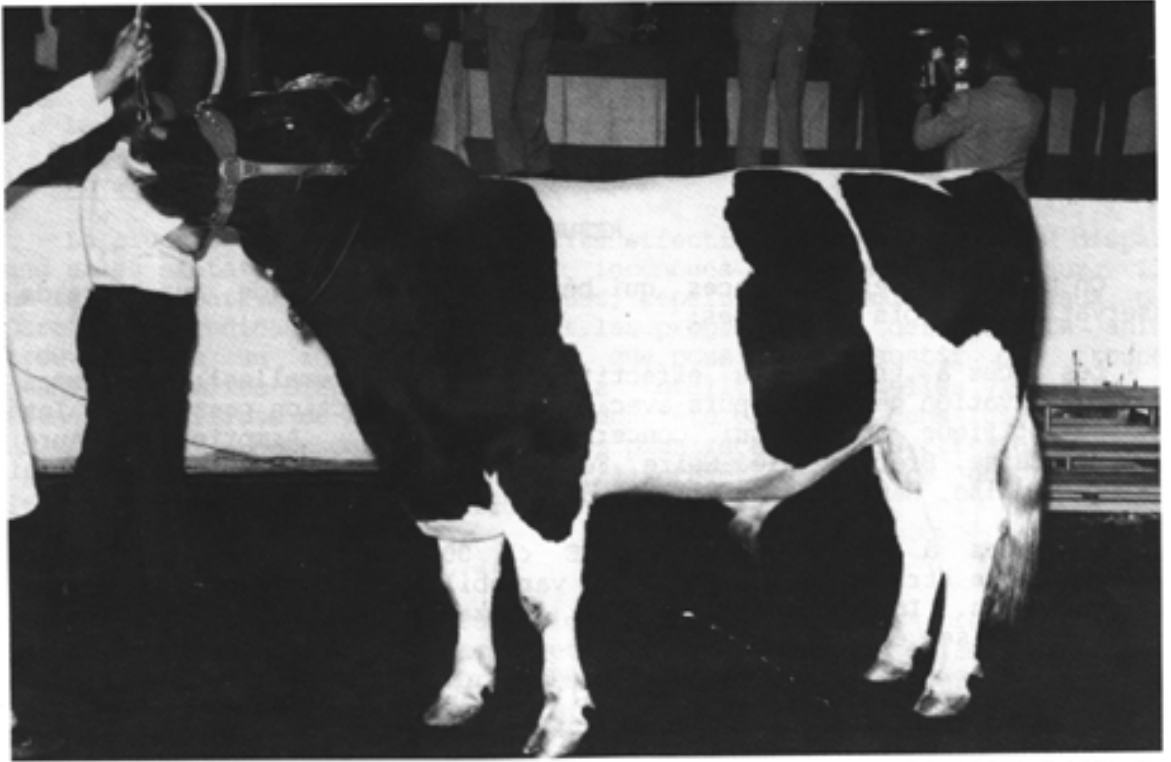
ESTIMATED PERCENTAGE OF HOLSTEIN-FRIESIM GENES IN MINISTRY¹ FRIESIAN-HOLSTEIN BULLS' GENETIC EVALUATION(1977 to 1985)

	A.I. year	Mean percentage of Holstein genes
	1977	53.75
	1978	66.65
Genetic evaluation	1979	63.65
for milk production	1980	70.20
	1,983	70.20
	1985	66.35
	1986	65.95
Genetic evaluation I	1984	75.15
for conformation ² II	1985	73.00

¹ Ministry of Agriculture, Fisheries and Food.

² Ministry of Agriculture, Fisheries and Food and National Friesian Association of Spain (ANFE).

Source: Calcedo, 1982 and 1984 and Calcedo, 1986, unpublished data.



Typical Friesian cow and bull in Spain at present time.

TABLE 3

ESTIMATED PERCENTAGE OF HOLSTEIN-FRIESIAN GENES ACCORDING TO THE NUMBER OF FROZEN SEMEN DOSES BY EACH BULL (1979 to 1983)

A.I. year	Mean percentage of Holstein genes
1979	60.2
1981	67.1
1982	49.2
1983	53.4

Source: Calcedo, 1982 and 1984 and Calcedo, 1986, unpublished data.

REFERENCES

- Calcedo Ordóñez, V. 1980. sobre las estirpes de ganado Frison. Aproximación a una síntesis crítica de situación. Comunicaciones INIA, Producción Animal No. 6, 44 pp. Instituto Nacional de Investigaciones Agrarias. Madrid.
- Calcedo Ordóñez, V. 1982. La estirpe Holstein en España: Aproximación al conocimiento del Frisón americano. Anales del INIA, Serie Ganadera, 17, 33-39.
- Calcedo Ordóñez, V. 1984. Nueva información sobre la incidencia de la estirpe Holstein en la población vacuna española. AYMA, XXV, (3) 217-227.
- Calcedo Ordóñez, V. 1986. Valoración de razas y estirpes de vacuno lechero. ITEA, 64, 3-19.
- Cunningham, E.P. 1985. Recent genetic evolution of EEC cattle populations. Paper presented at Seminar on 'Breeding strategies to optimize beef and milk production from EEC dairy and dual purpose populations', held in Brussels, 4 and 5 June 1985.
- Kuipers, A. 1984. Animal breeding strategies and farm adjustment under surplus milk conditions. 35th Annual Meeting 'of the EAAP, The Hague, 6 to 9 August 1984.
- Niebel, E. and Fewson, D. 1985. Consequences of milk quotas for the breeding goals. a) Improving milk and beef production potential within the purebred dual purpose cattle population. Polic. 10 pp.
- Steane, D.E. and Swanson, G.J.T. 1985. Consequences of milk quotas for breeding goals: Improving milk and beef production in the dairy beef crossing systems in the UK. Paper presented at seminar on 'Breeding strategies to optimize beef and milk production from EEC dairy and dual purpose populations', held in Brussels, 4 and 5 June 1985.
- Swanson, G.J.T. and Steane, D.E. 1985. Selection strategies for milk and beef production in dairy beef crossing systems. Current UK situation. Paper presented at seminar on 'Breeding strategies to optimize beef and milk production from EEC dairy and dual purpose populations', held in Brussels, 4 and 5 June 1985.

CONSERVATION DES RESSOURCES GENETIQUES BOVINES

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RESUME

On peut classer les races qui bénéficient d'une aide au titre de la conservation en trois catégories:

- Les races à très petits effectifs (TPE <1 000 femelles): programmes de conservation génétique purs avec très peu de sélection possible. Intérêt scientifique en ce qui concerne dix races: Américaine, Auroise, Bretonne, Bretonne Pie Noire, Ferrandaise, Froment du Léon, Lourdaise, mirandaise, Nantaise, et Villard de Lans.
- Les races à petits effectifs (PE <1 000 <10 000 femelles): gestion intensive stricte (maintien de la variabilité) et pression de sélection possibles. Intérêt agricole local: Bazadaise, Bleue du Nord, Flamande, Parthenaise, et Vosgienne.
- Les races régionales (>10 000 femelles): programmes de relance. Pression de sélection maintenue mais avec quelques aménagements dans les programmes techniques. Aides importantes: Abondance, Aubrac, Gasconne à Moutons Noires, et Tarentaise.

Nous n'évoquerons ici que le travail réalisé pour les races des deux premières catégories.

1. DEROULEMENT DES PROGRAMMES

C'est en 1976 que la Commission Nationale d'Amélioration Génétique affirma la nécessité d'entreprendre des programmes de conservation génétique et proposa de réserver chaque année à ces actions une fraction (0.5 pourcent) des crédits, 'amélioration génétique' (44.50) du budget du Ministère de l'Agriculture.

Cette part très faible du budget de l'amélioration génétique n'a jamais été revue depuis 1976 alors que le nombre de programmes et d'actions n'a fait qu'augmenter au fil des ans.

A. PROGRAMMES TPE

Bien que modestes les financements les plus solides et les plus sûrs ont été les crédits 44.50 (Ministère de l'Agriculture). Dans certains cas il a pu être obtenu des crédits régionaux, essentiellement des crédits FIDAR. L'obtention de ces crédits régionaux n'est pas automatique et des programmes n'en ont encore jamais bénéficié. De plus ces crédits n'ont pas de caractère pérenne. Ils sont affectés à un maître d'œuvre qui est une Organisation locale intéressée à ces actions (Association, Etablissement Départemental de l'Elevage, Parc Régional, ou Chambre d'Agriculture). Le maître d'œuvre s'occupe de la gestion financière et de l'animation. La Section Amélioration Génétique de l'Institut Technique de l'Elevage Bovin (ITEB) assure l'essentiel des actions techniques et le suivi méthodologique. Il est important qu'une autorité neutre intervienne dans des races où l'ensemble des animaux doivent être comus et suivis et où l'absence de contrôle de performance officiel, l'impact possible de quelques éleveurs dominants pourraient amener très facilement les programmes dévier de leur but initial.

La mise en place de ces programmes s'est faite par étape:

- Inventaire des races à conserver

La plupart des races à très petits effectifs étaient supposées disparues quand elles n'étaient pas complètement inconnues des techniciens locaux. Il a donc fallu, à partir d'indications vagues, repérer les premiers troupeaux, puis, à partir des indications fournies par les propriétaires des premiers animaux retrouvés faire un inventaire autant que possible exhaustif des troupeaux restants, des mâles disponibles et de la totalité des femelles vivantes. Des dizaines de milliers

de kilomètres ont donc été parcourus dans les régions les plus variées et jusque dans les coins les plus reculés. Le critère de choix de la race a été son existence même car il n'est relatif qu'à la période considérée.

(ii) Inventaire des animaux

L'existence de taureaux conditionne le démarrage des programmes. Fort heureusement, dans toutes les races retrouvées des taureaux existaient bien que, dans la plupart des cas en nombre très réduit (en race Lourdaise il n'y avait plus qu'un seul taureau). Le décompte des souches réelles initiées étant fait il fallait aussi repérer les vaches susceptibles de recréer d'autres mâles de qualité en apportant de par leur origine de la variabilité génétique à l'échantillon de mâles qui sera ensuite proposé aux éleveurs pour l'insémination artificielle.

(iii) Création d'un stock de semence

- Prélèvement de certains des taureaux repérés dans l'inventaire initial.
- Accouplement programmé des mères A taureaux repérés dès que les premiers mâles sont disponibles en I.A.
- Achat des veaux mâles issus de ces accouplements puis prélèvement en station d'un stock de semence important par taureau (en moyenne 3 000 doses). Toutes les opérations de prélèvement de semence et les pensions des taureaux sont facturées au programme par les coopératives.

(iv) Entretien des inventaires femelles

Tout élevage est visité au moins une fois par an. Le contact est donc maintenu avec l'éleveur ce qui est très important pour les uns et les autres. Comme la plupart des femelles de ces races ne sont plus soumises à un contrôle de performance toute information qu'elle soit d'ordre généalogique ou zootechnique doit être collectée sur place. Cette information est ensuite reprise sur le fichier PETPE de l'ITEB.

(v) Fichier PETPE

Il a été constitué pour gérer une information minimale sur des animaux n'étant pas dans leur ensemble soumis à un contrôle de performance officiel, l'information de base étant, comme il a déjà été dit, prise directement sur le terrain.

Il y a deux sous-fichiers: un fichier éleveur et un fichier animaux mâles ou femelles. Il est possible de produire différentes listes. Chaque année une liste de femelles vivantes au 31 décembre de l'année écoulée classées par élevage est mise à jour et diffusée auprès des éleveurs et des personnes concernées par le programme.

Il serait facile techniquement de produire, à la demande, des certificats d'origine pour les animaux de ce fichier dont nous connaissons déjà, pour certains, trois ou quatre générations.

La particularité des programmes français tient à la place déterminante qui a été accordée aux taureaux: choix et stockage de semence. Ces taureaux vont permettre de maintenir la qualité d'ensemble et d'éviter l'installation de la consanguinité. Pour les femelles il a paru plus important de tenter de maintenir des animaux en situation que de stocker des embryons. Il était, de toute façon, compte tenu des moyens financiers mis en œuvre impossible de mener les deux actions en parallèle. De plus il pouvait y avoir des obstacles pratiques ou psychologiques (négociation pour faire superovuler des vaches âgées en l'absence de structures d'accueil adéquates), génétiques (absence d'un échantillon de mâles suffisant pour des embryons), philosophiques (des animaux que l'on ne voit pas sont oubliés; ils ne peuvent être étudiés; les C-éleveurs méritent d'être épaulés). On espère que l'existence d'un minimum de bonnes femelles qui se reproduisent sans problèmes pourra attirer l'attention d'adeptes potentiels.

Après 10 ans de fonctionnement de ces programmes (pour les plus vieux) il est aujourd'hui possible de faire quelques observations.

1. Les races conservées sont intactes, avec des souches d'excellente qualité qui pourront se reproduire normalement sans problèmes de consanguinité particuliers et sans que l'on soit obligé de disposer des plantings d'accouplement draconiens aux éleveurs. Si les

programmes n'avaient pas déjà été mis en place depuis 1976, il est vraisemblable que depuis lors un certain nombre de races auraient déjà disparu faute de géniteurs mâles disponibles ou localisés.

2. Le contact est maintenu avec les éleveurs et l'évolution des effectifs femelles peut être très facilement suivie.

Malheureusement:

- La semence stockée dans le cadre des programmes de conservation n'a pas de statut qui garantisse leur conservation par les coopératives bien que les opérations de prélèvement aient été pour la plupart financées sur des fonds publics.
- Il n'est rien prévu pour permettre la survie d'un effectif minimum de femelles vivantes si les éleveurs qui assurent actuellement intégralement le coût de leur entretien faisaient faux feu (primes, troupeaux conservatoires, embryons congelés).
- L'ambiance générale dans la profession est plutôt à l'indifférence pour ce qui ne semble pas représenter un intérêt économique immédiat.
- Il n'y a pas encore une très grande curiosité des scientifiques pour ces races et il faut reconnaître qu'elles sont très mal connues. Les seules études en cours sont:
- un essai d'engraissement de taurillons de race Parthenaise au Lycée de médecine suivi d'une expérience d'évaluation des carcasses de ces taurillons 'à la station de l'ITEB de Villers-Bocage (qualité des viandes); et
- une étude sur la production laitière de la race bovine Béarnaise dans la vallée d'Aspe par un stagiaire de l'INRASAD.

B. PROGRAMMES PE

Au départ le principe de la mise en place de programmes de gestion adaptés est venu de l'Union Nationale des Livres Généalogiques. Les financements proviennent du 44.50, du FIDAR, des conseils généraux. Il y a une Organisation sur place - UPRA ou Herd Book - qui est le plus souvent aidée mais pas systématiquement par les structures techniques agricoles locales. Les races Flamande et Bleue du Nord sont épaulées en outre par le Centre Régional des Ressources Génétiques du Nord-Pas de Calais qui fonctionne dans le cadre de l'Espace Naturel Régional et financé par la région. La contribution de ce Centre à la conservation de ces races est d'ores et déjà importante. En général les coopératives d'insémination artificielle jouent bien le jeu et il y a une part plus ou moins grande d'autofinancement pour les opérations de production de semence. La plus grande partie des élevages sur lesquels on travaille sont soumis au contrôle de performance et font des déclarations de naissance. La Section Amélioration Génétique n'intervient pas directement sur le terrain (sauf pour les races Flamande et Bleue du Nord) mais elle fournit appui technique et méthodologique.

Une gestion des origines est nécessaire pour éviter les problèmes de variabilité génétique surtout dans les races utilisant beaucoup d'insémination artificielle. On veille à ce qu'il y ait un nombre suffisant de familles mâles. Il est probable que cela ralentisse quelque peu le travail de sélection mais il est difficile de faire autrement si l'on ne veut pas que la race se bloque, sur deux ou trois souches.

Pour la Bazadaise les taureaux qui entrent en station sont choisis en fonction de leur famille. Puis il y a un contrôle individuel à Soual. Huit taurillons entrent en station chaque année; quatre sont en général retenus pour l'insémination artificielle. Un certain nombre de doses de chaque taureau est réservé - aux accouplements planifiés dans les troupeaux en race pure.

Pour la Bleue du Nord dans ses deux rameaux mixte et viandeux la semence a été importée jusqu'à maintenant de Belgique.

Pour la Flamande l'on tâche de conserver les souches de race pure. L'on travaille avec des taureaux anciens et d'autres plus récents en veillant à ne pas trop perdre d'origines. Le

renouvellement des taureaux est difficile aussi la tendance serait de stocker un nombre important de doses de chaque nouveau taureau de race pure.

Pour la race Parthenaise la Coopérative d'Élevage et d'Insémination Artificielle des Deux-Sèvres a fait un gros effort en poursuivant d'une façon continue l'entrée de nouveaux taureaux en centre (en pension ou achetés) puis testés en ferme sur leur descendance pour la production de veaux sevrés.

Pour la Vosgième le renouvellement des mâles se fait pour chaque famille déjà représentée. Chaque taureau d'insémination est remplacé par un fils ou un petit-fils.

Dans l'ensemble ces races se défendent bien. Il y a des équipes motivées sur place et un fond d'éleveurs suffisant a pu être maintenu. Cela permet lorsque les conditions locales s'améliorent pour elles - ce qui est le cas actuellement - de voir leurs effectifs femelles se conforter,

Il n'y a pas lieu d'évoquer ici le programme de relance régionale de races comme l'abondance, laubrac, la Gascome, la Tarentaise ou même la Salers. Il y a souvent plusieurs motivations en jeu dont les motivations génétiques ou techniques ne sont qu'une partie.

Il peut également signaler le fait que dans des races non menacées ont été plus ou moins évacués des programmes de sélection officiels des caractères qui représentent un effort de sélection antérieur important comme la production laitière (Maine-Anjou, Parthenaise et bientôt peut-être Salers). Ce processus est à rapprocher du processus d'appauvrissement génétique qui menace notre patrimoine bovin et des mesures devraient être prises pour maintenir les souches les plus laitières (stockage de semence) à toutes fins utiles ou toute autre souche extrême sur des caractères non sélectionnés en priorité.

Enfin il peut évoquer rapidement les programmes de croisement (la plupart limités) de races rouge et blanche avec des taureaux Holstein homozygotes pour le facteur rouge. Nul doute que si ces croisements se généralisaient ils seraient un danger pour l'existence des races qui les auraient essayés.

TABLEAU 1
FEMELLES INVENTORIEES (3/4 DE SANG ET PLUS)

1. TPE (très petits effectifs)

	1980	1981	1982	1983	1984	1985
Bretome Pie Noire	410	470	432	428	408	434
Ferrandaise*	-	194	248	279	246	230
Villard de Lans*	90	140	144	154	149	136
56arnaise*	-	-	70	112	130	122
Mirandaise* 1/	-	-	-	-	-	88
Auroise* 2/	-	-	73	76	79	72
Armoricaïne*	-	47	47	52	53	49
Lourdaise*	-	-	28	30	30	36
Froment du Leon*	-	42	46	44	32	30
Alpine Herens*	-	-	-	32	32	30
Nantaise* 3/	-	-	-	-	-	-

*Fichier PETPE de l'ITEB.

1/ Gascome aréolée.

2/Aure et St. Girons ou Casta.

3/variante de la Parthenaise, laitière.

2. PE (petits effectifs)

L'effectif femelle est en progression pour les races Bazadaise, Bleue du Nord, Parthenaise, Vosgieme. Il doit être stationnaire pour la Flamande. Un inventaire plus précis des femelles Bleues du Nord et Flamandes est en cours. Pour les races Bazadaise et Vosgieme les mises à jours se poursuivent.

TABLEAU 2
ELEVAGES AVEC FEMELLES INVENTORIEES

	1980	1981	1982	1983	1984	1985
Ferrandaise*	-	.50	65	65	64	58
Bretome Pie Noire	48	56	47	50	49	50
villard de Lans*	20	32	32	32	31	26
Mirandaise*	-	-	-	-	-	22
Be'arnaise*	-	-	21	22	21	21
Lourdaise*	-	-	14	13	14	16
Auroise*	-	-	13	12	14	15
Armoricaïne*	-	18	15	14	12	10
Alpine Herens*	-	-	-	9	9	10
Froment du Leon*	-	11	11	12	10	9

*Fichier PETPE de l'ITEB.

TABLEAU 3
FEMELLES NEES ET RENOUVELLEMENT

	1983	1984	1985	1/	2/	3/
Alpine Herens	4	3	5	12	40%	18
Armoricaïne	4	1	3	9	22%	18
Auroise	10	12	9	27	37%	45
Bérnaise	14	6	8	45	37%	77
Ferrandaise	24	19	19	61	26%	169
Froment du Leon	7	5	3	14	46%	16
Lourdaise	5	3	4	11	30%	25
Mirandaise	-	-	0	9	11%	79
Villard de Lans	14	15	19	64	47%	72

1/ Femelles de renouvellement (- de 3 ans).

2/ Proportion de femelles de renouvellement dans l'effectif total.

3/ Femelles de souche (+ de 3 ans).

Il s'agit des femelles nées et conservées dans l'année considérée avec pore et more comus et identifiées.

Aucune de ces races ne possède de surplus de femelles jeunes qui puissent permettre de répondre à la demande en reproducteurs si elle s'exprimait. Dans certaines même (Mirandaise, Armoricaïne) le renouvellement n'est pas assuré. Des troupeaux conservatoires permettraient pour les plus menacées de garantir la survie d'un minimum de femelles en production et leur étude.

RACES BOVINES : programmes en cours

Voir légende annexe 1





Vache de race Génaise



Taureau de race
Ferrandaïse

TABLEAU 4
POUR L'INSEMINATION ARTIFICIELLE (Ali 3 DECEMBRE 1986)

	1/	2/	3/	4/	5/
TPE					
Armoricaine	9	6	-	15	6
Auroise	7	-	1	7	5
Béarnaise	8	-	2	8	4
Ferrandaise	7	-	2	7	6
Froment du Leon	7	-	1	7	4
Lourdaise	5	-	3	5	3
mirandaise	4	-	-	4	1
Villard de Lans	12	-	1	12	7
PE					
Bazadaise	18	13	-	31	9
Corse	10	-	-	-	10
Flamande	18	3	-	21	14
Parthenaise	12	4	-	16	9
Vosgienne	12	3	-	15	10

1/ Taureaux en service 'a 1,IA.

2/Taureaux en réserve géne'tique (aval).

3/Taureaux en station (pour TPE).

4/Total taureaux (semence conserves).

5/Familles m^ales représentées.

Rappelons que les programmes géne'tiques mis en place pour les races très petits effectifs visent à assurer la possibilité d'une reproduction normale des vaches en race pure et sur le long terme avec le minimum de contraintes pour les éleveurs quelle que soit l'évolution des effectifs femelles. Ils impliquent le stockage de la semence d'un nombre suffisant de taureaux qui soient facilement ge'rables ou utilisables. Des stocks de semence importants par taureau permettent d'éviter un renouvellement rapide des géniteurs ce qui - en l'absence d'un progrès géne'tique observable - n'a que des avantages (allongement des intervalles de génération, maintien de familles m^ales autonomes) cf. modèle Villard de Lans.

Dans tous les cas il est important de ne pas dégrader l'acquis de la sélection antérieure. Une attention particulière est portée au maintien des souches laitières qui représentent un effort de sélection important et qui sont d'un intérêt zootechnique évident. Pour ce qui concerne les races simples ou les aspects standard de race, nous adoptons aussi les hypothèses les plus larges, ne s'écartant pas systématiquement, par exemple, les animaux avec des patrons colorés déviant par rapport aux standards traditionnels (cf. taureau Ferrandais UBU).

Le statut de ces semences stockées grâce à l'intervention de fonds publics (44.50 et FIDAR) n'est toujours pas précise.

Pour les races à petits effectifs il est possible de renouveler les mâles plus fréquemment que dans la catégorie précédente sans cependant pouvoir appliquer l'ensemble des schémas d'amélioration génétique que l'on pourrait appeler 'classiques'. Ainsi devient défendable

1. l'utilisation sur grande échelle de taureaux non testés;
2. la publication d'index laitiers avec un CD de 0,50; et
3. l'utilisation possible comme pères à taureaux de l'ensemble des, taureaux positifs et non pas seulement les meilleurs d'entre eux (cf. modèle vosgien lait, et modèle bazadais (viandel).

Troupeaux constitués d'animaux des races régionales ou locales gérés par différentes organisations autres que les éleveurs privés:

Abondance

Lycée Agricole privé, Poisy, 74330 La Balme de Sillengy
troupeau de vaches laitières

Auroise

Réserve Naturelle des Marais de Bruges, Sepanso, 33520 Bruges
troupeau de vaches allaitantes

Station Biologique de la Tour de valat, Le Sainbuc, 13200 Arles
troupeau de vaches allaitantes

Bleue du Nord (mixte)

CFPPA, 17 rue des Tilleuls, 59530 Le Quesnoy
troupeau de vaches laitières

Parthenaise

Lycée de melle, 79500 melle
troupeau de vaches allaitantes

Tarentaise

Lycée Agricole de Chambéry-Cognin, 73290 La motte Servolex
troupeau de vaches laitières

CONSERVATION OF GENE RESOURCES OF FARM ANIMALS IN THE NORDIC COUNTRIES

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1. INTRODUCTION

The Nordic Council of ministers decided in 1979 to finance a working party for coordinating the Nordic Animal- Gene Banks (NAGBs). This party has five members, one from each Nordic country and a part-time secretary. The working party has been in contact with several other researchers and institutions and is represented in the corresponding European working party. These links have provided possibilities for fruitful communication. On the initiative of the working party, the agricultural ministries reported on the national situation in their respective countries (Majjala et al., 1986). Overall responsibility is considered as an official task. Each Ministry of Agriculture, in cooperation with other ministries, is responsible for animal conservation. That includes providing necessary investment funds and covering the operating expenses of gene banks.

This report summarizes the activities undertaken and progress achieved.

2. NORDIC GENE BANKS FOR ANIMAL GENETIC RESOURCES

For several reasons responsibilities and activities are divided into national and joint Nordic-country tasks.

The national part covers the registration and maintenance of all valuable biological material stored in gene banks, in the form of live animals and/or frozen cells. Local storage is preferable as it is simpler, cheaper and safer than centralized storage. In the case of live animals, care is taken to avoid their unnecessary transport and to minimize the risk of loss, while valuable material is stored in at least two places.

In support of their activities, the governments cooperate with breeding organizations and research institutes possessing the know-how and equipment required to freeze and store semen and embryos correctly, even originating from animals which are not included in their particular area of interest. The conservation of living populations of small or less productive breeds is, for

economic reasons, important and thus can be combined with the keeping of animals for other purposes. To promote economic improvement, live populations of less productive breeds can be used to a limited extent as producers, for therapeutic investigations in prison farms, as educational tools in agricultural schools, participants in the management of pasture and landscape development, to remove coppices from forests, to utilize harsh environments or marginal areas, and as experimental animals, producers of furs, riding horses, and company and tourist attractions in national parks and zoos. These populations are also important members of living museums'.

In the past, it has been demonstrated that concerned private individuals make valuable contributions to this work when they succeed in obtaining the necessary support.

3. NORDIC DATA BANK FOR ANIMAL GENETIC RESOURCES

The central part of Nordic animal gene banks concentrates on tasks which can be carried out most efficiently by all the Nordic countries together, i.e., firstly, through the establishment of an information centre, including a data bank. All information registered in the individual countries is submitted to the main data bank for tabulation and maintenance. Thus, the bank is able to supply users with needed information. The joint Nordic data register is also beneficial as many Nordic breeds are closely related and as such their conservation can be considered from the same genetic point of view. Some breeding organizations interchange males and semen for breeding purposes across borders. The collection of all data in one central bank simplifies the calculation of genetic relationships and populations differences among breeds. The Nordic data bank was developed in., collaboration with the European working group for animal genetic resources (Majala and Simon, 1987@., and this working group has helped to establish gene banks at the national level and map endangered breeds.

The future work plan will proceed according to the original plan which is summarized as follows: 1) to operate a data bank with standardized information about breeds, single animals and cells to facilitate long-time storing; 2) to follow up the continuation of related work, in the Nordic countries; 3) to keep informed of research results, and to work toward the adaptation of modern techniques for storing genes; 4) to maintain an information centre on the inter-Nordic level and seek up-to-date data on the scientific and practical levels; and 5) to seek to establish cooperation with other agencies conducting similar operations on animal and plant production, on both national and international levels.

4. MOTIVATION FOR CONSERVATION OF GENE RESOURCES

Advanced methods and techniques of breeding have made rapid changes possible in farm animal populations and breeds suited to the modern economic uses of today's market have been developed. This potential has increased with the use of artificial insemination and electronic data processing capabilities.

The undesirable aspect resulting from the disappearance of breeds and animal varieties is reflected in the loss of genetic variation. It is difficult, at any particular time, to say which qualities may be considered useful in the future. The founding of gene banks is, therefore, an important step to ensure the conservation of these resources.

The NAGB has three different motives for practising conservation methods: 1) biological-economic; 2) scientific; and 3) cultural-historical (Majala *et al.*, 1986).

The biological-economic motives concern preparation for unpredictable future needs. An economic goal is to breed animals which, in an effective and economical way, turn feed into products which satisfy market demands. Consequently, breeding goals must be adapted to reflect trends in the production and market situation. Biotechnical research has made better use of valuable genes possible in traditional populations, and genetic engineering developments allow the transfer of wanted traits without the inclusion of other unwanted gene material. A gene bank also assures the possibility of being able correct errors, one of the fundamental goals of breeding.

The scientific basis for protection of gene resources concerns the need for genetic variation for research purposes, the evaluation- of genetic and environmental changes in terms of development and behaviour (control populations), and the teaching of biology and animal husbandry. .

The cultural-historical motives for the protection of the gene resources of domestic animals are the same as those for the protection of other examples of cultural heritage and nature.

Earlier, this cultural protection included mainly material values, such as handicrafts, tools, buildings, and later entire cultural landscapes. Farm animal breeds constitute literally living parts of our cultural heritage. This is quite clear, considering the important role farm animals have played in the life and foundation of the Nordic countries. Variations in national and regional breeds reflect geographical and cultural ‘differences in basic lifestyle, agricultural environment and production methods. In a suitable traditional environment, farm animal breeds reflect the interaction between people, production and nature. This contributes to the making of museum and the protection of culturally important parts of modern existence.

The cultural-historical motives are those most easily understood by people, yet they may not always understand the other motives. The NAM encourages cooperation among people with different points of view.

5. METHODS FOR PRESERVATION

There are, in principle, three methods of preserving animal gene resources: preservation in haploid form as frozen semen and embryos; preservation in diploid form as living animals and frozen embryos; and - single genes preservation.

The NAGB has concentrated mainly on preserving live animals, and frozen semen and embryos. The former is the only method available for all species, but the number of species for which semen and embryo freezing is possible has been increasing. The-practices of embryo freezing and conserving DNA in simply frozen semen may be well-founded for genetic analyses and the later isolation and transfer of genes of particular interest. (Brem *et al.*, 1989).

Live populations are able to satisfy the requirements of cultural-historical conservation. Frozen embryos and semen are cheap to store and pose the least risk of infections and inbreeding depression. Conservation through live animals is very common, and ‘old, semen doses have been stored for some breeds of cattle,, horses, pigs, sheep and hens. The freezing of embryos has been carried out for some cattle and sheep breeds.

6. THE NEED FOR PROTECTION OF GENE RESOURCES OF NORDIC FARM ANIMALS

Horses

A good criterion for considering endangered breeds is the actual number of males and females selected and used annually for breeding purposes. The trend for Nordic horse breeds is shown in Table 1.

TABLE 1
NUMBER OF MARES SERVED BY NUMBER OF STALLIONS IN 1978 AND 1983

Country	Breed	1978		1983	
		Mares	Stallions	Mares	Stallions
DK	Jutland	190	18	237	42
DK	Belgian	274	23	345	40
S	Ardemes	1621	80	1077	89
DK	oldenburger	416	21	716	39
DK	Frederiksborg	300	32	251	34
S	Swedish half-blood	4751	137	4025	392
S	North Swedish	2294	127	1200	131
N	Dole	2015	108	2979	112
DK	Fjord	1592	66	1683	90
N	Fjord	739	53	945	62
S	Fjord	1263	75	800	76
N	Nordland Pony	64	19	101	25
S	Gotland Pony	1078	126	654	121
DK	Iceland Pony	500	30	820	56
F	Iceland Pony	20	2	18	2
N	Iceland Pony	60	9	100	19
S	Iceland Pony	56	12	280	18
IS	Iceland Pony total		50000		52000

1/ The countries are indicated by their car registration symbols.

From the national reports, only the Jutland horse is directly threatened. of the Finnish, North Swedish and Dble horses, the heavier type is significantly reduced as a result of fewer draught horses being used in agriculture and forestry. The lighter type, a work and trotting horse combined, is the most popular.

For the Jutland horse it is necessary to make allowances for breeding that ensures a sufficient stock of semen. This race should also be the first choice when storing frozen embryos. For the rest of the Nordic races, and especially for the threatened varieties, the freezing and storing of semen should start as soon as possible. At least 100 doses from each of 25 stallions should be stored if as many suitable stallions can be found.

Cattle

Since production of highly productive breeds is usually more economics the success of animal breeding causes a displacement of less productive breeds. Some breeds might continue to exist under the same name as the original but with changed genotypes. This development, therefore, has led to substantial changes in gene frequencies and loss of genes. The original Danish Black Pied - SDM is an example of a landrace which now consists entirely of 6 500 semen doses from 13 SDM bulls.

The cattle breeding organizations in all five countries deep-freeze every year semen from a number of bulls for longtime storing. Sweden still has some nearly 30-year-old stored doses. Some landraces not supported by an active conservation organization are in a precarious situation, such as two of Finland's landraces. To avoid total losses, a herd of each breed is kept in separate prison farms, where they form a part of mental health and work programmes for the prisoners.

The trend in Nordic cattle breeds is shown in Table 2.

TABLE 2
IN CATTLE BREED DEVELOPMENT IN THE NORDIC COUNTRIES

Country	Cows and heifers inseminated with semen from these breeds	1978	1983	1988
DK	Danish Black Pied - SDM	728890	715876	592970
DK	Danish Red - RDM	239410	108730	137230
DK	Danish Red Pied	54220	33765	25000
DK	Jersey	140405	164345	127020
S	Jersey	7643	10053	6950
N	Jersey	2515	3702	3357
S	Finnish Ayrshire	511634	506157	419312
SF	East Finnish	1823	220	352
SF	North Finnish	0	25	99
SF	West Finnish	45893	23671	11589
S	Swedish polled - SKB	9985	9598	5666
S	Friesian - SLB	208562	246796	219210
SF	Finnish Friesian	156415	167872	130711
N	Norwegian Red - NRF	433718	468151	422898
S	Swedish Red and White - SRB	363147	375148	315518
N	Blacksidet Tr6nder and Nordland - STN	620	611	832
N	Telemarkcattle	270	255	591
IS	Iceland cattle, total	36325	32941	32023
IS	Galloway, total	100	100	350

Norwegian Red cattle - NRF - is a population based on extensive crossing of landraces, initially with SRB, and some Finnish Ayrshire. During recent years considerable elements from both Swedish and some overseas Friesian have also been introduced.

Apart from differences in colour, the population is still quite homogeneous. There is a NRF control population on a 1970 level in connection with a research programme being conducted at seven agricultural colleges and one officially run farm.

One hundred doses of semen from every progeny-tested bull have been stored since 1983. The costs have been borne by the continuous breeding work. Some old Norwegian landraces exist as frozen semen only, while small populations of some others remain.

The cattle population of Iceland can be considered as a natural gene bank, with a history dating back to the beginnings of Icelandic agriculture. To protect valuable genes, which can be lost through modern selection procedures, semen from all bulls used in artificial insemination programmes is stored.

Goats

Denmark has about 9 500 goats of German and Swiss breeds. Finland has about 2 500 - 3 000 landrace goats.

Iceland has a goat population of about 250. This population is probably of Norwegian heritage from old times. Financial incentives are paid to all farmers who keep goats, to maintain populations, but the breed is still endangered, and further steps are planned. Research done in 1985 shows that the Icelandic goat has more bottomwool (Kashrftirwooll) than other goat breeds in Western Europe.

Norway has about 100 000 landrace goats. The breeds were divided into local breeds, named

after the district in which they were found. There are, however, no sharp distinctions in racial traits. Semen from some he-goats is being frozen each year.

Sweden has a population of about 8 000 goats. They are not distinctly different from the Norwegian landrace, and can be included in the same population. Some breeding animals are also imported from Norway.

Sheep

The Nordic landraces belong to the North European group of short-tailed sheep. In addition, there are some breeds of British and Dutch origin.

In Denmark the following five breeds are considered worthy of protection: oxford Down, Leicester, Texel, Shropshire and whiteheaded marsk. The two breeds mentioned initially have been in Denmark for 100 years. None of the breeds are now endangered, but the stock sizes of some breeds should be kept under surveillance so action can be taken if the number decreases" considerably.

In Finland the sheep population has decreased to 10 percent of the number in 1950. There are still 55 000 landrace ewes left, known especially for their high fecundity, and for that trait, exported to many countries. There is a breeding centre with 150 animals on a prison farm. The stock will be increased to about 500 animals. moreover, the State Agricultural Centre has a stock of 150 females.

The Iceland landrace (about 712 000) is, according to investigations, more closely related to the Norwegian landrace than to the sheep on Shetland and the Orkneys. The colour, which varies considerably, has lately become of great practical importance, especially grey, for the production of furs, and the chocolate brown colour (moorit) for wool production to supply the specialized knitwear industry. The breed is rather fertile. Recently, a particular single gene has been found in the breed, the Thoka gene. Females which carry this give birth to an average of 0.7 lambs more per lambing than those without this gene. 'Variations in colour and fertility are not threatened. In the breed there are some individuals with a special gene for leadership. This peculiarity has been known and highly valued from old times. In recent decades the number of 'Leadersheep, has decreased significantly. Pure breeding of sheep with leader ability is provided for by law, but the grants have so far been inadequate. This quality is still valuable and the provision of the law should be followed up.

Norway has four national breeds: the pure landrace Spel; Dala; and Rygja, both crossbred from Spel, Leicester, Cheviot, and possibly oxford Down; and 4) Steigar which is Spel crossed with Cheviot. The last three are heavier breeds, while the mothering abilities and flock instincts are best developed in the Spel. None of the breeds are threatened.

Norway also has some small groups of wild sheep. They are of the same kind as the Spel sheep, but are smaller and more varied. Further investigations of their qualities are needed.

Sweden, according to official records, has divided its sheep breeds into four groups:

1. Fur sheep comprising Gute sheep and Fur sheep breeds
2. White Landrace with breeds Rya, Landrace Finewool and Spel sheep the
3. Heavier breeds for meat production that include 10 breeds; Texel, Leicester, and oxford Down are the most important
4. Crossbreeds.

The Gute sheep is a wild sheep from Gotland. This breed is very old. During the 18th century some Merino, Cheviot and Leicester sheep were imported to Gotland, and the breed has probably got some of these genes. The breed still has some primitive qualities like horns, mane hair on the males, and strictly seasonal reproduction. It is very frugal, and is kept mainly on poor pasture areas for grazing, but demonstrates a low level of reproduction.

The Fur sheep descends from the Gute sheep, with some qualities of the Leicester and Rya

sheep breeds. This is a popular breed, which is also exported, among others, to Norway. Its fur is sold under the name 'Viking Lamb,.

The Rya sheep is a breed with an especially glossy wool. It nearly became extinct around the turn of the century. During the 1960s and 1970s it was crossed with meat breeds to improve its slaughterweight. The breed is no longer endangered. moreover, none of the Swedish breeds are threatened species.

Official aid to support the conservation of endangered breeds can be provided by designating reserved areas as pastures for sheep.

Pigs

Landrace and Yorkshire are the dominant breeds in the Nordic countries. They are indigenous populations sharing common origins. Swedish landswine are mainly based on imports from Deranark effected in the periods 1914-15 and 1935-39. Norwegian landswine have developed from imports from Sweden following 1945. Later, there were exchanges of -breeding material between Sweden and 'Norway. The Yorkshire breed is found to a larger extent in Finland, where both breeds are almost equal in size. Finland has exported breeding animals both to Norway and Sweden. In Dermark, where the Yorkshire pig has been poorly represented in comparison to the landswine, the breed is being re-established. These breeds resemble similar breeds outside the Nordic countries, and are therefore not endangered.

Danish Blacks'potted pigs are bred from traditional Danish Landrace. The breed merits protection, especially because of its immunogenetical potential. With about 30 boars and about 340 sows spread over 20 breeding centres, the breed is thus protected.

Denmark and Sweden have some Hampshire and Duroc pigs for crossbreeding purposes. Norway procures the semen of these breeds from Sweden for similar purposes.

The pigstock on Iceland dates from the beginning of the 20th century, and is not defined as a national breed.

Even though none of the pig breeds in the Nordic countries are threatened, a limited effort to protect them is needed. Rapid changes may occur, which could lead to total crossbreeding, especially if crossing with imported breeds is found to be more successful economically.

Poultry

Nordic landraces are small and some are endangered species. These breeds represent a wide spectrum of genes. The short generation interval of poultry makes it possible to make rapid use of gene resources from both the productive and scientific points of view. The breed is protected mainly through living populations.

Hens

White Leghorn is the dominate breed in all Nordic countries, followed by the Rhode Island Red and New Hampshire hens. The breeds are imported from the USA, but further developed and specialized in Nordic country lines.

Denmark, Finland, Norway and Sweden have established a joint Nordic control line, the 'Ultuna population'', based on international white Leghorn hybrids.

The production of chicken for slaughter is based mainly on imported breeds but further developed in the different Nordic countries.

Denmark has two traditional national breeds: the Danish Land hen and Lute hen. The populations are small, 1 000 and 100, respectively.

The Finnish landrace hen w ' as saved in the 1970s by private individuals and is kept in zoos, on some farms, and by the Oulu University, which uses the breed for research purposes.

Iceland has a traditional flock of coloured hens, which was threatened considerably, but the

Agricultural Research Institute took action to save it in 1974 and its eggs were gathered from varied locations around the country. Economic problems have made follow-up action difficult, but new steps have been taken to solve them.

Norway has had a gene bank for poultry since 1973. Breeding material, about 16 000 hens, is divided into about 30 lines. The Jaer hen, a traditional Norwegian small landrace, is included in the gene bank, both as a pure breed and in a few crossbreeds. The Jaer breed is influenced somewhat by inbreeding, but shows good ability in crossing, especially in improvement to the shell quality. The Jaer hen has the sex-tied genetic factor for cross-striped feathers, making it autosexing.

The Swedish University of Agricultural Sciences has for some years tried to breed a 'Swedish hen, 'with the ability to make satisfactory use of Swedish-produced feeds, which contain less protein than ordinary hen feed. Research has so far proved very promising. At the same time, the most important stocks are conserved in a gene bank. Sweden also has some animals of a traditional dwarf breed which form a handsome hobby breed.

Ducks

Steps have been taken to save a traditional Danish duck and two Swedish landraces. These include the Black and White-chested Danish duck, the Swedish Blue duck, which originally came from Poland, and the Swedish Yellow duck, which is supposed to have risen spontaneously from the Blue duck. Both are good layers, especially the Yellow duck, but this breed is less fleshy than the Blue duck.

Geese

The breeds selected for gene bank conservation in the Nordic countries are listed below. -

Denmark: Greyspotted Danish goose and Grey Danish goose;

Iceland: Grey-spotted Tame goose;

Norway: Smaalens goose and White Norwegian goose;

Sweden: Skaane goose and Oland goose.

The breeds represent great variations in size, growth rate, and laying ability. These variations provide good potential for improved crossing results.

Rabbits

The following breeds are considered worthy of conservation: the White Land and French Wddder, in Denmark; White Land and Trbnder in Norway; and the Kohare rabbit in Sweden.

Four of the breeds are landraces. The French Wddder has been a popular rabbit breed in Denmark for many generations. The Trbnder rabbit has decreased significantly and is now endangered. The Kohare changes colour somewhat, owing to seasonal change. There are few left, but some breeding is done by the Swedish Small Animal Corporation.

Fur Animals

The breeding of fur animals has traditions going back to the turn of the century. Norway obtained Blue fox and Polar fox from Iceland in 1903, and later from Alaska and Greenland. Red fox and Silver fox arrived from the USA, in the late 1920s, and the Polecat some years later. Denmark and Finland have, during recent years, obtained Raccoon Dogs from the USSR. Denmark also produces Chinchilla on a limited scale. The extent of the mutation and combination types for the different species varied considerably, owing mainly to variations in market conditions.

The genetic constitution of fur colour has been worked out, and given symbols. The same phenotype can be produced through different combinations of genotypes. No genes, which at this time are considered favourable, are endangered. The situation is different for small populations

manifesting uneconomic or negative mutations, however, they may still be of genetic interest.

Conservation of gene resources which exist, or will evolve in the coming years, will make it quicker and easier to meet future demands for new colour combinations. White Polar fox is an example: the race was common earlier, but later went out of production. Now it is of interest again, for crossbreeding with the Silver fox, to produce the popular Golden Iceland and Northern Light species. Finland may start conservation programmes for fur animals on a research farm.

Bees

The Brown bee is indigenous to all of the Nordic countries, except Iceland. It is still the largest breed in Norway, while the Yellow Italian bee is now the most common in Sweden and Denmark. Other breeds, like Krainer and Buckfast, are also found, but to a lesser extent. Moreover, there is a large group of uncontrolled crossbreeds.

In Norway, a breeding plan for bees was drawn up in 1976 to ensure the conservation of their gene resources.

In Northern Sweden, conservation of the Brown bee is currently considered to be of most interest. This is thought to be the purest of the breeds, and has the most resistance to cold. The Swedish Organization of Beebreeders (SBR) has a mating station in Umeå. In inland, beekeepers have agreed, on a voluntary basis, to keep Brown bees exclusively in the area around Östersund.

Reindeer

Reindeer are spread all over the Northern Hemisphere in forest and tundra areas. There are variations in size and colour, and in the skull and horn shapes. The reindeer can be divided into wild reindeer and (tundra reindeer) and tame reindeer (forest reindeer), but there is no clear distinction between the two. In the Nordic countries, only Norway has wild reindeer. The approximate distribution of reindeer is: Denmark (Greenland) 18 000, Finland 364 000, Iceland 2 000, Norway 200 000, and Sweden 260 000. Reindeer genetics are influenced by different management techniques as well as natural selection. Research has shown that wild reindeer have better ability to dig up lichen from under the snow than tame reindeer.

Reindeer are kept separately in groups, but there is a high degree of mixing between groups during mating seasons. The size of the groups varies from a few hundred to 15 000-20 000. From a breeding point of view, the transfer of animals from one group to another, and the mixing of close groups allow the group sizes to increase considerably.

Thus, there is no danger of inbreeding. Gene pools of characteristic groups of both wild and domesticated reindeer should include both sexes, as the problem of freezing semen and embryos has not yet been satisfactorily solved.

REFERENCES

- Brem, G., Brenig, B., Müller, M. & Springman, K., 1989. FAO Animal Production and Health Paper 76. 123 pp.
- Maijala, K., Adalsteinsson, S., Kolstad, N., Neimann-Sørensen, A., Wilhelmson, M. & Gjelstad, B., 1986. Nord. Jordbr. forskn. 68: 159-179.
- Maijala, K. & Simon, D., 1987. Paper presented at the 37th Annual Meeting of the European Association for Animal Production (EAAP), Lisbon, 23 pp.

RESEARCH ON GENETIC MARKERS IN THE SURQO ZEBU OF SOMALIA

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SUMMARY

The zebu population of Somalia includes four main types (Boran, Dawara, Gasara and Surqo), which cannot be considered as breeds in the same sense as cattle in Europe. Boran, Dawara and Gasara are included in the type known as East African Shorthorned zebu, while the Surqo is regarded as an ancient stable mixture of zebu and Sanga (see Figure 1).

The task of identifying the genetic relationships existing among these types, within a rather heterogeneous population, could best be approached through the study of marker loci like those controlling the immunogenetic and biochemical polymorphic systems, rather than through the comparison of morphological traits.

Research was continued along these lines to facilitate the genetic characterization of Boran and Dawara types (Di Stasio et al., 1978 and 1980), and the study was extended to include the Surqo type - a comparison of the results.

1. MATERIALS AND METHODS

Blood samples were obtained from 124 Surqo adult animals at the Mogadishu slaughterhouse.

The erythrocytes were typed for blood groups using the following reagents: A, ZI, B-), GI, K, I O P, Q, TI, YI, AI, BI, II, Jt, OI, PI, OI I cil 3' E1, M, S, S,)-, U, UII, U" and Z. These reagent 'I@ ' ' !! so2-!@izati Pr ed by 1 1 on from EuropeafI cat@le f5reeds at the osservatorio di Genetica Animale, Turin, were tested in the 1979 and 1982 comparison tests arranged by the International Society for Animal Blood-Groups Research (ISABR).

Plasma and haemolysate samples were subjected to horizontal starch gel electrophoresis according to the techniques suggested by Braend and Stormont (1963) for haemoglobins (Hb), by Sartore (1970) for carbonic anhydrases (CA), by Kristjansson (1963) for transferrin (Tf), by Ashton and Lampkin (1965) for albumins (Al) and by Rondolini et al. (1973) for amylases (AmI). For the nucleoside phosphorylases (NP) the technique suggested by Harris and Hopkinson (1978) has been used with minor changes in the staining technique (0.05 phosphate buffer pH 7.2 ml 10, inosine mg 10, xantine oxidase 0.2 U, MTT mg 10 and PMS mg 1 in ml 10 of 2 percent agar at 52 0 C).

To detect haemoglobin and carbonic anhydrase types, polyacrylamide horizontal electrophoresis in 0.032 M Tris-0.1 M glycine buffer, pH 8.4, has also been used.

2. RESULTS AND DISCUSSION

In Table 1 the phenotypic frequencies found in the Surqo population for the blood antigen factors, of, the A, B, C, F, J, L, M, S and Z systems are reported and compared with the frequencies found in Boran and Dawara populations (Di Stasio et al., 1980). From the results, it appears that the frequencies are similar among the three populations except for S, which resulted rarely in Surqo, and for K, P, S 1 and UI, which are much more frequent in Surqo than in Boran and Dawara.

Considering the F system, with the F, and V, reagents in this investigation, the presence of the

F (T- allele reported @ osterhoff (1967) in South African cattle could not be ascertained.

In Tables 2 and 3 the phenotype and allele frequencies for Hb, CAF IV, ;at AmI and Ti systems are given for Surqo, together with the allele frequencies for Boran and Dawara. All systems, except Hb and Tf, harmonized according to the Hard@Weinberg law.

From these results, it appears that data from Surqo are rather similar to those obtained from Boran and Dawara, although some aspects seem worthy of note with respect to Hb, CA and NP systems.

With regard to the Hb system, in addition to the well-known A and B variants, a third variant with intermediate electrophoretic mobility (see Figure 2) has been found. In the absence of a reference sample, this variant could not be identified with certainty, either with Hb C or Hb I. However, on the basis of electrophoretic mobility and the data reported in the literature (Schwellnus and Guerin, 1977) it would appear to be most likely Hb I, considering also that according to Schwellnus and Guerin (1977) the Hb' allele is of African origin, while @ originated in Asia. Because the presence of rare alleles is of significant importance in the study of genetic relationship among populations, it would be helpful to establish whether this variant corresponds to the one found in Boran and Dawara. In this respect, it must be noted that electrophoretically identical variants may be controlled by different alleles; hence, conclusions based on the presence of rare variants must be confirmed by thorough biochemical studies.

This also applies to the CA system, where two variants have been found, one corresponding to type S of the European cattle reference sample, while the second has much slower electrophoretic mobility (see Figure 3). In the genus Bos three variants with slower electrophoretic mobility than S have been reported so far, that is, S (Sartore, 1970), z (Penedo et al., 1982) and stchanker et al., Ig@l@ntof these, the z variant could correspond to trgh;alf““ found in @urqo-. Furthermore, it must be noted that this variant can be detected only when alcohol-chloroform extracts of haemolysates are used in the electrophoretic analysis, therefore this method must be used always when dealing with samples from Bos indicus.

With regard to the NP system, to our knowledge the present data are the first reported in zebu cattle. It is felt that future studies would require further investigation of other populations both from Africa and Asia, in order to establish whether the frequency of the @'allele, much higher in Surqo than in European cattle (Ansary and Hanset, 1972), could be used as a marker to distinguish Bos taurus from BOS indicus.

3. CONCLUSIONS

From the results reported here, it would appear that, from a genetic point of view, the Surqo population is very similar to Boran and Dawara populations. In this respect, it must be noted that the investigation dealt with nomadic populations, among which crossing occurs frequently, and for which no kind of registration and/or pedigree documentation exists.

Nevertheless, a thorough investigation of the-rare variants identified should be conducted, in-view of their possible contribution to the study of the phylogensis of the genus Bos, by generating data concerning the ancient origins of the different popu ations.

Table 1

Phenotypic frequencies of blood antigen factors in the Surqo population compared with those found in the Boran and Dawara populations.

System	Blood factor	Frequency			System	Blood factor	Frequency		
		Surqo	Boran	Dawara			Surqo	Boran	Dawara
A	A	0.72	0.65	0.50	C	C ₂	0.81	0.56	0.68
	Z'	0.20	0.15	0.15		E	0.98	0.82	0.82
B	B ₂	0.59	0.65	0.62		R ₁	0.05	0.01	0.00
	G ₁	0.69	0.59	0.41		W	0.67	0.78	0.56
	K	0.28	0.03	0.00		X ₁	0.82	0.51	0.76
	I ₁	0.23	0.10	0.09		X ₂	0.14	0.27	0.12
	I ₂	0.06	0.09	0.09	F	F ₁	1.00	0.95	0.94
	O ₁	0.49	0.42	0.38		V ₂	0.41	0.29	0.18
	O ₃	0.14	0.06	0.21	J	J	0.63	0.60	0.56
	P	0.51	0.03	0.00	L	L	0.85	0.71	0.79
	Q	0.40	0.35	0.44	M	M	0.00	0.01	0.00
	T ₁	0.24	0.24	0.23	S	S	0.59	0.41	0.32
	Y ₂	0.63	0.54	0.75		S ₁	0.92	0.47	0.47
	A'	0.39	0.14	0.25		S ₂	0.08	0.53	0.50
	B'	0.37	0.13	0.47		U ₁	0.60	0.22	0.32
	I'	0.43	0.39	0.35		U ₁ '	0.11	0.25	0.18
	J'	0.17	0.12	0.21		U''	0.46	0.53	0.41
O'	0.52	0.64	0.35	Z	Z	0.98	0.94	0.91	
P'	0.15	0.34	0.35						
Q'	0.75	0.68	0.50						

Table 2

Distribution of phenotypes of Hb, CA, NP, AI and AmI systems in the Surqo population and respective estimated allele frequencies compared with those found in the Boran and Dawara populations.

System	Phenotype							Allele frequency				
	AA	A(I)	AB	(II)	B(I)	BB		Hb ^A	Hb ^B	Hb(I)		
Hb								Surqo	0.58	0.35	0.07	
	obs.	36	11	61	2	3	11	Boran	0.54	0.42	0.04	
	exp.	41.71	10.07	50.34	0.61	5.08	15.19	Dawara	0.63	0.36	0.01	
									CA ^S	CA ^(Z)		
CA		SS	SZ	ZZ				Surqo	0.86	0.14		
	obs.	77	24	2				Boran	1.00	0.00		
	exp.	76.18	24.80	2.02				Dawara	1.00	0.00		
									NP ^H	NP ^L		
NP		H	L					Surqo	0.67	0.33		
		105	13									
AI		AA	AB	AC	BB	BC	CC		AI ^G	AI ^A	AI ^B	AI ^C
	obs.	5	31	1	74	2	0	Surqo	0.00	0.19	0.80	0.01
	exp.	4.08	34.35	0.43	72.32	1.81	0.01	Boran	<0.01	0.30	0.69	0.01
								Dawara	0.02	0.28	0.69	0.01
AmI		BB	BC	CC					AmI ^B	AmI ^C		
	obs.	94	21	1				Surqo	0.90	0.10		
	exp.	93.96	20.88	1.16				Boran	0.92	0.08		
								Dawara	0.92	0.08		

Table 3

Distribution of transferrin phenotypes in the Surqo population and respective estimated allele frequencies compared with those found in the Boran and Dawara populations.

Phenotype:	Phenotype distribution (*)		Allele frequency			
	obs.	exp.	Surqo	Boran	Dawara	
AA	6	6.40	Tf ^G	0.00	0.01	0.00
AB	1	3.90	Tf ^A	0.23	0.20	0.33
AD ₂	8	9.46	Tf ^B	0.07	0.05	0.05
AF	17	16.14	Tf ^{D₂}	0.17	0.15	0.17
AE	17	13.36	Tf ^F	0.24	0.41	0.33
BB	3	0.59	Tf ^E	0.29	0.18	0.12
BD ₂	1	2.88				
BF	5	4.91				
BE	4	4.07				
D ₂ D ₂	3	3.50				
D ₂ F	12	11.93				
D ₂ E	14	9.87				
FF	13	10.18				
FE	11	16.84	(*)	= 19.27***		
EE	6	6.97				

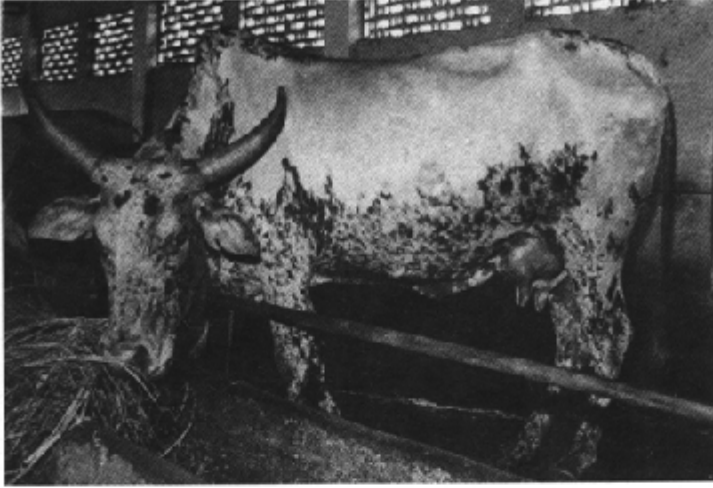


Figure 1. A typical Surqo cow.

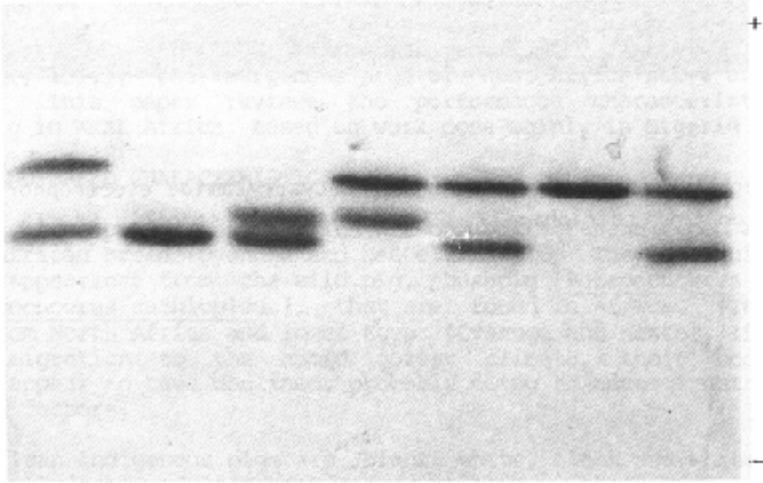


Figure 2. Haemoglobin phenotypes (starch gel electrophoresis); from left to right: AB, AA, A(I), (I)B, AB, BB, AB.

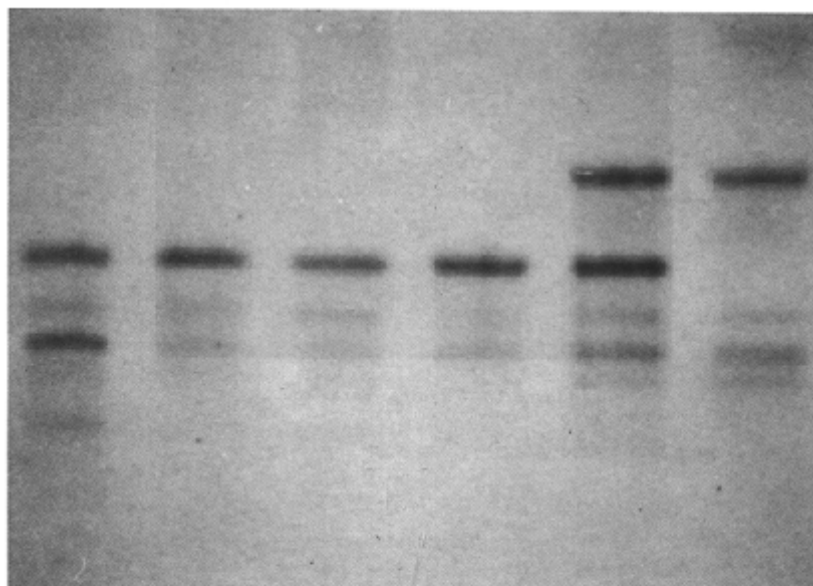


Figure 5. Carbonic anhydrase phenotypes (polyacrylamide electrophoresis);
from left to right: ZZ, SZ, SS, SS (ref. sample), SS, FS (ref. sample).

REFERENCES

- Ansary, M., and Hanset, R. 1972. Purine nucleoside phosphorylase (NP) of bovine erythrocytes: genetic control of electrophoretic variants. *Animal Blood Groups and Biochemical Genetics*, 3, 219-227.
- Ashton, G.C., and Lampkin, G.H. 1965. Serum albumin and transferrin polymorphism in East African cattle. *Nature*, 205, 209-210.
- Braend, M., and Stormont, C. 1963. Haemoglobin and transferrin types in the American buffalo. *Nature*, 197, 910-911.
- Di Stasio, T., Merlin, P., Cristofori, F., Pancani, I., and Sartore, G. 1978. Investigation on genetic polymorphisms in Somali zebu cattle. *Proceedings of the 32nd National Conference of 'SocietA Italiana delle Scienze Veterinariel, Forte dei Matmi.* 32, 259.
- Di Stasio, L., Sartore, G. and Ginanni, C. 1980. Antigen and protein polymorphism in Somali zebu cattle. *Animal Blood Groups and Biochemical Genetics*, 11, 229-234.
- Harris, H., and Hopkinson, D.A. 1978. *Handbook of enzyme electrophoresis in human genetics.* North-Holland Publishing Company, Amsterdam.
- Kristjansson, F.K. 1963. Genetic control of two pre-albumin levels in pigs. *Genetics*, 48, 1059-1063.
- Osterhoff, D.R., 1967. Blood group gene frequencies in South African cattle breeds. *Proceedings of the 10th European Conference of Animal Blood Groups and Biochemical Polymorphism, Paris.* 107-115.
- Penedo, M.C.T., Mortari, N. and magalhaes, L.E. 1982. Carbonic anhydrase polymorphism in Indian zebu cattle. *Animal Blood Groups and Biochemical Genetics*, 13, 141-143.
- Rondolini, G., Fossa, L. and Gaudino, G. 1973. A note on blood protein and enzyme polymorphism in the Piedmont cattle breed. *Genetica Agraria*, 27, 217-223.
- Sartore, G., 1970. Carbonic anhydrase types of cattle red blood cells. *Proceedings of the 11th European Conference of Animal Blood Groups and Biochemical Polymorphism, Warsaw.* 211-216.
- Schwellnus, M., and Guerin, G. 1977. Difference between the Hb C variant in Brahman and in indigenous Southern African cattle breeds. *Animal Blood Groups and Biochemical Genetics*, 8, 161-169.
- Shanker, V., Bhayana, R.K. and Bhatia, S. 1983. Red cell carbonic anhydrase polymorphism in Indian zebu cattle and their crossbreeds. *Animal Blood Groups and Biochemical Genetics*, 14, 287-292.

INDIGENOUS PIG OF NIGERIA

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SUMMARY

Indigenous pigs of West Africa form the majority of the pig population in Nigeria. They are very precocious but have low prolificacy, a low growth rate and poor carcass characteristics. However, the ability to thrive on low-quality diets in stressful environments is quite remarkable. In recent years, there has been a steady decline in the indigenous pig population. Therefore, conservation of the germplasm of this valuable genetic resource is highly desirable.

1. INTRODUCTION

Tropical Africa has an estimated population of 7.3 million head of pigs (FAO, 1981). of these, more than 50 percent are in the coastal regions of West Africa, extending from Senegal to Cameroun. The greatest proportion of the pig population in the region is made up of slow-growing indigenous pigs (Fetuga, 1983). Presently, Nigeria has the largest pig population in West,Africa (Temple and Reh, 1984), estimated at one million animals, of which approximately 60 percent are of the indigenous type (ogunfawora et al., 1980). Although the production potential of the indigenous pig is l@, @t is well adapted to the harsh unfavourable environmental conditions of the tsetse fly”infested humid and sub-humid areas and provides a valuable source of meat and income to small-scale farmers in the region. Therefore, in situations where small-scale farmers cannot provide the nutrition and mmmgement required by exotic improved breeds (Fetuqa et al., 1976), the indigenous pigs of West Africa serve as a valuable alternaff’vi.- This paper reviews the performance characteristics of the indigenous pig in West Africa, based on work done mainly in Nigeria.

2. ORIGIN AND BREED CHAPACTERISTICS

The indigenous pigs of West Africa are of Mediterranean type and are known as the West African breed (Oyenuga and Nestel, 1984). They are quite different in size and appearance from the wild pig, bushpig (*Potamochoerus porcus*) and

warthog (*Phacochoerus aethiivieus*), that are found in Africa. Probably originated from Nor@ A rica and lower Egypt (Oyenuga and Nestel, 1984). In the process of migration to the humid forest climate, their body size and productivity appear to have declined, probably owing to adverse nutritional and environmental factors.

West African indigenous pigs are black, white, black and white or pied in colour with well developed hair coat and erect ears. Their body is small, long and shallow with a level back. A characteristic feature is their long, straight, pointed snout and strong jaws and feet which facilitate searching for feed below ground level. Saws have 5-6 pairs of teats.

Under traditional management systems, adult animals weigh 70-100 kg and measure about 59-63 am at the withers, but there can be considerable variation in this range depending on the management.

In comparison with exotic breeds, indigenous pigs may possess greater heat tolerance and disease resistance (Igboeli and Orgi, 1980) and some kind of trypanotolerance also. However, there is no experimental evidence to support such claims. The authors, observations on these pigs in the sub-humid zone showed that they can tolerate more internal and external parasites than exotic breeds.

3. POPULATION, DISTRIBUTION AND PRODUCTION SYSTEMS

Presently, Nigeria has an estimated population of 0.6 million head of indigenous pigs (ogunfawora et al., 1980). During the last decade, there has been a steady decline in numbers while the exotic and crossbred populations have steadily increased (see Table 1). For example, in some major pig-producing areas of the sub-humid zone, indigenous pigs are virtually non-existent in their pure form, owing to indiscriminate breeding with exotic breeds (Pathiraja et al., 1986).

As in the case of other West African countries, most of the indigenous pigs in Nigeria are also concentrated in the southern humid forest areas (Oyenuga and Nestel, 1984). However, pig production based on indigenous genotypes features quite prominently in some areas in the sub-humid zone as well (Pathiraja et al., 1986). Small numbers of indigenous pigs are also found in the semi-arid northern parts, in isolated pockets. To a large extent, distribution of the pig population is governed by socio-religious factors.

Indigenous pigs are kept mainly under extensive production systems, described as small-scale subsistence production (Dafwang et al., 1986). In this system, animals receive only household scraps but are allowed to roam and find food by scavenging. However, in urban and intensively cultivated areas, indigenous pigs are also kept under semi-intensive systems, confined in low-cost houses and fed agricultural by-products and a variety of plant materials.

4. REPRODUCTIVE CHARACTERISTICS

The breed is very precocious. Females mature at 5 and a half months at a live weight of about 10.6 kg, and the first farrowing occurs at 8-10 months of age (Chiboka, 1981). Its average ovulation rate is 10.6 (Akpokodje et al., 1985), while the mean litter size is 7.4 (with a range of 2 - 14, Ogunfawora et al., 1986; and Fetuga et al., 1976). The litter size increases steadily from the first to the fourth parity and then declines (Adebambo, 1982). Excessively early precocity, as when farrowing occurs at 8 months, results not only in small litters but also in high perinatal mortality (Ogunfawora and Akpokodje, 1981). The latter is associated with a high incidence of dystocia and low birth weight. Although they mature early, gilts are not sufficiently mature physically to farrow at 8 months.

Sows come into heat within 3-9 days of weaning (Somade and Makinde, 1984; and Adebambo, 1986). However, the first heat after weaning is short, particularly the standing heat (Somade and Makinde, 1984). Under improved management, it is possible to get 2.3 farrowings a year and as the preweaning mortality rate is 15.8 percent, about 14 weanlings per sow can be obtained annually. Some parameters of reproductive traits are shown in Table 2.

Sows have good mothering ability and produce richer milk than exotic breeds but have lower total milk yield during a 56-day lactation period (see Table 3). Despite this, indigenous pigs consume more milk per kg of litter gain than the exotic breeds (Adebambo and Dettmers, 1982). During lactation, indigenous sows often lose up to 35 percent of their body weight.

Males can be used for mating as early as 6-9 months of age and their semen characteristics appear to be normal at this age (Ekpe, 1981).

A. GROWTH AND CARCASS CHARACTERISTICS

Piglets of the West African breed are smaller at birth than exotic breeds and the females are lighter than males (Makinde and Olowookorun, 1985 and 1986). The mean birth weight is 1.05 kg while the mean weaning weight is 5.87 kg (Adebambo, 1986). Daily gain, feed intake and feed efficiency of indigenous pigs are lower than those of exotic breeds (see Table 4). The maximum growth rate occurs in the phase between 45-56 kg live weight. The growth rate of the indigenous pig increases from weaning up to 56 kg live weight and beyond this weight average daily weight gain and feed efficiency decrease. Observations on sex effects on the growth

performance of indigenous pigs reared to different terminal weights show that the barrows grow at a faster rate, consume more feed, but utilize feed less efficiently than boars and gilts (Fetuga et al., 1976).

Tissue growth rates are poorer in the indigenous pigs than in the exotic breeds (see Table 4). Lean tissue deposition declines rapidly after 34 kg live weight. The rate and efficiency of tissue growth as well as efficiency of feed utilization indicate that these animals should not be reared beyond a live weight of 45-56 kg (Fetuga et al., 1976).

Indigenous pigs have relatively poor conformation and carcass quality compared to improved exotic breeds (Fetuga et al., 1976). They have a lower proportion of lean cuts and a greater proportion of fat cuts than European breeds (see Table 5). At all slaughter weights, the indigenous pigs are shorter but have thicker back-fat, higher dressing percentage and smaller loin-eye muscle area compared to European breeds (Fetuga et al., 1976). Sex differences in carcass quality are similar to those observed in other breeds. Boars are leaner and have superior carcass conformation than gilts which are leaner than barrows (Fetuga et al., 1976).

B. CROSSBREEDING

F crosses of the indigenous pig with the Large White and Hampshire have been evaluated under intensive management. Data on reproductive, growth and carcass traits (see Tables 5 and 6) show that the crosses exhibit some degree of heterosis for these traits.

5. PERFORMANCE UNDER TRADITIONAL MANAGEMENT

Under traditional management systems, the production potential of the indigenous pig appears to be much lower than its genetic potential (see Table 7). Although the reasons for its low productivity under such management systems are manifold, inbreeding owing to the small population size of individual herds appears to be a significant contributory factor.

6. CONCLUSIONS

West African indigenous pigs have low production potential, but their ability to thrive on low-quality diets under small-scale farmer extensive production systems in the humid forest zone is quite remarkable. With increasing demand for grains by the growing human population, pig production in the region will have to rely increasingly on agricultural by-products which are low in quality and bulky in nature. Therefore, there is every justification to conserve the valuable germplasm of the West African indigenous pig, not only for use in its pure form but also to introduce its adaptational qualities to exotic, high-producing but susceptible populations. An effective way of doing this is to improve its genetic potential for production while conserving its valuable adaptation characteristics.

REFERENCES

- Adebambo, A.O. 1982. Evaluation of the genetic potential of the Nigerian indigenous pigs. Proceedings of 2nd World Conference on Genetics Applied to Livestock Production, Madrid. pp. 543-553.
- Adebambo, A.O. 1986. Pig improvement and development in the tropics: the application of breeding and genetics. Proceedings of the International Seminar on Pig Production in the Tropics, University of Nigeria, Nsukka. February 1986.
- Adebambo, A.O. and Dettmers, A.E. 1982. Efficiency of feed and milk utilization by litters of indigenous and exotic pure and crossbred pigs. *Tropical Animal Production*, 7: 204-208.
- Akpokodje, J.U., Osuagwuh, A.I.A. and Akusu, M.O. 1985. Ovulation, foetal distribution and migration of the indigenous pigs of Nigeria. Nigerian Society for the Study of Reproduction. 5th Annual Meeting, Ibadan.

- Chiboka, O. 1981. The effect of age at first mating on litter characteristics in the native Nigerian pig. *Livestock Production Science* 8: 155-159.
- Dafwang, I.I., Balogun, S.T. and Pathiraja, N. 1986. Extension services and pig production in Nigeria. *Proceedings of the International Seminar on Pig Production in the Tropics*, University of Nigeria, Nsukka. February 1986.
- Ekpe, G. 1981. Enzymes and proteins of the testicular and epididymal sperm cells of the indigenous West African boar. MSc thesis, University of Ibadan, Nigeria.
- FAO 1981. *Production Yearbook*, FAO, Rome.
- Fetuga, B.L., Babatunde, G.M. and Oyenuga, V.A. 1976. Performance of the indigenous pigs of Nigeria under intensive management conditions. *Nigerian Journal of Animal Production* 3: 148-161.
- Fetuga, B.L., Babatunde, G.M.- and Oyenuga, V.A. 1976. Comparative physical carcass characteristics in the indigenous Nigerian and imported European pigs. *Nigerian Journal of Animal Production* 3: 74-85.
- Fetuga, B.L. 1983. Efficient utilization of feed resources and the development of feeding technology suited to the African region. *Proceedings of Vth world Congress on Animal Production*, Vol. 1, 113-121.
- Igboeli, G. and Orji, B.I. 1980. Female reproduction of tolerant breeds and the possibility of artificial insemination in West Africa. *FAO/SIDA Workshop on the Breeding of Trypanotolerant Livestock*. Lomé, Togo.
- Makinde, M.O. and Olowookorun, M.O. 1985. Post-natal development in the Nigerian indigenous and Large White piglets raised in a tropical environment. *Animal Technology* 35: 169-175.
- makinde, m.o. and Olowookorun, M.O. 1986. Use of SBX dye in plasma and blood volume measurements in the Nigerian indigenous pig from birth to weaning. *Bulletin of Animal Production and Health, Africa* 34: 21-23.
- Ogunfowara, O.I., Olayemi, I.K., Fetuga, B.L. and Amogu, N. 1980. An evaluation of the state of development and economics of pig production in Nigeria. Study commissioned by the Federal Livestock Department, Lagos, Nigeria.
- Osuagwu, A.I.A. and Akpokodje, J.U. 1981. Age of first breeding and incidence of dystocia and losses at parturition and postpartum in the indigenous Nigerian pig. *Animal Reproduction Science*, 4: 149-153.
- Oyenuga, and Nestel, B. 1984. *Animal production systems in humid Africa*. World Animal Science Basic Information. Ed. B. Nestel, Elsevier, Amsterdam.
- Pathiraja, N., Oyedipe, E.O. and Alhassan, W.S. 1986. Pig production in Nigeria - country report. *Pig News and Information* (in press).
- Pathiraja, N., Rekwot, P.I., Oyedipe, E.O., Alhassan, W.S. and Dawuda, P.M. 1986. Studies on pig production systems in the sub-humid zone of Nigeria. (unpublished).
- Somade, B. and Makinde, A.O. 1984. The influence of season on sow weaning to oestrus interval and subsequent reproductive performance following oestrus synchronization by batch weaning. *Beitrag Trop. Landwirtschaft. Veterinarmed*, 23: 339-343.
- Temple, R.S. and Reh, I. 1984. *Livestock populations and factors affecting them*. World Animal Science. Development of animal production systems. Ed. B. Nestel, Elsevier, Amsterdam.

Table 4

GROWTH RATE AND EFFICIENCY OF TISSUE DEPOSITION IN INDIGENOUS (I) AND EXOTIC (E)
PIGS FROM WEANING TO DIFFERENT TERMINAL WEIGHTS

	Terminal Weight (kg)											
	34.1		45.5		56.8		68.2		79.6		91.0	
	I	E	I	E	I	E	I	E	I	E	I	E
Mean daily live weight gain (kg)	0.29	0.48	0.30	0.55	0.32	0.61	0.34	0.65	0.31	0.74	0.30	0.78
Feed efficiency (kg feed/kg gain)	3.06	2.11	3.38	2.26	3.60	2.49	3.85	2.74	4.21	3.36	4.68	3.52
Lean deposition (g/day)	160.5	284.6	174.2	342.0	180.7	381.0	183.0	413.0	164.4	470.8	155.5	491.8
Fat deposition (g/day)	66.8	85.8	103.1	123.0	122.3	155.0	145.7	196.5	146.4	241.3	150.5	269.7
Bone deposition (g/day)	27.8	47.4	30.9	53.6	27.9	57.9	28.4	60.2	26.3	61.7	26.1	61.0
Ratio of lean to fat deposition	2.4	3.3	1.96	2.78	1.48	2.46	1.26	2.10	1.12	1.95	1.03	1.82

Adapted from Fetuga et al., 1976

TABLE 1

ESTIMATED POPULATION OF LOCAL AND EXOTIC BREEDS OF PIGS IN NIGERIA, 1975-1985 (1000)

Year	Local	Exotic	Total
1975	771.3	95.3	866.6
1976	761.7	103.9	865.6
1977	752.4	112.4	864.8
1978	743.1	121.0	864.1
1979	734.0	129.6	863.6
1980	718.5	146.7	865.2
1981	718.2	179.8	898.0
1982	709.6	224.0	933.6
1983	679.7	291.3	971.0
1984	656.4	353.4	1009.8
1985	609.1	441.1	1050.2

Source: Ogunfowora *et al.*, 1980.

TABLE 2

SOME REPRODUCTIVE TRAITS OF INDIGENOUS SOWS UNDER INTENSIVE MANAGEMENT

Mean litter size at birth	7.15
Mean litter size at weaning	6.30
Gestation length (days)	113.10
Litters/saw/year	2.36
Pigs/saw/year	14.50
Interval in days	
Weaning to oestrus	9.86
Farrowing to mating	51.79
Between farrowings	164.80

Adapted from: Adebambo, 1986.

TABLE 3

AVERAGE MILK YIELD AND COMPOSITION OF INDIGENOUS AND EXOTIC SOWS UNDER INTENSIVE MANAGEMENT

	IND 1/	BREED LW 2/	LR 3/
milk production/sow (kg) (lactation of 8 weeks)	54.3	112.2	95.7
Milk composition (%)			
Total solids	22.4	19.4	19.7
Protein	6.9	6.3	6.4
Fat	9.3	6.9	6.9
Lactose	5.4	5.4	5.7
Ash	0.83	0.71	0.73
Calcium	0.47	0.28	0.27
Phosphorus	0.19	0.14	0.14

1/ IND - Indigenous.

2/ LW = Large White.

3/ LR = Landrace.

Source: Adebambo and Dettmers, 1982.



West African indigenous sows.

TABLE 5

PERFORMANCE OF INDIGENOUS AND EXOTIC PIGS AND THEIR F 1 CROSSES UNDER INTENSIVE MANAGEMENT

Trait	Pure Breeds			Crosses	
	LW 1/	HA 2/	IND 3/	LWXIND	HAXIND
Litter size at birth	8.75	8.25	7.15	8.36	7.89
Birth weight (kg)	1.58	1.95	1.05	1.40	1.35
Weaning weight (kg)	9.95	12.45	5.87	8.82	10.80
154-day-weight (kg)	57.85	62.51	30.53	55.44	56.45
Mortality up to slaughter (%)	38.15	17.82	6.49	12.32	11.22

1/LW=Large White.

2/HA=Hampshire.

3/IND=Indigenous.

Source: Adebambo (1986).

TABLE 6

CARCASS CHARACTERISTICS OF INDIGENOUS AND EXOTIC PIGS AND THEIR F 1 CROSSES

Trait	Pure Breeds			Crosses	
	LW 1/	HA 2/	IND 3/	LWXIND	AXIND
Age at slaughter (days)	149.2	146.8	174.0	156.0	154.6
Weight at slaughter (kg)	51.6	52.6	49.8	52.3	51.2
Carcass yield (%)	65.4	66.8	65.7	60.4	64.7
Carcass length (cm)	65.0	68.1	60.5	64.1	66.6
Back-fat thickness (mm)	19.6	16.1	22.0	20.4	18.2
Carcass lean (%)	54.7	58.7	52.7	52.5	55.4
Carcass fat	26.5	29.3	28.5	27.9	31.2
Ham	29.0	30.8	26.8	28.2	31.8
Shoulder	20.9	16.8	21.10	21.4	16.5

1/LW=Large White.

2/HA=Hampshire.

3/IND=indigenous.

Source: Adebambo (1986).

TABLE 7

PRODUCTION CHARACTERISTICS OF INDIGENOUS PIGS UNDER SMALL-SCALE FARMER PRODUCTION SYSTEMS IN THE SUB-HUMID ZONE 1/

Trait	Mean	Range
Age At first litter (months)	16	13-22
Litter size at birth	5.1	1-16
Litter size at weaning	4.0	0-8
Mortality to weaning	22.5	15-35
Weaning age (weeks)	9	7-13
Number of litters/sows/year	1.3	1-2.2
Mortality from weaning to slaughter	12	4-18
Age of boars at first mating (months)	15	10-21

1/ Data is based on 35 small farms.

Source: Pathiraja *et al.* (1986).

POLISH RED CATTLE: A SCHEME FOR THEIR CONSERVATION

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SUMMARY

Polish Red is the only indigenous cattle breed in Poland. Breeding was first started at the end of the 19th century. At the end of the 1960s the breed constituted more than 20 percent of the total cattle population in Poland. During the 1970s Polish Red cattle were superseded by Friesian, and now there are about 200 000 cows left (i.e., 3 percent of the total population).

These dual-purpose (dairy-beef) animals are hardy and well adapted to rather poor feeding conditions. An improvement programme, through crossbreeding, would likely diminish their original characteristics. Therefore, together with breed improvement, a gene reserve in the form of a conservation herd of 300 cows and a gene bank of frozen semen and embryos have been implemented. A systematic breeding programme has been implemented also to maintain the old genotype and ensure wider genetic variation within the herd.

1. HISTORY

Polish Red is an indigenous cattle breed originating from uniformly red cattle of different shades - from red to brown. They used to be the native cattle of western and southern Slavonic peoples and of all Baltic countries. The first time that particular attention was paid to Polish Red cattle in terms of breeding was at the end of the 19th century, when the Red Cattle Breeders' Association was founded by the Agricultural Society in Cracow in 1894. The first monograph describing the breed was published by Adametz in 1901; he classified it, according to its craniological type, as originating from *Bos brachyceros* (europeus). The introduction of milk-data recording in 1906 marked the beginning of selection work. In 1913, volumes I and II of the herd book were published. Between the two world wars, these cattle were bred successfully and played a significant role in the rural economy of Poland.

At the end of the 1960s, there were about 2 million head of this breed in the southern and eastern parts of Poland, i.e., about 20 percent of the total cattle population. From the year 1960 Danish Red and, to some extent, Jersey bulls were used in this breed, since high-production herds no longer had high-quality sires. In southern regions, however, there remained areas where this crossbreeding was not practised.

2. CHARACTERISTICS OF THE BREED

The environment and especially feeding conditions in the habitat of Polish Red cattle were never favourable to high production. Cattle were fed exclusively on pasture and, during the winter, mainly or exclusively on hay. This breed evolved under circumstances where natural selection gave rise to the development of traits which rendered the animals very hardy and well adapted to the harsh environmental conditions, although yields were rather low. Selection has been minimal, so the breed is poorly specialized and characterized by several inconsistent genetic features, and performance reflects highly varied levels of production.

The breed is dual-purpose (dairy and beef). The mature weight of cows is 380-550 kg and their height at the withers is 115-130 cm. Milk yield averages about 2 500 kg. In 1982, milk-production data revealed that 1 600 cows averaged 3 096 kg milk, 127 kg fat and 4.10 percent fat; in 270 days of first lactation, the figures were: 2 705 kg, 118 kg and 4.35 percent, respectively.

The yield of the best-performing cow in 1982 in 305 days was: 5 704 kg, 274 kg and 4.80 percent, respectively and of dams of young sires in 305 days it was: 5 088 kg, 228 kg and 4.50 percent, respectively. The protein content in milk averaged 3.5 percent and total solids averaged 12.7 percent. Poor and unequally developed udders constitute a frequent body conformation defect.

This breed possesses a number of significant advantages, such as longevity, high fertility, disease resistance and a high survival rate for calves. For instance, during breeding trials it was easy to find several 17-to-20-year old cows as embryo donors which were fertile and calving regularly. Good reproductive ability was demonstrated also by the fact that only 4 percent of young breeding bulls having met performance test requirements were unsuitable for reproduction purposes, compared to 12 percent of Friesian bulls. There were no problems with mastitis, and the whole population was free of tuberculosis and, to date, of leukaemia.

Milk from Polish Red cows is distinguished by its very good technological properties and is used as raw material in the manufacture of Emmental cheese. Meat from young fattened bulls is of the highest quality, but the breed does not meet contemporary modern farming requirements as fattening to higher weights is unprofitable. Cattle of this-breed are not big. Adult bulls reach 700-900 kg, and daily weight gain becomes too low when their weight exceeds 400 kg. Therefore, commercial crossbreeding has been fairly extensive, and about 20 percent of cows are inseminated with semen from Charolais or Simmental bulls. The crossbreds obtain very good slaughter evaluation.

3. THE PRESENT SITUATION

When agriculture was intensified during the 1970s, Polish Red cattle were replaced by Friesian and Red-and-White cattle in almost all regions. In spite of pressure to introduce Friesians, this native breed survived owing to the efforts and persistence of some farmers. They appreciated its advantage over other breeds in harsh agricultural/environmental conditions. There are now about 200 000 head left. The breed is found in southern Poland in the foothills of the Carpathians (about 100 000 in an area where there are exclusively Polish Red cattle) and in some pockets in south-central and north-east Poland. About 99 percent are on smallholdings, with an average size of 5 ha. In the submontane region, the cattle are kept at a high stocking rate (98 head, with 55 cows on 100 ha).

Animal husbandry practices have changed during recent years, however, including those practised in areas where Polish Red cattle are bred. This process is influenced by the intensification of feedstuff production, an increasing number of specialized dairy farms, and especially by the fact that milk production has become profitable.

About 60 percent of Polish Red cows are inseminated artificially. At present about half of these cows have been, and soon most of them will have been, mated with proven sires. Plans for genetically improving this population aim at obtaining quickly genetic improvement for higher and more effective milk production. Great variation in milk performance in this breed makes it possible to obtain a high selection differential. Thus, the fat yield of dams of young sires is now almost twice the average performance of all Polish Red cows according to milk-production data. Crossbreeding with foreign breeds is also included in the programme. Good results were obtained by crossbreeding with proven Angler sires. Crossbred heifers averaged 3 416 kg of milk, 4.29 percent fat, and 3.32 percent protein. Their advantage over purebred Polish Red contemporaries reached 700 kg of milk and 0.15 percent fat content. Their lactation lasted an average of 301 days compared to 249 days for Polish Red heifers. Since these results are encouraging, Angler bulls will be used again this year.

4. MEASURES TO CONSERVE GENETIC QUALITY

The breeding program being carried out now may result in some of the original characteristics of these cattle becoming weaker. Therefore, the Ministry of Agriculture and Food decided to establish a gene reserve for conserving the old genotype of this breed. Two main methods of conservation were employed: the creation of gene banks for frozen semen and embryos and a breeding herd.

A matter of high priority was the collection of semen. Two hundred doses or more of semen were collected from 40 bulls. These were intended for current use in the conservation herd, as well as for long-term storage.

To enlarge the reserve of purebred animals, the practice of embryo freezing has been started. To date, 82 eggs from 11 cows, 17 to 20 years old, have been collected non-surgically. Of those, 39 embryos were morphologically normal and were frozen. However, long periods of hormonal imbalance after treatment made the use of older animals inefficient and as such was stopped (Wierzbowski, *et al.*, 1984). A new group of purebred cows is now ready for this purpose. According to the results of the previous experiments, a calving rate of 35 to 55 percent, after transfer of frozen embryos, and of 50 to 65 percent, after transfer of fresh embryos, may be expected.

Within the small closed population of a conservation herd, changes in genotype occur with time. Inbreeding is the cause of this genetic drift. An increased rate of inbreeding decreases genetic variation. In order to limit this occurrence, carefully planned breeding is required when keeping a small group of breeding females. Breeding ought to ensure the maintenance of original and valuable breed characteristics, as well as wide genetic variation within the herd.

The following factors were taken into consideration in creating and managing the conservation herd: a) herd size, and selection of initial material; b) division of the herd into groups; c) mating system; and d) choice of offspring to be kept in the herd.

a) The relatively high cost of maintaining unimproved stock means that its size must be limited. A herd size of 300 head was calculated to be the minimum required (Reklewski *et al.*, 1982). Also, Klautschek (1984) demonstrated that a minimum of 300 cows is needed in a closed herd for breeding activities. Increasing the inbreeding coefficient in subsequent generations, by random mating, depends on the sex which occurs in the smaller number (Falconer, 1960), in this case male. Increasing the number of cattle of the other sex will not have a noticeable effect on decreasing the inbreeding rate.

A conservation herd of 300 cows was formed in 1983. It is kept on three separate farms. The cows were selected from all regions native to the breed. The semen of 20 bulls representing 6 genealogical lines was selected from the gene bank. The bulls were interrelated to a very limited degree.

b) Since there is a ratio of males to females of 1:15, the herd of cows was divided into groups of 15 cows each. Animals of the initial generation should not be related to each other, not even to a limited degree, i.e., sires to each other and dams of one group to dams of the remaining groups. Within a group of females, however, close relationships are permissible. Animals resembling each other were put in the same group. Purebred cows were grouped together according to their pedigrees and the non-pedigree cows were grouped according to their body conformation type and size, their birth place and blood group. Bod6 *et al.* (1982) and Bod6, (1982) believe that blood groups, especially according to the number of 'BI alleles, as well as other polymorphic alleles, may be helpful in dividing into groups animals of which the pedigree is unknown. Heifers bred through embryo transfer are added to the family groups.

c) Each group of cows was inseminated with the semen of one bull. To avoid excessive inbreeding, controlled mating practices should be followed. To do this, a bull with the least relationship to a given group of cows should be chosen systematically every generation.

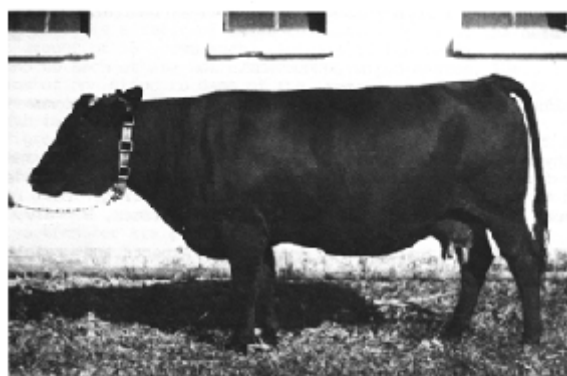
After cow grouping, a mating plan for many future generations should be prepared. The second generation would be inseminated again with the semen of bulls selected from the gene bank. Subsequently, bull production would then be based exclusively on the conservation herd. From the third generation, female progeny of a given group would be mated to a bull selected from the progeny of a different group of cows, thus creating a rotational mating system. However, this method is still being investigated as Bodó et al. (1982), on the basis of Yamada's research (1980), suggest that instead of Rotational mating, a more correct procedure would be to divide the stock into a 'few subpopulations and to breed cattle separately through 8-10 generations - allowing them to. inbreed - and then to mate those subpopulations with each other.

d) The size of the conservation herd will be constant; therefore, only a part of the offspring would be used for further breeding. Selection runs counter to maintaining genetic variation within a population. During the routine improvement of commercial performance, genes and their unique combinations disappear unintentionally owing to selection. Genes which determine specific and rare traits for an indigenous breed can never be replaced with new genes introduced from outside,.

To avoid decreasing the original variation, heifers should be brought into the herd at random. On the other hand, it is also desirable to maintain such traits as high milk-fat content and longevity in this conservation herd, if we hope to use the conserved genetic material in the future for improving the population continually. Therefore, these traits should be taken into consideration in the selection of young sires. Selected sires must come from dams with at least 6 recorded lactations and they should possess milk-production capabilities of above average milk-fat content and fat yield. In every group of cows, 2 or 3 should be selected as dams of young sires. In this way, every group would generate a young sire every 2-2.5 years. To minimize the rate of inbreeding, a general rule has been formulated: one male descendant per sire, and one female descendant per dam, as recommended by Smith (1983). Every cow should likely bear the herd a heifer.

This undertaking is expensive and requires constant government subsidies. Part of the purpose of preserving Polish Red cattle is the possibility that in the future their traits in milk and meat quality may be valuable economically.

Such traits, as well as their hardiness, mean that these cattle may be a genetic resource for future breeding. moreover, Poland's only indigenous cattle breed should be preserved as a living example of Polish agricultural history.



Polish Red - Cow and Bull. (photo credit Maria Pazdan).

REFERENCES

- Adametz, L. 1901. Studien uber das polnische Rothvieh. C. Fromme Hof-Verlag, Wien.
- Bodó I., Dohy, T. and Tokács, E. 1982. Theoretical aspects and practical methods for maintaining gene frequency in domestic animal breeds which are exposed to the danger of becoming extinct. Paper for the International Conference on Gene Reserves, 6-9 Sept. 1982, Debrecen, Hungary, 5 pp.
- Bodó I. 1982. The Hungarian Grey cattle. conservation. *Ibid.*, 5 pp.
- Falconer, D.S. 1960. Introduction to quantitative genetics. Oliver and Boyd, Edinburgh.
- Klautschek, G. 1984. Beitrag zur mathematisch-statistischen Planung des Umfanges von zuchttierpopulationen. (In press).
- Reklewski, Z., Wezyk, S. and Zukowski, K. 1982. Preservation of Polish Red cattle. Paper for the International Conference on Gene Reserves, 6-9 Sept. 1982, Debrecen, Hungary, 5 pp.
- Smith, C. 1984. Economic costs of conserving Animal Genetic Resources., *Animal Genetic Resources Information*, 3.10-14.
- Wierzbowski S., Wierzchos, E., Smorag, Z., Kareta, W., Gajda, B., Krupintki, J. and zukowski, K. 1984. The practical application-of-embryo freezing and transfer for preservation of endangered Polish Red cattle and long-wool primitive sheep. *Proceedings of the 10th International Congress on Animal Reproduction and AI*, 10-14 June 1984. Urbana, the USA. (Accepted for publication).

ISTRIAN CATTLE

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SUMMARY

The Istrian breed of cattle, of the Yugoslavian peninsula of that name, is an endangered species. The Istrian breed is related to other Podolic breeds and research into its genetic relationships with other breeds, as well as its conservation through the establishment of open nucleus units, frozen embryo stocks and a semen bank is being undertaken.

1. INTRODUCTION

The peninsula of Istria is the biggest peninsula of Yugoslavia and is situated off the north-eastern coast of the Adriatic, opposite Italy (see Figure 1). The first data on cattle in Istria were registered by Povse (1894). In the 1890s, there were about 50 000 cattle in Istria and according to Povse (1894), there were four breeds: Buje, Labin, Istrian Karst and self-coloured light cattle. According to Ogrizek (1957), the Buje breed is identical to Istrian.

The Istrian Karst breed is small and approximately 110 cm in height at the withers. It was mainly bred in Cicaria and thus crossbred with Kranjska, Gorica and Croatia cattle.

Cattle from the basin of Labin are similar to the Istrian Karst breed. As this breed walked at a quick pace, it was given the name I - bue cavallol.

Late in the 19th century, only a few of the self-coloured light cattle, described as autochthonous by Povse ("bue indigeno bianco"), remained. This breed resembled Mariadvori cattle.

Buje or Roman cattle were, according to Povse, imported from the Italian regions of Romagna and Puglia at the end of the 18th century. They were of average size and the cows weighed 350-450 kg, and measured roughly 134 cm at the withers. The cows were not milked and fattened oxen attained a weight of 700-950 kg, with carcass percentage of approximately 52 percent.

According to the 'Appunti zootecnici' (from the Inspector's Office of Pula, 1954) Istrian draught cattle are said to have been brought to the peninsula by Roman legions from the plains along the Danube estuary and also by Attila's hordes (in 452 AD), from the steppes of south Russia and Bessarabia. Data from the same source show that Istrian draught cattle were crossbred, around the year 1800, with bulls of Podolic breed imported from Romagna and Puglia and later from Marcha and Polesina. Under Istrian conditions and over a long period of time, with only little crossbreeding with Italian-type Podolic cattle, a special breed of cattle was created and named after the centre of its breeding, Buje. From 1886 to 1931 Buje cattle were improved through the introduction of selected bulls in the region of Buje, initially Romagnola bulls and later on Maremma bulls.

Following a Zootechnics Conference held in Padova in 1931, the practice of home improvement was established by means of maintaining bull stations, where selected bulls were kept.

According to Smalcelj et al. (1958), Istrian cattle made up 70 percent of the total cattle population in Istria after World War II. Then Brown Swiss cattle numbers tended to increase until, in 1972, out of a total of 18 000 cows and pregnant heifers, 7 500 head were Brown Swiss and Istrian cattle crossbreds, and approximately 10 500 head were Istrian cattle (Sic, Rakos and Putinja, 1973). In the same year, 5 950 Istrian cows and heifers and 2 802 head of F 1 generation, resulting from crossbreeding with Brown Swiss, were inseminated. Istrian Podolic cattle are still threatened by other cattle populations.

2. DESCRIPTION OF THE BREED

The Istrian breed is of light grey to white colour with some darker shades. It has long horns and hard hooves. It is a late-maturing breed and reaches adult size when it is 6 to 7 years old.

The height at the withers of an adult cow is 136-138 cm, body length is 152-153 cm and chest-depth is approximately 69 cm. The bull can weigh up to 700 kg and its height at the withers is about 148 cm. Fattened oxen can weigh more than 1 000 kg. Istrian cattle reach a height similar to Hungarian Podolic cattle (Bodó and Reti, 1985) but they are somewhat shorter and thinner.

Compared to other Yugoslavian Podolic types (from Posavina or Kolubara), whose numbers are diminishing, Istrian cattle have a larger frame and body size (ogrizek, 1957 and 1963).

3. PHYSIOLOGICAL CHARACTERISTICS

The draught power of the Istrian breed is excellent. Its step, although unhurried, is steady and strong. It has a lively temperament and obeys readily. moderate in intake, it feeds on pasture, browse vegetation, dry leaves, straw and corn stalk. It is resistant to heat. These factors contribute to the fact that oxen are **used** for ploughing for 12-15 years.

The fattening-capacity of the Istrian breed is moderate. The meat of young animals is succulent, while that of the older animal is tough and dark-red in colour with rough fibres. Fat deposits form around the abdominal organs and muscle tissue is lean. Normal carcass percentage is 50-52 percent while for a well-fattened ox it can exceed 56 percent.

The milk yield of the Istrian cow is poor - about 1 000 l milk during lactation - with 4-4.5 percent milk fat. The udder is small and fleshy and the teats are short. Cows are not milked and the calves suck for 5-6 months. The Istrian cow is highly fertile and calves every year for a period of 12-15 years.

4. CONSERVATION PROGRAMME

In 1987 Majjala elucidated reasons for the preservation of the small number of rare cattle breeds associated with the characteristic climate and economic development of Istria. The conservation of Istrian cattle is of significant importance in view of these considerations:

- their excellent draught power under difficult conditions;
- their use in the production of biological' food and the exploitation of marginal pasture land;
- their successful use in landscape management;
- their role in the production of female animals for crossbreeding purposes in meat production;
- the need for production of animals for experimental purposes and research (in genetics, physiology, biochemistry, immunology and morphology, etc.);
- their importance in the fields of ethnography, history and genetics;
- their role in ensuring preservation of local culture and tradition (as examples of living cultural heritage,);
- their use in zoological gardens as tourist attractions, and for ceremonial purposes;
- their use in teaching animal science; and
- in demonstration of man's ethical respect for all living creatures.

The principal motive for preservation of Istrian cattle, however, is the importance the breed could have for cattle development in the future and, hence, one is inclined to accept the statement of Bowman (1981), cited by Majjala in 1987; that is, for animal production in the future and for quicker and cheaper reproduction of desirable types of animals, it is more important to conserve a wide range of genetic variation rather than to develop 'over sophisticated forms of within-population selection'.

Conservation of the breed is based on two aspects:

a) Establishment of four open nucleus units

The programme foresees laying the foundation for the establishment of open nucleus units at four localities, where cattle are kept freely in fenced areas similar to wildlife conditions. The establishment of four herds with 50 female animals in each is planned, including the number of bulls required for natural insemination.

one such herd is to be located in Buzet and in addition to Istrian it will also include the Pannonian type of Podolic cattle. The initial stock (19 head) will be used for research on external characteristics, reproductive criteria and genetic relationships to other types of Podolic cattle (through transferrin and haemoglobin analyses). Previous research carried out in this field will help in formulating methods and analyses (Gaspert, 1977).

The origin of Istrian cattle is linked to the development and migration of other Podolic types of cattle from their Middle Eastern origins through Pannonia, to central and southern Italy. Research carried out on the genetic relationships among the Istrian cattle population will contribute to an understanding of its historical development and also to the origins of Podolic cattle in this part of Europe. This idea was recommended to the authors by Astolfi et al. (1983), who were of the opinion that migration paths could be traced by analysis of the frequency of cattle genes in the areas situated along these hypothetical paths (see Figure 1).

b) Semen and embryo conservation

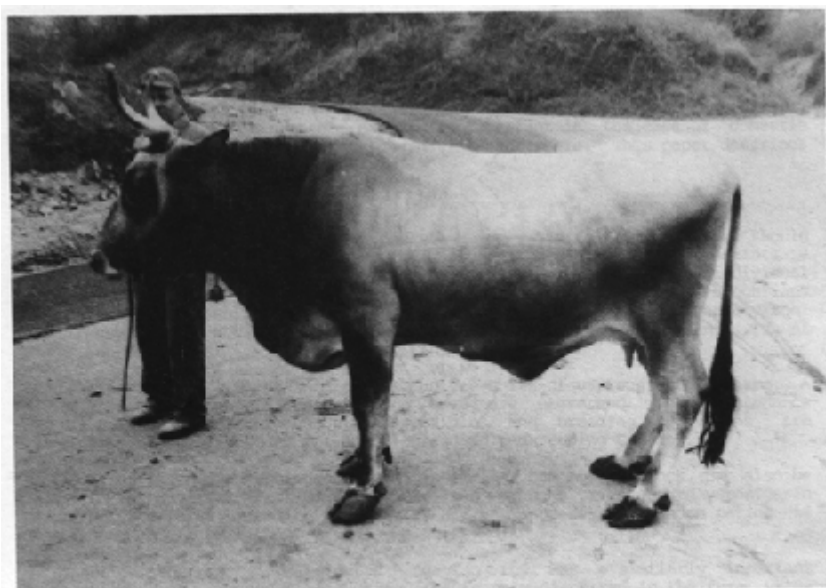
The constraints of breed preservation through living animal gene collections (for example, maintenance costs, accident and disease risks, inbreeding depression, possible contamination from other breeds and genetic drift) would be overcome by practising simultaneous conservation of frozen semen and embryos.

The additional advantage of freezing embryos would mean that the breed can be regenerated and used for crossbreeding within a generation, even if the number of live animals is zero or minimized to show only its type and colours to our descendants, (majjala, 1987).

In order to avoid accidental risks, Istrian cattle semen banks will in future be located in three places rather than one as at present. The technique of embryo transfer is being improved, and it will soon be possible to produce and freeze adequate numbers of Istrian cattle embryos. The calculations of Smith (1984), cited by majjala (1987), on the possibility of a conserved gene-inventory being exploited in the future would be especially useful.

REFERENCES

- Astolfi, P. et al., 1983. Phylogenetic analysis of native Italian cattle breeds. *t.-TierzUchtg. Zilchtgsbiol.* 100, 87-100.
- Bod6, I. and Reti, J., 1985. Qualities of Hungarian Grey Cattle (steppe) in small population beef herds. 36th Annual Meeting of the European Association for Animal Production (EAAP), Kalithea.
- Brinzej, M. and Rastija, T., 1974. Slavonsko podolsko govedo. *Stocarstvol* 3-4, 119-125.
- Caput, P. et al., 1986. Zastita autohtonih pasmina goveda. III jugosl. kongres za razmnozavanje i uzogoj zivotinja. *zbornik radova*, vol. II, 559-565.
- Gaspert, Z., 1977. Prilog poznavanju B - globulinskog polimorfizma kod crno-sarih i simentalskh krava i povezanost polimorfnih tipova s proizvodnjom mlijeka. *Polj. znan. smotra*, sv. 40 (50) 71-83.
- Majjala, K., 1987. Surveying animal breed resources in Europe. *Det kgl. danske Landhusholdningscelskab.*
- Majjala, K., 1987. Possible role of animal gene resources in production, natural environment conservation, human pleasure and recreation. *FAO Animal Production and Health Paper*, No. 66.



Istrian Podolie cow, 12 years, 650 kg.

Owner: Blaković Franjo, Ordošelo near Pazin

Foto: Mumančić M. (1988.)

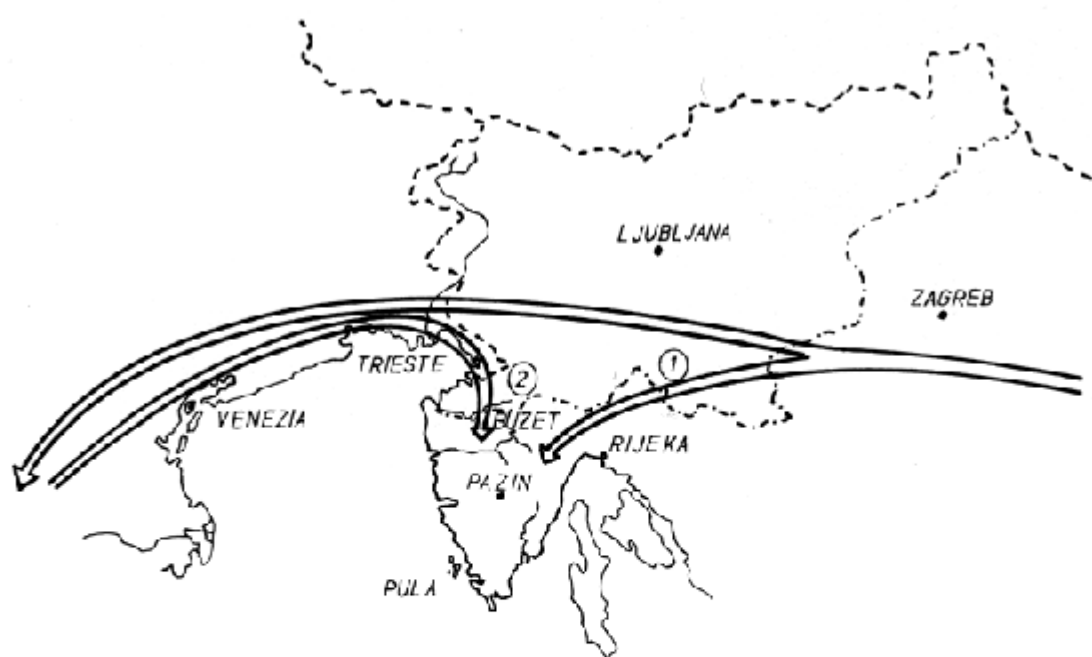


Fig.1. The lines drawn may indicate migration pathways of Podolic cattle to peninsula Istra.

Route (1) is the accepted path of migration of the Podolic stock. Route (2) indicates the diffusion of the Italian podolic breeds to Istra.

- ogrizek, A., 1957. Prilog poznavanju istarskog primigenog goveda (I dio) Acta biologics I, 155-186, Zagreb.
- ogrizek, A., 1963. Prilog poznavanju istarskog primigenog goveda (II dio) Acta biologics III, 5-14, Zagreb.
- Povse, F., 1894. Rinder in der Karst und Kilstenlgnder.
- Sic, R., Rakos, F. and Putinja, F., 1973. Sadaanje stanje reprodukcije goveda Istre s posebnim osvrtom na istarsko govedo. Stocarstvo 7-8.
- Smalcelj, I. et al., 1958. Razvojne tendencije pasminske strukture govedarstva Istre. "Stocarstvo" 1-2, 2-15.

THE NAKED NECK FOWL

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SUMMARY

The genetic value of ancient breeds of livestock is recognized increasingly all over the world. This seems especially important in the case of domestic fowl where hybrids are increasingly dominating everywhere. This paper describes some old Hungarian breeds.

Within the species of domestic fowl in Hungary the following breeds should be taken into consideration for preservation: the three colour variants white, yellow and speckled - of improved fowl, already classified as individual breeds called White Hungarian, Yellow Hungarian and Speckled Hungarian, respectively. The white and speckled breeds both have a naked neck variety too. The Transylvanian Naked Neck, although similar to the above variants, is of different origin.

These breeds are maintained in the poultry units of various state farms. A minimum of 200 or more layers of each breed are preserved. The maintenance costs are financed through state subsidies and breeding activities are supervised by the Institute for Animal Breeding and Feeding Control.

Some of the above-mentioned breeds, in smaller numbers of stock, can also be found in the National Park of Kis-Kunscig, and in some private farm yards. In these private farms, breeding activities are not supervised, random roosting is practised, and no particular breeding plan is followed.

Earlier, the partridge-coloured Hungarian fowl was a similarly important attractive breed. Nowadays this breed occurs only dispersed in the farm yards of small households, mostly crossbred with other breeds. The institution responsible for the maintenance of genetic resources is planning also the reconstruction and preservation of this breed. All these breeds developed from the Hungarian native fowl in the course of centuries.

The Transylvanian Naked Neck Fowl, perhaps the most interesting of the above-mentioned breeds, according to Csukás (1955), was brought from Asia Minor to Transylvania, Serbia and Bosnia during the Turkish occupation of Hungary more than 400 years ago. In the opinion of Hreblay (1900), this breed originates from elsewhere and not from Asia minor. The breed is mentioned sometimes as 'Szeremley fowl', after the name of Szeremley, who first took it to the Vienna International Exhibition in 1875. The use of this name as the breed designation has been disputed as Szeremley was not its breeder, he simply brought it to the exhibition where it caused a great sensation among the breeders. The exhibition jury classified it as a previously unknown breed and it was registered as Transylvanian Naked Neck, after its geographical origin. Later, it spread over Europe, especially Germany, where even a breeders' organization called 'NackthalszUchter-Verein für Deutschland', was established. Owing to rigorous selection criteria for production, the breed spread widely in Germany (Biszkup, 1983).

The naked neck trait is transmitted as a dominant character, if required it can be introduced easily into other breeds. Practical hobby breeders made use of this character to produce heavily crossbred species with fancy feathers and then advertised them as Transylvanian Naked Neck. Thus, today there are many naked neck varieties of fowl with considerably different phenotypes.

The conformation of the Transylvanian Naked Neck fowl is similar to that of the Hungarian fowl with the difference that its neck, and occasionally its mid-breast, are naked. There are

varying degrees of nakedness, and the breed is characterized by its blood-red colour and feather collar. Its rump is medium-long, and egg-shaped. The wings are high, relatively large and well developed and close to the body. The thigh and shank are longer than average. The feet and beak are white or slate-grey. Of the many coloured varieties, black is the most common at present but white, speckled and pied varieties are known also. The adult hen and cock weigh about 2.0 to 2.5 kg, and 2.5 to 3.0 kg, respectively.

At the end of the last century, this breed was popular, owing mainly to its tolerance of extreme climatic conditions, its prolificacy and rapid development, and its tender meat. Also, it had moderate feeding requirements. Kept on an appropriate area, it collected a considerable proportion of its feed. It was an excellent brooder and took care of its baby chicks reliably (Böheim, 1896). These characteristics were important 80-90 years ago. However, in 1903, Kiss and Verner reported that in spite of all its good characters Transylvanian Naked Neck fowl propagation was limited as its naked neck caused breeders to feel an aversion toward this particular breed. Therefore, at the end of the 19th century and the beginning of this century, this breed became an endangered species.

With the beginning of intensive management, the danger of extinction increased as the formerly advantageous characters no longer had the same importance. In closed management systems, brooding proved to be decidedly harmful. Thus, this breed and other indigenous breeds, were neglected as modern breeds and specialized hybrids produced more profitably. As a result, it became clear that the conservation of this breed required more attention. However, it was found that some of the apparently undesirable characteristics of this breed, resulting in its lack of commercial popularity, could be utilized successfully in modern hybrids. Research has been increasingly centred on the heat tolerance of the Naked Neck fowl in varying climatic conditions (Bordas et al., 1978; Merat, 1979; Momet et al., 1979 and 1980, Hanzl-Somes, 1983; te'In-El-Dein et al., 1984, Horst-Rauen, 1986, and Ludrovsky et al., 1986).

These experiments have shown generally that the Naked Neck fowl tolerates and adapts more easily to extreme high temperatures and that its genetically determined characters are manifested more completely than in fowls with normal feathering. This advantage is increased by the fact that owing to its naked area, this breed requires less energy for feather formation. Naked Neck and feathered neck stocks of chickens were also compared under varying climatic conditions in our experiments. Unfortunately, there were no Naked Neck and feathered neck birds available from the same line, therefore the experiment had to be carried out with two different breeds. The two breeds used were: Transylvanian Naked Neck, Na/Na; and Hybro broiler feathered neck, na/na.

The chickens were raised from one day old up to seven weeks in different controlled environments. Climatic chamber No. 1 simulated the normal conditions used in Hungarian broiler raising, and chamber No. 2 simulated desert conditions (35°C at 30 - 40 percent relative humidity), while in chamber No. 3 tropical conditions (35°C at 90 percent relative humidity) were produced. In all three climatic chambers genotype A and B individuals were kept separately. The body weights reached in chamber No. 1 - by each genotype (A and B) and each sex (male and female) were regarded as 100 percent and the others were compared on this basis. These data, together with percentage death losses, are shown in Table 1. Feed conversion was also investigated (see Table 2). As expected, the broilers produced more favourable results than the Naked Neck ones, but the latter proved to be better feed converters in desert and tropical conditions than in normal conditions.

On the basis of the results it would seem that Transylvanian Naked Neck chicks, owing possibly to their better heat tolerance, produced closer to their genetically determined production capacity than the broiler chickens. However, other influencing factors may have existed as well. In the case of genotype B, mortality was also lower.

On the basis of this experiment and the observations of other investigators conducting similar research the Naked Neck character may be useful to layer or broiler lines which must produce under tropical or desert conditions.

This study represents a good example of demonstrating how the preservation of native breeds of poultry and/or livestock in order to conserve their useful characters can be utilized successfully in improving overall food production, even under the intense production constraints and market requirements of today. production constraints and market requirements.

TABLE 1

EFFECTS OF GENOTYPE AND ENVIRONMENT ON THE BODY WEIGHT AND MORTALITY OF 7-WEEK-OLD CHICKS

Climatic chamber conditions	Parameters	Broiler		Naked Neck	
		male	female	male	female
normal	body weight/g	2021	1.688	713	596
	body weight/% 1/	100	100	100	100
	mortality/%	8.8	2.9	2.9	2.9
desert	body weight/% 1/	74.1	76.8	93.5	89.9
	mortality/%	8.8	0	2.9	2.9
tropical	body weight/% 1/	73.6	79.1	88.9	89.4
	mortality/%	44.1	61.7	2.9	2.9

1/ Body weight of chicks kept under normal conditions = 100 percent.

TABLE 2

EFFECTS OF GENOTYPE AND ENVIRONMENT ON FEED CONVERSION UP TO 7 WEEKS OF AGE

Genotype	unit	Environment		
		normal	desert	tropical
Broiler	kg feed/kg	2.16	2.15	2.12
	body weight %	100	99.5	98.1
Naked Neck	kg feed/kg	2.68	2.30	2.30
	body weight %	100	85.8	85.8

REFERENCES

- Biszkup, F., 1983. Personal communication.
- Bordas, A., Mórát, P., Sergent, D. and Richard, F.H., 1978. Influence du g'ene NA (,Cou-nul) sur la croissance, la consommation alimentaire et la composition corporelle du poulet selon la temperature ambiante. *Annales de Génétique et de Sélection Animale* 10/2: 209-231.
- Bóheim, T., 1986. Erdélyi kopasznyakd tyék - Transylvanian Naked Neck. *Sz'arnyasaink* 11/3: 39-40.
- Csukás, Z., 1955. *Baromfitenyészte's. Poultry Breeding.* mezógazdasági Kiadó. 339 pp -
- Hanzl, C.J. and Somes R.G., 1983. The effect of the naked neck gene, Na, on growth and carcass composition of broilers raised in two temperatures. *Poultry Science* 62: 934-941.
- Horst, P. and Rauen, H.W., 1986. Significance of the naked neck gene (Na gene) in poultry breeding in the tropics. *Proceedings of the 7th European Poultry Conference, Paris*, 191-195.

- Hreblay, E., 1900. A gazdasági baromfitenyésztésre vonatkozó fittalános tudnivalók. Budapest, Pallas, R.T. (book).
- Kiss, G. and Verner, J., 1903. Az aprójószágok tenyésztése. Budapest, ATH (book).
- Ludrovsky, F., Bodó, I., Rafai, P. and Takfics, E., 1986. Genotype and environment interaction in broiler production of commercial and naked neck line. Proceedings of the 7th European Poultry Conference, Paris, 196-199.
- Mérat, P., 1979. Effets associés au gène Na (Cou Nu) sur le poids corporel et le poids des oeufs chez des poules 'Innormales' et 'Inaines'. Annales de Génétique et de Sélection Animale 11/2: 127-131.
- Monnet, L.E., Bordas, A. and Mérat, P., 1979. Gène Cou Nu et performances de croissance selon la température chez le poulet. Annales de génétique et de Sélection Animale 11/4: 397-412.
- Momet, L.E., Bordas, A. and Mérat, P., 1980. Gène Cou Nu, poids corporel et paramètres anatomiques et physiologiques des poulettes et poulets adultes selon la température. Annales de Génétique et de Sélection Animale 12/3: 241-254.
- Zein-El-Dein, A., Mérat, P. and Bordas, A., 1984. Comportement de poulets 'Cou Nu' et normalement emplumés en cages individuelles, et corrélations avec la croissance et l'efficacité alimentaire. Archiv für Geflügelkunde 48/5: 200-204.



Transylvanian Naked Neck cock.
(photo Monostori)



Speckled Hungarian Naked Neck hen.
(photo Monostori)



A group of Transylvanian Naked Neck birds. (photo Eszes)



Speckled Hungarian Naked Neck birds. (photo Eszes)