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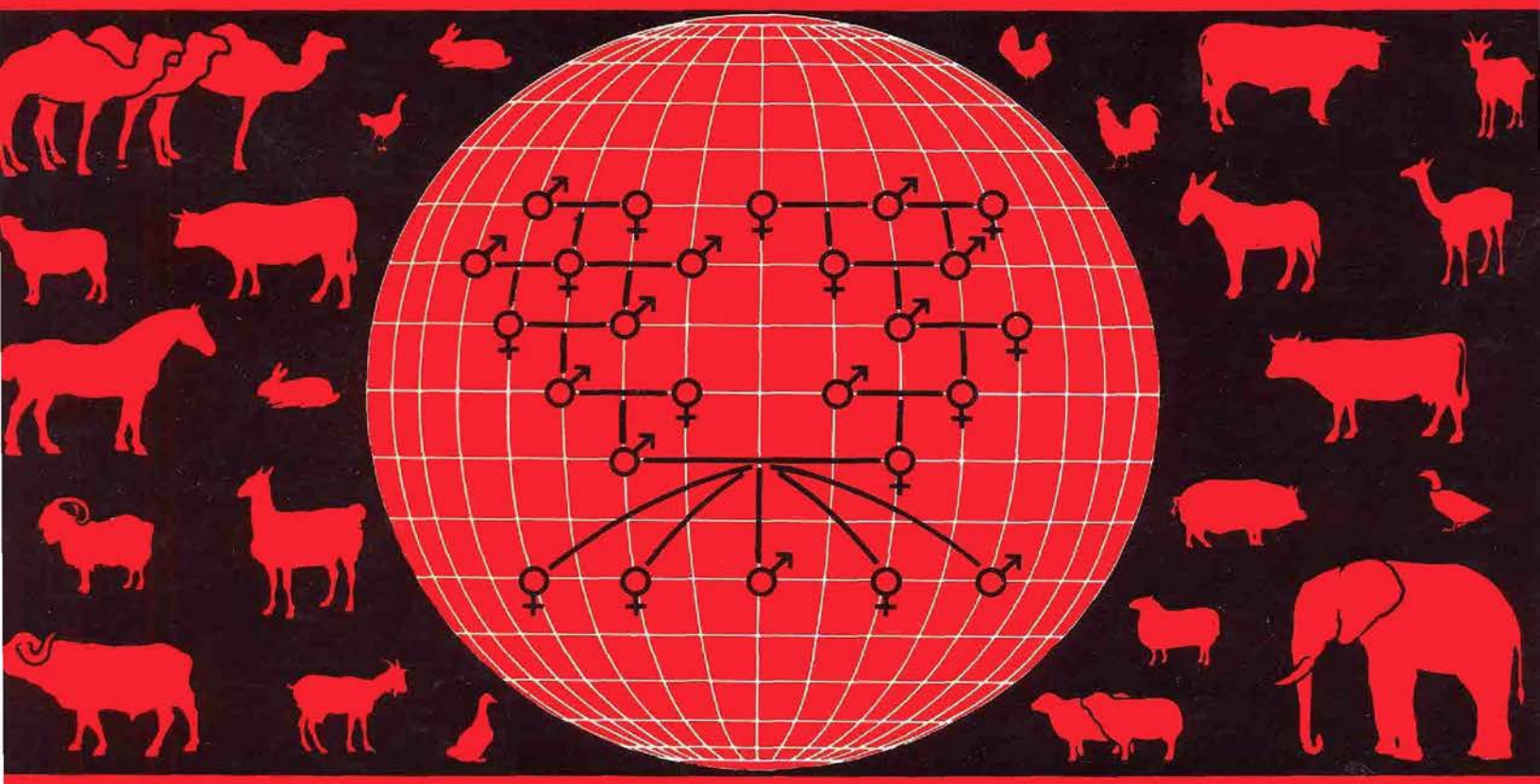
# 12

# ANIMAL GENETIC RESOURCES INFORMATION

# BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

# BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

1993



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UNEP

UNITED NATIONS ENVIRONMENT PROGRAMME
PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT
PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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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.

LE BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES 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 à l'éditeur, à l'adresse indiquée en page v.

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## 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 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 de l'original. Le Bulletin accepte les photographies à condition qu'il s'agisse de bonnes épreuves en noir et blanc. Le Bulletin rend également compte des ouvrages nouvellement parus sur les ressources génétiques animales. Un échange de correspondance est le bienvenu.

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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.

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00100 Roma, Italia.

# EDITORIAL

Since the last issue of AGRI a lot of activities have been implemented within the Animal Genetic Resources group, establishing a solid basis for the coming Special Action Programme. Meanwhile, ongoing activities have been pursued.

As was announced in the previous editorial, the World Watch List has been finalized and sent to the printer. It has not been an easy task to design this WWL in such a way that it could be used by different readers/users and that it could be updated regularly (not only as regards the population data or the introduction of new breeds, but also as regards the information available on each of the breeds). A more detailed description of the structure of the WWL will be given in the next issue.

Two working groups have been created, one on Genetic Distancing (chaired by S. Barker) and the second on Databanks (chaired by T. Henzen). These groups have considered the available methodologies and the needs in their respective fields and have proposed plans of action. The two reports will be widely distributed. A special emphasis is put on the need that the information gathered and/or created within these activities be accessible to everyone. Modern communication systems (notably electronic mail) will be developed while keeping active the more conventional communication packages (paper).

A team constituted of a geneticist and a livestock economist has spent six weeks in China to make an inventory of the Animal Genetic Resources and to make proposals for future plans of action. Similar missions will be initiated for other regions, as funds become available: in a near future for Africa, followed by Eastern Europe, and later on by Latin America.

On Genebank management, with the financial support of UNEP, two training courses are being organized for Africa (one in English and one in French), in association with ILCA in Addis Ababa and CRTA/CIRDES in Bobo Dioulasso. With these, all regions will have been informed, and links developed at regional levels. The future activities in this field will then rely mainly on each country's awareness and willingness to act. The regional nodes will serve as safety storage and coordination centres. It is now planned to gather all the information related to these genebank activities in a separate databank, connected with the Global Data Bank for Domestic Animal Diversity. While preparing the WWL, information on storage of semen and/or embryos was used to evaluate the degree of risk.

The first paper in the present issue gives the results of the survey initiated in 1992 by a questionnaire included in AGRI No. 8. Useful information on what is done in 40 countries is presented here. However nothing is known regarding the other 142. This survey should be continued. A call is made to anybody able to forward the relevant information from his own country to have a look at page vi of AGRI No. 8 and fill in the questionnaire.

# NOTES

## 1.0 REPORT ON THE FIRST CONSERVATION SYMPOSIUM IN BRAZIL

The first Brazil Symposium on the Conservation of animal Genetic Resources was held over 4 days during the 30th Annual Meeting of the Brazilian Society of animal Science (SBZ) over 18-23 July 1993, held in Rio de Janeiro. The Symposium was supported by FAO, strongly promoted by SBZ and coordinated by Dr. Arthur Mariante, an EMBRAPA researcher who is also the regional coordinator of an FAO project aiming to implement a regional animal genebank for Latin America in Brazil.

The Symposium involved 14 contributions and considerable time for discussion. It was attended by between 80 and 100 people from throughout Latin America and the Caribbean. The status of the sub-regional work aimed at best utilizing and maintaining for the longer term its wide range of genetic resources was considered in the context of the new FAO global programme for the management of domestic animal diversity. Most of the unique Brazilian breeds of animals are the result of the adaptation process since the introduction to Latin America of a range of species by Portuguese and Spanish settlers come 400 to 500 years ago.

this symposium was the first opportunity for virtually all researchers concerned with the development and maintenance of the brazilian conservation nuclei, established for each of those breeds currently at risk of extinction, to meet together with a range of other experts to exchange information on progress and plans.

In addition to providing a unique opportunity to consider how to further improve strategies for the conservation of the large range of breeds, the symposium also served to increase the awareness of the audience on the extinction risk threatening much of the irreplaceable domestic animal diversity

A. Mariante

## 2.0 SYMPOSIUM ON ANIMAL GENETIC RESOURCES IN LATIN AMERICA

The Latin American Association of Animal Production held its 13th meeting last July (25 through July 30th) at the Universidad Catolica de Chile in Santiago, Chile. In recognition to the ever increasing importance that animal genetic resources are playing in the sustainable animal production systems, a symposium on animal Genetic Resources in Latin America was held on the 29th of July. This first Symposium was sponsored by ALPA, FAO and the Latin American Network on Animal Genetic Resources (REGENAL) and was attended by more than a hundred individuals from different Latin American countries, the US and Europe.

Presentations covered different aspects of animal genetic resources conservation and management from regional and global point of view. Topics included the status of animal genetic resources in Latin America; global concern of animal genetic resources; monitoring

of animal genetic resources as they relate to Latin America; genetic resources and sustainable production systems; Spanish animal genetic resources and their relationship to the Latin American indigenous cattle. There was also a contribution on heterogeneous genetic variance in animal evaluation. Speakers involved included Drs. Keith Hammond from FAO-Rome, Arthur Mariante from CENARGEN/EMBRAPA, Brazil, Robert McDowell from North Carolina State University, Manuel Betteta from the Ministry of Agriculture of Spain, Assefaw Tewolde from CATIE and Dr. Daniel Gianola from the University of Wisconsin.

Collectively, all presentations highlighted the significant advances that have taken place as well as the global challenges faced, while they also outlined the direction and action needed to warrant that Latin America as any other part of the world does not loose the remaining genetic resources. All highlighted the need for the region to assess its resources in order to better define an adequate conservation and management strategy. The importance of developing further FAO's global data bank on animal genetic resources, and of countries contributing all relevant information was emphasized. while there are significant efforts in the region to define and promote projects pertaining to domestic animal genetic resources, few countries have really been able to consolidate their national programmes.

The round table discussion generated useful and rich exchange of ideas amongst all present, and highlighted national concerns; particularly the need to develop and promote a regional programme in animal genetic resources, to cover poultry, pig, cattle, camelids and sheep and goats in the region.

A. Tewolde

## 3.0 GENEBANK

On 24th August 1993, the Ministry of Agriculture of Brazil has officially created the Brazilian Gene Bank. In this document, CENARGEN is designated as the operating institution, in charge of management of the bank, as well as of the production of technical and scientific information on animal genetic resources. One of the elements leading to this decision was the initiative taken by FAO to establish the regional genebank for Latin America at CENARGEN (together with INTA from Argentina).

D. Chupin

# ACTORS OF KEEPING AND MANAGING GENETIC RESOURCES OF FARM ANIMALS IN 1992

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## RÉSUMÉ

Une enquête au moyen d'un formulaire diffusé en 1992 dans le *Bulletin d'information sur les ressources génétiques animales* (AGRI) a obtenu 80 réponses. On a pu ainsi identifier 77 organismes impliqués dans l'étude, la conservation et la gestion des ressources génétiques des animaux de ferme dans le monde. Ces organismes s'occupaient de 9 différentes espèces : l'âne, le boeuf, le buffle, le chameau, le cheval, la chèvre, le lama, le mouton et le porc. Selon leur rattachement administratif ces organismes ont été classés en supra-gouvernementaux, gouvernementaux, para-gouvernementaux, non gouvernementaux et mixte (à la fois supra-gouvernementaux et gouvernementaux). L'activité de ces organismes pouvait être mondiale, régionale ou nationale. Les premiers organismes recensés ont commencé leur activité dans les années 40. L'augmentation du nombre de ces organismes est très nette au cours des décennies 70 et 80. Les derniers organismes créés sont des organismes mixtes qui rassemblent en réseau des laboratoires s'adonnant à l'analyse du génome de certaines espèces (BovMap, PigMap, SheepMap etc...). Les espèces qui suscitaient le plus d'intérêt étaient, dans l'ordre, le boeuf (36 organismes), le mouton (29), la chèvre (26), le cheval (12), le porc (7) suivi par le buffle (4). Cette première enquête est incomplète car seulement 40 pays sur les 182 ayant une activité d'élevage notable ont répondu. La reprise de l'enquête sur une base plus détaillée est souhaitable.

## SUMMARY

80 replies have been received in the framework of a survey initiated in 1982, via a questionnaire inserted in AGRI No. 8. 77 institutions have been identified, working on characterization, conservation and management of livestock genetic resources around the world. 9 species are involved: ass, buffalo, camel, cattle, goat, horse, lama, pig and sheep. These institutions have been distributed according to their administrative status in intergovernmental, governmental, para statal, non governmental and mixed (intergovernmental and governmental). Their activity can be global, regional or national. The first activities have taken place during the 40s, and a significant increase was observed between the 70s and the 80s. The lastly created institutions are mixed organisms, networking laboratories involved in genome analysis (BovMap, PigMap, SheepMap...). The ranking of activities per species in decreasing order start with cattle (36 institutions), followed by sheep (29), goat (26), horse (12), pig (7), and buffalo (4). However only 40 countries have replied, out of 182 having a significant animal production. A second and more in depth study is needed.

## 1.0 INTRODUCTION

The keeping and managing of genetic resources of farm animals has been a part of the duties of FAO in the field of animal production at the very beginning of its activities, in the 40's (PHILLIPS, 1991).

A considerable increasing of activities in that field has followed the *First International Conference on Environment* of Stockholm in 1972, with the creation of UNEP (*United Nations Environment Programme*), MASON (1974). Since the 70's, activities of other supra-governmental agencies, for example EAAP (*European Association for Animal Production*), have been noticeable as well as activities at the national level in several countries.

Many conferences, days, seminaries, sessions of congresses and other formal and informal meetings at the national, regional and World level have been hold in these two decades.

In its 31st Annual Meeting of Munich 1980 the *Commission on Animal Genetics* of the EAAP (*European Association for Animal Production*) established a *Working Group on Animal Genetic Resources*, MAIJALA *et al.* (1984). This *EAAP Working Party* gave a first listing of organisms which, in Europe, were concerned with this type of activity. Twenty-one european countries were then identified in that field at a governmental or non-governmental level.

This listing deserves now to be updated and extended to the whole World. This is the goal of the present work which was asked by both FAO and EAAP and which is based on a survey made in 1992.

## 2.0 THE SURVEY

The questionnaire which is given in table 1 was circulated among organisms and people known as having some activities in this field in a country or a group of countries through a notice published in issue N° 8 of AGRI (*Animal Genetic Resources Information*) 1991 which was circulated at the beginning of 1992, ANONYMOUS (1992).

The answers were received between January and September 1992. A few letters have been then sent personnally and other missing details have been gained by phone or fax up to June 93.

The scope was limited to species of farm animals and to activities at an international, national and regional level (several countries) excluding organisms working in regions inside countries.

## 3.0 DESCRIPTION OF BASIC SET OF ANSWERS

Our correspondents have documented nine farm animal species i.e. buffalo, camel, cattle, donkey, goat, horse, llama, pig and sheep. Other species have been eventually listed by error or when they were included in conservation programme of the 9 above mentioned species i.e. poultry, rabbit, fur-bearing animals. The inventary of these species is by no means exhaustible and they have not been included in our analysis.

**Table 1.**

**1992 SURVEY/QUESTIONNAIRE**

**ORGANIZATIONS INVOLVED IN THE CONSERVATION OF ANIMAL GENETIC RESOURCES**

This questionnaire is circulated in order to identify the organism acting/directly interested in the field of conservation of farm animal germ plasm.

If relevant, please full in and send back to : J.J. LAUVERGNE, Génétique Factorielle CRJ, F-78 352 Jouy-en-Josas Cédex, France.

The results will be analysed for publication in coming issue of *Animal Genetic Resources Information* [AGRI].

Name of organization (in full) :

Acronym :

Address :

Phone number :

Fax number :

Type[1] : governemental/non governemental
international/national/regional

Date of foundation :

Date and place of registration :

President or manager :

Scope of interest :

Species :

Geographical area covered :

Main realizations :

[1] Delete what not applicable

A total of 80 filled questionnaires were received of which 77 were retained as valid.

These 77 organisms kept for the analysis are listed with their name, acronym and address in Annexe 1 (World wide level), 2 (regional level) and 3 (national level).

## 4.0 METHOD OF ANALYSIS

The extension of activities of each organism was checked : World-wide, regional or national.

The countries with a livestock activity were considered according their geographical localization.

Five types of subordination have been taken into consideration : supra-governmental, governmental, mixed, para-governmental and non-governmental. The mixed type is used when supra-governmental and governmental agencies are acting together. The prototype of these mixed activities are the recent BovMap and PigMap projects subsidied by CEC (*Commission of the European Communities*) and gathering a network of, for example, 30 governmental laboratories for BovMap, HALEY and ARCHIBALD (1991), OLLIVIER (1993).

The term "all species" which was sometimes used by our correspondents has been saved here, keeping in mind it may have a changeable meaning : for a given country it means usually the common domestic species of this country, when for the FAO or other international agencies it means all the domestic species in the World or in a region of the World.

The listing of scales and codes used for sorting-out data of the questionnaires is given in table 2.

## 5.0 RESULTS

### 5.1 Number and percentage of answering countries

The number and percentage of countries having individually answered is given in table 3, taking account of the level of livestock activities of these countries.

### 5.2 Specific interest

The interest of organisms for various species is given in tables 4 and 5 with resp. World-wide and regional activities. The organisms working at a national level have been numbered by continent and by species in table 6.

**Table 2. Scales and codes used for sorting-out data of questionnaires**

| Scale | | Code or instructions for sorting out |
|---|---|---|
| N° | Title | |
| 1 | Extension of activities | 1. national<br>2. regional<br>3. world-wide |
| 2 | Country or countries involved | individual countries : in full, according terminology by GROSJEAN (1991)<br>grouped countries : code |
| 3 | Part of the world covered | 1. Africa<br>2. America<br>3. Asia<br>4. Australia and Oceania<br>5. Europe<br>6. World |
| 4 | Subordination | 1. supra-governmental<br>2. governmental<br>3. mixed<br>4. para-governmental<br>5. non-governmental |
| 5 | Species | a. buffalo<br>b. camel<br>c. cattle<br>d. donkey<br>e. goat<br>f. horse<br>g. llama<br>h. pig<br>i. sheep<br>j. all species |
| 6 | Year of beginning of activities | year when given (4 digits)<br>0000 when unknown |
| 7 | Name of organism, acronym, address | in full |

**Table 3. Countries covered by the survey**

| Total number of Countries in the world (1) | Countries with livestock activity | | Answering countries | |
|---|---|---|---|---|
| | n | % (2) | n | % (3) |
| 219 | 182 | 83 | 40 | 22 |

(1) According to GROSJEAN (1991)
(2) Reported to the total number of countries in the world
(3) Reported to the countries with livestock activities

**Table 4. Specific interest of organisms with a world-wide activity**

| Name of Organism | Acronym | Species | Subordination[1] | Year[2] |
|---|---|---|---|---|
| Food and Agriculture Organization | FAO | all species | SUG | 1948 |
| United Nations Environment Programme | UNEP | all species | SUG | 1972 |
| Caprinae | IUCN | goat | SUG | 1979 |
| Committee on Standardized Genetic Nomenclature of Sheep and Goat | COGNOSAG | cattle goat sheep | NGO | 1986 |
| International System for Cytogenetic Nomenclature of Domestic Animals | ISCNDA | Cattle goat sheep | NGO | 1989 |
| Rare Breeds International | RBI | all species | NGO | 1989 |
| Pig Gene Mapping Project[3] | PigMap | pig | Mixed | 1991 |
| Bovine Gene Mapping Project[3] | BovMap | cattle | Mixed | 1993 |
| Sheep Gene Mapping Project[3] | SheepMap | sheep | Mixed | |

[1] : SUG (Supra-governmental); NGO (Non-governmetal)

[2] : year of beginning of activities

[3] : This is not an organism, only an interlaboratory project supported by CEE

**Table 5. Specific interest of organisms working on a regional level**

| Name of organisms | Acronym | Species | Subordination[1] | Year[2] | Covered regions |
|---|---|---|---|---|---|
| Coopération Internationale en Recherche Agronomique pour le Développement/Élevage et Médecine Vétérinaire des Pays Tropicaux. Maisons-Alfort, France | CIRAD/EMVT | all species | GOV | 1986 | Africa French-speaking |
| International Livestock Center for Africa. Addis Abbaba, Ethiopia | ILCA | all species | SUG | 1977 | Africa |
| Livestock Publications Council. California, USA | LPC | buffalo, catlle horse, llama | NGO | 1974 | Canada/USA |
| American Minor Breeds Conservancy. North Carolina, USA | AMBC | all species | NGO | 1977 | Canada/USA |
| National Institute of Animal Industry. Ibaraki, Japan | NIAI | all species | GOV | 1991 | Japan |
| University of Malaya, Department of Genetic and Cellular Biology. Kuala Lumpur, Malaysia | | all species | GOV | 1975 | South-East/Asia |
| University of Malaya, Institute of Advanced Studies Kuala Lumpur, Malaysia | IAS | cattle, goat, sheep | GOV | 1988 | South-East/Asia |
| European Association for Animal Production (Working Party on Animal genetic resources). Rome, Italia | EAAP | cattle, goat horse, pig, sheep | SUG | 1980 | Europe |
| Féderation européenne de revalorisation des races menacées. Lyon, France | FERME | all species | NGO | 1989 | Europe |
| Danubian Countries Alliance for Gene Conservation in Animal Species Wien, Austria | DAGENE | all species | NGO | 1989 | Danubian countries |
| Society for the Advancement of Breeding Researches in Asia and Oceania | SABRAO | buffalo, cattle, goat, sheep | NGO | 1977 | Asia Oceania |
| Eko-Team-Praha. Udernicka, Czechoslovakia | | all species | NGO | 1991 | East-Europe |
| Pro Specie Rara. Wien, Austria | | all species | NGO | 1982 | East-Europe |

[1] : SUG (Supra-governmental); GOV (Governmental); NGO (Non-governmental); [2] : year of beginning of activities

**Table 6. Specific activities of various type of organisms acting at a National level**

| Part of the World | Species | Subordination[1] | | | Total |
|---|---|---|---|---|---|
| | | GOV | PAG | NGO | |
| 1. Africa | c. cattle | 15 | | | 15 |
| | i. sheep | 9 | | | 9 |
| | e. goat | 7 | | | 7 |
| 2. America | a. buffalo | 1 | | 1 | 2 |
| | f. horse | 1 | | 1 | 2 |
| | b. camel | 1 | | | 1 |
| | c. cattle | | | 1 | 1 |
| | d. donkey | 1 | | | 1 |
| | e. goat | 1 | | | 1 |
| | g. llama | | | 1 | 1 |
| | h. pig | 1 | | | 1 |
| | i. sheep | 1 | | | 1 |
| 3. Asia | c. cattle | 2 | | | 2 |
| | e. goat | 2 | | | 2 |
| | i. sheep | 2 | | | 2 |
| | f. horse | 1 | | | 1 |
| 4. Australia | Non answering | | | | |
| 5. Europe | i. sheep | 7 | 1 | 3 | 11 |
| | c. cattle | 6 | 1 | 3 | 10 |
| | e. goat | 6 | 1 | 3 | 10 |
| | f. horse | 3 | 1 | 3 | 7 |
| | h. pig | 3 | | 1 | 4 |
| | j. all species | 1 | | | 1 |
| | **Total** | **71** | **4** | **17** | **91** |

[1] : GOV (Governmental); PAG (Para-governmental); NGO (Non-governmental)

### 5.3 Crossed subordination and specific interest

A summary of various type of subordination of organisms involved in the conservation of various species in given in table 7.

### 5.4 Evolution of number of organisms involved in gestion/conservation

The full list of organizations is listed in table 8 when the date they first (have?) shown interest in resources conservation is known, and in table 9 when not known.

## 6.0 DISCUSSION

### 6.1 Geographical coverage

One can see that only 22% of countries with a noticeable livestock activity have given an answer, table 3. This deficiency may be due:

i) to the use of a periodical such as AGRI to launch such a survey instead of a mailing device but we had no choice; the answers to this first survey will give the basis for a mailing list of the future;

ii) to the absence of a national programme of conservation in some developing countries,

iii) to special situations such as warfare state, political disorganization and/or extreme poverty.

This deficiency is partially balanced by the activities of organisms at the World (FAO, UNEP) or regional level (EAAP, CEC for Europe, ILCA for Africa). One can also note that, in various countries, governmental agencies may work on cooperation programme with developing countries including activities of inventary and conservation of domestic animal resources (for example the French CIRAD/EMVT in French speaking Africa).

### 6.2 Type of subordination

The percentage of NGO (non-governmental organisms) acting at the World and regional levels is noticeable, resp. 30 and 60% of all organisms, tables 4 and 5.

At the national level with only 18% of non-governmental organisms, the percentage of governmental or para-governmental organisms is higher.

After the involvement of supra-governmental, governmental organisms in conservation, the noticeable feature of the 90's is the appraisal of mixed organisms such as BovMap and PigMap which give a World dimension to fondamental scientific investigations on genetic resources.

### 6.3 Species in observation

According to table 7 one sees that most of the organisms with single species activities are involved in cattle conservation (followed by sheep, goat, horse, pig, horse, buffalo, llama, camel, donkey). This reflects the economical weight of these species in the World livestock industry.

## 6.4 Chronological activity

The cumulated numbers of organisms with known date of beginning of their activity of table 8 shows important growth since the early 70's. This is probably due to the impulse for keeping biodiversity after the *Stockholm International Conference on Environment* in 1972.

## 7.0 CONCLUSIONS

The survey is imperfect and needs certainly to be improved.

The main efforts of organisms seems to be done on the most economically important species. It means that an effort must be made for the less important species (camel, llama, buffalo etc..)

One notes the involvment of supra-governmental, governmental organisms and a significant activity of non-governmental and the appraisal of a important basic scientific activity.

**Table 7. Distribution of various organisms according their specific interest**

| Species | Number of involved organisms according their subordination[1] | | | | | |
|---|---|---|---|---|---|---|
| | SUG | GOV | Mixed | PAG | NGO | Total |
| a. Buffalo | | 1 | | | 3 | 4 |
| b. Camel | | 1 | | | | 1 |
| c. Cattle | 2 | 24 | 1 | 1 | 8 | 36 |
| d. Donkey | | 1 | | | | 1 |
| e. Goat | 2 | 17 | | 1 | 6 | 26 |
| f. Horse | 1 | 5 | | 1 | 5 | 12 |
| g. Llama | | | | | 2 | 2 |
| h. Pig | 1 | 4 | 1 | | 1 | 7 |
| i. Sheep | 1 | 20 | 1 | 1 | 6 | 29 |
| j. All species | 2 | 4 | | | 6 | 12 |

[1]: SUG (Supra-governmental); GOV (Governmental); PAG (Para-governmental); NGO (Non-governmental)

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**Table 8. Chronological starting of activities of the various organims**

| Year | Geographical coverage | Subordination[1] | Name of organism |
|---|---|---|---|
| 1940 | Zimbabwe | GOV | Matopos Agricultural Research Station |
| 1948 | Europe | SUG | European Association for Animal Production, (EAAP/FEZ) |
| 1948 | World | SUG | Food and agriculture organisation (FAO) |
| 1950 | Bulgaria | GOV | Institute of Animal Science |
| 1961 | Bangladesh | GOV | Bangladesh Agricultural University, Department of Animal Breeding and genetics |
| 1961 | Japan | GOV | National Institute of Animal Industry (NIAI) |
| 1962 | France | NGO | Société d'ethnozootechnie (SEZ) |
| 1969 | France | PAG | Union nationale des livres généalogiques (UNLG) |
| 1969 | U.K. | NGO | Rare Breeds Survival Trust Ltd (RBST), National Agricultural Centre |
| 1970 | Botswana | GOV | Animal Production Research Unit (APRU) |
| 1972 | Indonesia | GOV | Research Institute for Animal Production |
| 1974 | Brazil | GOV | Ministério da Agricultura, Empresa brasileira de pesquisa agropecuaria (EMBRAPA), Centro nacional de recoursos genéticos e biotenologia (CENARGEN) |
| 1974 | World | SUG | United Nations Environment Programme (UNEP) |
| 1974 | France | GOV | Département de génétique animale, Laboratoire de Génétique biochimique (INRA) |
| 1974 | Canada/USA | NGO | Livestock Publications Council (LPC) |
| 1974 | France | GOV | Département de génétique animale, Laboratoire de Génétique factorielle (INRA) |
| 1975 | Netherlands | NGO | Stiching Zeldzame Huisdierassen (SZH) |
| 1975 | Malaysia | GOV | University of Malaya, Department of Genetic and Cellular Biology |
| 1976 | Swaziland | GOV | Mkhaya Nature Reserve |
| 1976 | France | GOV | Ministère de l'Agriculture, Bureau de la Sélection Animale et du Développement de l'Élevage, Direction de la Production et des Échanges (DPE) |
| 1977 | Africa | SUG | International Livestock Center for Africa (ILCA) |

[1] : SUG (Supra-governmental); GOV (Governmental); Mixed (SUG + GOV); PAG (Para-governmental); NGO (Non-governmental)

| Year | Geographical coverage | Subordination[1] | Name of organism |
|---|---|---|---|
| 1977 | France | PAG | Institut de l'élevage (IE) |
| 1977 | Canada/USA | NGO | American Minor Breeds Conservancy (AMBC) |
| 1977 | Asia/Oceania | NGO | Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO) |
| 1978 | Malaysia | GOV | University Pertanian Malasyan (UPM) |
| 1979 | Swizerland | SUG | Caprinae (IUCN) |
| 1982 | Austria | GOV | Österrische National Vereinigung für Genreserven (ÖNGENE) |
| 1982 | East-Europe | NGO | Pro Specie Rara |
| 1984 | Norway | NGO | Norsk Bufe |
| 1984 | Iceland | GOV | Iceland Gene Bank Committee, the Agricultural Research Institute |
| 1984 | France | GOV | Bureau des Ressources Génétiques (BRG) |
| 1984 | Finland | GOV | Finnish Working Party on Animal Genetic Resources, Agricultural Research Centre, Department of animal Breeding |
| 1984 | Sweden | GOV | National Board of Genetic Resources (Swedish Board of Agriculture) |
| 1986 | Canada | NGO | Joywind Farm Rare Breeds Conservancy (RBC or Joywind) |
| 1986 | World | NGO | Committee on Genetic Nomenclature of Cattle, Sheep and Goat (COGNOSAG) |
| 1986 | Africa | GOV | Coopération Internationale en Recherche Agronomique pour le développement/Élevage et Médecine Vétérinaire des Pays Tropicaux (CIRAD/EMVT) |
| 1988 | India | GOV | National Bureau of Animal Genetic Resources and National Institute of animal genetics |
| 1988 | Malaysia | GOV | Institute of Advanced Studies (IAS) |
| 1989 | Danubian Countries | NGO | Danubian Countries Alliance for Gene Conservation in Animal Species |
| 1989 | Europe | NGO | Vereniging voor het Behoud vans Zeldzame Huisdierrassen (VBZH) |
| 1989 | Spain | NGO | Sociedad Española pro Recursos (SERGA) |
| 1989 | Belgium | NGO | Féderation européenne de revalorisation des races menacées (FERME) |
| 1989 | World | NGO | International System for Cytogenetic Nomenclature of Domestic Animals |

[1] : SUG (Supra-governmental); GOV (Governmental); Mixed (SUG + GOV); PAG (Para-governmental); NGO (Non-governmental)

| Year | Geographical coverage | Subordination[1] | Name of organism |
|---|---|---|---|
| 1989 | World | NGO | Rare Breeds International (RBI) |
| 1990 | Ireland | NGO | RDS Conservation Committee, Royal Dublin Society |
| 1990 | Greece | GOV | Hellenic Institute for the Conservation and utilization of Indigenous Ruminants (HICUIR) |
| 1990 | Finland | NGO | Association for the Native Cattle Breeds of Finland agricultural Research Centre, Department of Animal Breeding |
| 1991 | East-Europe | NGO | Eko-Team-Praha |
| 1991 | Bulgaria | GOV | Center of Selection and Reproduction in Farm Animals |
| 1991 | USA | NGO | Institute for Agricultural Biodiversity (IAB) |
| 1991 | World | Mixed | Pig Gene Mapping Project (PigMap) |
| 1991 | World | Mixed | Sheep Gene Mapping Project (SheepMap) |
| 1993 | World | Mixed | Bovine Gene Mapping Project (BovMap) |

[1] : SUG (Supra-governmental); GOV (Governmental); Mixed (SUG + GOV); PAG (Para-governmental); NGO (Non-governmental)

**Table 9. Organism with unknown year for beginnig of activity**

| Year | Geographical coverage | Subordination[1] | Name of organism |
|---|---|---|---|
| 0000 | Australia | PAG | Rare Breeds Reserve, Gilgegannup/WA |
| 0000 | Benin | GOV | Ministère du développement rural et de l'action coopérative |
| 0000 | Cameroon | GOV | Institute of Animal Research (IRZ) |
| 0000 | Canada | GOV | Agriculture Canada (Ag CANADA) |
| 0000 | China | GOV | National Veterinary Biotechnology Laboratory, Herbin Veterinary Research Institute (CAAS) |
| 0000 | China | GOV | Institute of Animal Science, Chinese Academy of Agriculture Science (IAS) |
| 0000 | Egypt | GOV | Agricultural Research Centre, Ministry of Agriculture |
| 0000 | Ethiopia | GOV | Institute of Agricultural Research, Department of Animal Science |
| 0000 | Germany | NGO | Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen (DLG) |
| 0000 | India | GOV | Indian Veterinary Research Institute (IVRI) |
| 0000 | Morocco | GOV | Institut Agronomique et Vétérinaire Hassan II (IAV) |
| 0000 | Niger | GOV | Institut National de Recherches Agronomiques |
| 0000 | Pakistan | GOV | Livestock Division Pakistan Agricultural Research Council |
| 0000 | Philippines | GOV | Livestock Research Division |
| 0000 | Senegal | GOV | Centres de Recherches Zootechniques (Dahra-Djoloff et Kolka) |
| 0000 | South-Africa | GOV | Department of Development Aid |
| 0000 | Spain | GOV | Instituto National Investigation Agraria (INIA) |
| 0000 | Sudan | GOV | Institute of Animal Production |
| 0000 | Thailand | GOV | Department of Animal Science, Kasetsart University |
| 0000 | USA | NGO | Association for Living Historical Farms and Agricultural Museums (ALFHAM) |
| 0000 | USA | GOV | United States Department of Agriculture (USDA), Agricultural Research Centre |
| 0000 | Zambia | GOV | Mochipapa Regional Research Station |

[1] : SUG (Supra-governmental); GOV (Governmental); Mixed (SUG + GOV); PAG (Para-governmental); NGO (Non-governmental)

**Annex 1. List and address of organisms working on a world-wide level**

| Name of organisms | Acronym | subordination[1] | Addresses |
|---|---|---|---|
| Caprinae | IUCN | SUG | Avenue du Mont-Blanc 1196 Gland, Switzerland |
| Food and agriculture organization | FAO | SUG | Via delle terme di Caracalla, 00100 Roma, Italia |
| United Nations Environment Programme | UNEP | SUG | Box 30602 Nairobi, Kenya |
| Committee on Genetic Nomenclature of Cattle, Sheep and Goat | COGNOSAG | NGO | 147 C/3 avenue J.B. Clément, 92140 Clamart, France |
| Rare Breeds International | RBI | NGO | University of Saskatchewan, Saskatoon, SK S7N Owo, Canada |
| Bovine Gene Mapping Project[2] | BovMap | Mixed | Laboratoire de Génétique Biochimique, INRA. CRJ, 78 352 Jouy-en-Josas H. LEVÉZIEL (Coordinator) |
| Pig Gene Mapping Project[2] | BovMap | Mixed | Institute of Animal Physiology and Genetics Research, Endinburg, U.K. HALEY C.S and ARCHIBALD A.L. (Coordinators) |
| Sheep Gene Mapping Project | SheepMap | Mixed | |
| International System for Cytogenetic Nomenclature of Domestic Animal | ISCNDA | NGO | Laboratoire de Génétique Biochimique et de Cytogénétique INRA, 78 352 Jouy-en-Josas Cedex France |

[1] : SUG (Supra-governmental); NGO (Non governmental)

[2] : This is not an organism, only an interlaboratory project supported by CEE

## Annex 2. List and address of organisms working on a regional level

| Name of organisms | Acronym | (1) | Covered regions | Adresses |
|---|---|---|---|---|
| Coopération Internationale en Recherche Agronomique pour le Développement/Élevage et Médecine Vétérinaire des pays Tropicaux | CIRAD EMVT | GOV | Africa | 10, rue Pierre Curie, 94704 Maisons-Alfort, France |
| International Livestock Center for Africa | ILCA | SUG | Africa | PO. Box 5689, Addis abbaba, Ethiopia |
| Livestock Publications Council | LPC | NGO | Canada USA | 2631 Garland Street, Eureka, California 95501-3574, USA |
| American Minor Breeds Conservancy | AMBC | NGO | Canada USA | Pittsbirouth, North-Carolina 27312, USA |
| National Institute of Animal Industry | NIAI | GOV | Japan | Tsukuba Norindanchi PO. Box 5, Ibaraki, Japan |
| University of Malaya, Department of Genetic and Cellular Biology | | GOV | S-East Asia | University of Malaya, 59100 Kuala/Lumpur, Malaysia |
| University of Malaya, Institute of Advanced Studies | IAS | GOV | S-East Asia | Univerisity of Malaya, 59100 Kuala/Lumpur, Malaysia |
| European Association for Animal Production | EAAP | SUG | Europe | Via A, Torlonia, 15A, 00161 Roma, Italy |
| Féderation européenne de revalorisation des races menacées | FERME | NGO | Europe | Univ. Claude Bernard Lyon 1, 43, bd du 11 novembre 1918, 69 622, Villeurbanne cédex, France |
| Danubian Countries Alliance for Gene Conservation in Animal Species | DAGENE | NGO | Danubian countries | Univ. of Veterinary Medicine, linke Bahngasse 11, A-1030 Vienna |
| Society for the Advancement of Breeding Researches in Asia and Oceania | SABRAO | NGO | Asia Oceania | Tropical Agricuture Research Center, Ibaraki, Japan |
| Eko-Team-Praha | | NGO | E-Europe | CS-14900 Praha, Czechoslovakia |
| Pro Specie Rara | | NGO | E-Europe | Schneederstraβe 17, CH-9000 St.Gallen, Switzerland |

[1] = Subordination : SUG (Supra-governmental); GOV (Governmental); PAG (Para governmental); NGO (Non governmental)

## Annex 3. List and address of organisms working on a national level

| Country | Subordination[1] | Acronym | Name of organisms, address |
|---|---|---|---|
| Australia | PAG | | Australian Rare Breeds Reserve, Gilgegannup/WA-- |
| Austria | GOV | ÖNGENE | Österreichische Nationalvereinigung für Genreserven, Gumpendorferstraβe 15/II/2, 1060 Wien |
| Bangladesh | GOV | | Bangladesh Agricultural University, Department of Animal Breeding and genetics, Banglagesh Agricultural, Mymensingh 2202 |
| Belgiun | NGO | VBZH | Vereniging voor het Behoud vans Zeldzame Huisdierrassen, Stokstraat 5, B-9688 Maarkedal, Belgium |
| Benin | GOV | | Ministère du développement rural et de l'action coopérative, Samiondji cattle Ranch, BP. 2359 Cotonou, Benin |
| Botswana | GOV | APRU | Animal Production Research Unit, Department of Agricultural Research, Private Bag 0033 Gaborone, Botswana |
| Brazil | GOV | CENARGEN | Ministério da Agricultura, Empresa brasileira de pesquisa agropecuaria (EMBRAPA), Centro nacional de recoursos genéticos e biotenologia, Sain, Parque rural CP. 10.2372 CEP. 70.770, Brasilia, DF Brasil |
| Bulgaria | GOV | | Center of Selection and Reproduction in Farm Animals, 1756 Sofia, ul. Bistrishko shose, 26, Bulgaria |
| | GOV | | Institute of Animal Science, 2232 Kostinbrod, Bulgaria |
| Cameroon | GOV | IRZ | Institute of Animal Research, BP. 65 Ngaoundere, Cameroon |
| | GOV | IRZ | Institute of Animal Research, BP. 1457 Yaoundé, Cameroon |
| Canada | GOV | Ag | Agriculture Canada, Center for Food & animal Research, Agriculture Canada, Ottawa, Ontario KIA 0C6, Canada |
| | NGO | RBC | Joywind Farm Rare Breeds Conservancy General delivery, Marmora, Ontario, Canada K0M 2K0 |

[1] : SUG (Supra-governmental); GOV (Governmental); PAG (Para-governmental); NGO (Non-governmental)

| Country | Subordination[1] | Acronym | Name of organisms, address |
|---|---|---|---|
| China | GOV | CAAS | National Veterinary Biotechnology Laboratory, Herbin Veterinary Research Institute, 11 Maduan Street Herbin, 150001 China |
| | GOV | IAS | Institute of Animal Science, Chinese Academy of Agriculture Science, Malianwa, Haidian, 100094 Beijing, China |
| Egypt | GOV | | Agricultual Research Centre, Ministry of Agriculture, Dokki, Cairo, Egypt |
| Ethiopia | GOV | | Institute of Agricultural Research, Department of Animal Science, PO. Box 2003 Addis Ababa, Ethiopia |
| Finland | GOV | | Finnish Working Party on Animal Genetic Resources, Agricultural Research Centre, Department of animal Breeding, 31600 Jokioinen, Finland |
| | NGO | | Association for the Native Cattle Breeds of Finland, Agricultural Research Centre, Department of Animal Breeding, 31600 Jokioinen, Finland |
| France | GOV | BRG | Bureau des Ressources Génétiques, 57 rue Cuvier, 75231 Paris, France |
| | GOV | | Département de génétique animale, Laboratoire de Génétique biochimique (INRA), 78 352 Jouy-en-Josas cédex, France |
| | GOV | | Département de génétique animale, Laboratoire de Génétique factorielle (INRA), 78 352 Jouy-en-Josas cédex, France |
| | GOV | | Bureau de la Sélection Animale et Développement de l'Élevage. 3 rue de Barbey-de-Jouy, 75 349 Paris 07, France |
| | NGO | SEZ | Société d'ethnozootechnie, 25, boulevard Arago, 75 013 Paris, France |
| | PAG | IE | Institut de l'élevage, 149, rue de Bercy, 75 595 Paris cédex 12, France |
| | PAG | UNLG | Union nationale des livres généalogiques (UNLG), Paris, France |

[1] : SUG (Supra-governmental); GOV (Governmental); PAG (Para-governmental); NGO (Non-governmental)

| Country | Subordination[1] | Acronym | Name of organisms, address |
|---|---|---|---|
| Germany | NGO | DLG | Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen, Hofbrunnbstrasse 110, 8000 München 71, Germany |
| Greece | GOV | HICUIR | Hellenic Institute for the Conservation and utilization of Indigenous Ruminants, Athina, Greece |
| Iceland | GOV | | Gene Bank Committee, The Agricultural Research Institute, Keldnaholt IS-112 Reykjavik, Iceland |
| India | GOV | IVRI | Indian Veterinary Research Institute, Izatnagar 243122 U.P., India |
| | GOV | | National Bureau of Animal Genetic Resources and National Institute of animal Genetics. P.O. Box 129, Karnal - 132001, Haryana |
| Indonesia | GOV | | Research Institute for Animal Production, PO. Box 123 Ciawi, Bogor, Indonesia |
| Ireland | NGO | RDS | Conservation Committee, Royal Dublin Society, Ballsbridge, Dublin 4, Ireland |
| Malaysia | GOV | UPM | University Pertanian Malasyan, 43400 Serdang, Malaysia |
| Morocco | GOV | IAV | Institut Agronomique et Vétérinaire Hassan II, BP. 6002 Agdal Rabat, Morocco |
| Netherlands | NGO | SZH | Stiching Zeldzame Huisdierassen, Poststraat 6, 9712 ER, Groningen, Netherlands |
| Niger | GOV | | Institut national de recherches agronomiques du Niger, Toukounous Station Niamey, Niger |
| Norway | NGO | | Norsk Bufe, Zoological Museum, Museplas 3, 5014 Bergen, Norway |
| Pakistan | GOV | | Livestock Division Pakistan Agricultural Research Council, PO. Box 1031 Islamabad, Pakistan |
| Philippines | GOV | | Livestock Research Division, Pcarrd/Los Banos/Laguna 4030, Philippines |

[1] : SUG (Supra-governmental); GOV (Governmental); PAG (Para-governmental); NGO (Non-governmental)

| Country | Subordination[1] | Acronym | Name of organisms, address |
|---|---|---|---|
| Senegal | GOV | | Centre de Recherche Zootechnique de Dahra-Djoloff, BP. 3120 Dakar, Sénégal |
| | GOV | | Centre de Recherches Zootechiques de Kolka, BP. 53 Kolda, Senagal |
| Spain | GOV | INIA | Instituto National Investigation Agraria, Apartado 8111, 23080 Madrid, Spain |
| | NGO | SERGA | Sociedad Española pro Recursos, Facultad de Veterinaria, 50013 Zaragoza, Spain |
| South-Africa | GOV | | Department of Development Aid, PO. BOx 384 Pretoria 0001, South-Africa |
| Sudan | GOV | | Institute of Animal Production, PO. Box 32 Khartoum North, Sudan |
| Swaziland | GOV | | Mkhaya Nature Reserve, PO. Box 33 Mbabane, Swaziland |
| Sweden | GOV | | National Board of Genetic Resources (Swedish Board of Agriculture), S-551 Jönköping, Sweden |
| Thailand | GOV | | Department of Animal Science, Kasetsart University, Bangkok 10903, Thailand |
| U.K. | NGO | RBST | Rare Breeds Survival Trust Ltd, National Agricultural Centre, Stoneleigh, Kenilworth, warks CV8 2LG, U.K. |
| USA | GOV | USDA | United States Department of Agriculture, Agricultural Research Centre, USDA, Maryland 20705, USA |
| | NGO | ALFHAM | Association for Living Historical Farms and Agricultural Museums, MAH 5035 Smithonian Institution, Washington DC 20560, USA |
| | NGO | IAB | Institute for Agricultural Biodiversity, R.R. 3, Box 309, Decorah, Iowa 52101, USA |
| Zambia | GOV | | Mochipapa Regional Research Station, PO. Box 630090 Choma, Zambia |
| Zimbabwe | GOV | | Matopos Agricultural Research Station, Private Bag K.5237 Bulawayo, Zimbabwe |

[1] : SUG (Supra-governmental); GOV (Governmental); PAG (Para-governmental); NGO (Non-governmental)

# CONSERVATION OF ANIMAL GERMPLASM AT RISK OF EXTINCTION IN ITALY: THE CENTRE FOR THE DEFENSE OF ANIMAL GENETIC RESOURCES OF CIRCELLO

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## SUMMARY

After a rapid review of the sociocultural aspects justifying that rare breeds be protected, of the aim of a conservation programme. and of the possible strategies, this paper describes in details the activities implemented at the National Centre for the preservation of germplasm of animals at risk of extinction, at Circello, in the south of Italy. In this centre, established on 310 ha, are presently raised 281 animals of more than 30 different breeds, among which 11 cattle breeds, 7 sheep breeds and 10 goat breeds. Activities of the centre include preservation, description, multiplication, improvement and use of the breeds at risk. Collaboration with other insttitutions within the Mediterranean region are listed.

## RÉSUMÉ

Après une rapide revue des motivations socioculturelles qui justifient la protection des races rares, des objectifs d'un programme de conservation, et des stratégies possibles, cet article décrit en détails le programme du Centre National pour la Préservation du matériel Biologique d'animaux domestiques en danger de disparition, à Circello dans le sud de l'Italie. Dans ce centre, établi sur 310 ha, sont rassemblées plus de 30 races d'animaux de ferme, dont 11 races de bovins, 7 races de moutons et 10 races de chèvres. Les activités de ce centre comprennent la préservation, le description, la multiplication, l'amélioration et l'utitlisation des races en danger. Une liste des collaborations en cours avec d'autres organismes du bassin méditéranéen termine cet article.

## 1.0 INTRODUCTION

The problem of the defence and utilization of genetic resources in Italy has bee studied by the scientific world and the operating zootechnic one since the mid 1970s. It soon became obvious that in a few decades many animal genetic resources in the country would be extinct and many others would be difficult to safeguard and conserve (Rognoni, 1979; 1983).

The protection of rare breeeds and populations is justified by: (**a**) the socio-economic aspect, (**b**) the biological aspect, (**c**) the cultural aspect and (**d**) the operative aspect.

### 1.1 The socio-economic aspect

These ecotypes are mostly bred in marginal areas of our country where the model of intensive production cannot be applied because of the absence of the necessary economic preconditions. Such ecotypes are the only ones able to express their own zootechnic role, as far as their productive capacity is concerned, utilizing exclusively the available autochthonous grazing resources.

### 1.2 The biological aspect

Biological diversity may be considered real, if not unique richness, because it is the expression of a diversity in genetic information. It is, at the same time, the connecting link with the past and the basis of biological future. Its wide range is the only guarantee of evolutionary possibilities.

Continuous qualitative improvement of information is a merit of the biological diversity, hence the degree of fitness or biological success of a species in coping with changes in environmental conditions. Therefore, the level of organization or the order of information is important.

It is the intrinsic divergence of genetic information that induces innovation, while the biological convergent processes (differentiation and embryonic development) realize a genetic project linked to the present information, and therefore only slightly changeable.

Biological divergence leads to an apparent increase of disorder, that is an apparent increase of 'entropy' in the whole system.

Homoeostasis gives the animal the ability to regulate the internal environmental variables according to the external ones, in order to keep them within limits that do not induce irreversible damage to its 'status', which is identifiable with what is 'physiologically normal'. This self-governing mechanism often becomes a 'recurrent model', that is a real biorhythm or biological oscillator BETTINI, 1972).

Being a pluridimensional whole, it must not be deprived of a given psychic and affective environment. The self-government of a "such a whole is able to take place because of intricate cybernetic systems.

The basic principles of cybernetics can be found in the structure and function of living beings that have continued to survive and evolve on planet earth for milions of years regardless of continuous changes in the environmental conditions inside and outside the individual. In general, the animal has the following features:

(**a**) capability (individuallt variable) to control the sequence of the events;

(**b**) ability to reduce the negative effects of environmental changes converting them, if possible, into those which would be considered, at that moment, positive;

(**c**) a versatile reactive capacity, in order to face and solve positively for itself the wide range of environmental changes that influence its behavioural patterns in a broad sense;

(**d**) internal mechanisms that enable it to carry out mutable and numerous behavioural models;

(**e**) in addition to the previous characteristics, the capacity to maintain a balanced level of internal stability or homeostasis, at all times;

(**f**) the ability to develop the wide range of operations with the lowest amount of energy and, furthermore, to use the lowest fraction of energy for each answer.

The animal that is engaged in zootechnical production, lives increasingly in a cultural micro-environment, in which the anthropic component strongly determines the various moments of the animal's life.

### 1.3 **The cultural aspect**

These genetic types may be considered as cultural values because they represent a patrimony of remarkable documentary, historical and biological value. Therefore it is a social duty to preserve them for the new generations.

### 1.4 **The operative aspect**

The possibility of using such autochthonous types for animal production has been scarcely considered until today. They can be successfully used to produce traditional foodstuffs, whichmay help solve problems linked to nutritional controversies. These ecotypes can be multiplied by:

(**i**) the adoption of reproductive schemes peculiar to them;

(**ii**) the possible use of innovative biotechnics in order to build up ecotypes suitable to particularly unfavourable environmental conditions.

## 2.0 THE AIM OF CONSERVATION

The problems involved in the conservation of animal germplasm nearing extinction are quite complex. We believe that an exhaustive answer to this question is impossible because the problems to be solved are theoretically infinite.

As an example, some of these problems which actually concern all animals engaged in zootechnical production, can be summarized as follows (MATASSINO, 1985):

(**a**) which phenotypic expressions ('traits') are worth being either conserved or changed and what are the limits to such change;

(**b**) what techniques of improvement are available;

(**c**) which parameters should be used to measure the variation in one or more phenotypic expressions - among these parameters we must include the static (anatomical, physiological, biochemical, etc.) and dynamic ones, which can be thought to belong to zoosemiotics, zoopsychology, zoosociology, ethology and adaptation - which phenotypic expressions can be considered as primary and secondary in order to achieve a certain objective;

(**d**) as a consequence of the preceding point, how important is it to know all the rules regulating the relationships in order to understand the domesticated animal;

(**e**) which analytical instruments have to be used for the semantic scan of the variation in a given phenotypic expression;

(**f**) which part of the variation of a phenotypic expression is of a genetic and which is of an environmental nature, and what is their relative importance;

(**g**) what role is played by the adaptation and by the interaction between genotype and environment;

(**h**) what are the forms of selection that give the best results for changing the different phenotypic expressions

(**i**) how important is it to the know all the rules regulating the relations between the animals and their breeder,

(**l**) can the availability of a large number of local genetic types help to achieve productions with qualitative characteristics that make them better able to meet consumers need's, in relation to the continuous changes in life-style;

(**m**) what level of differentiation must characterize one ecotype from another;

(**n**) which breeding systems (between similar or dissimilar phenotypes or genotypes [inbreeding or crossbreeding] should be used and in what way;

(**o**) what role the heterosis and complementarity play;

(**p**) for some populations is it more convenient to have a large number of breeds with a relatively small number of individuals, each suited to a certain ecological niche, or a small number ofbreeds with a large number of individuals, obtained through a selection scheme which takes into account a broad spectrum of different environmental conditions affecting the phenotypic expressions concerned with a given production;

(**q**) how to arrange that the different models of production be adapted to the different productive realities in order to achieve a proper management of the autochthonous genetic resources, not forgetting the health aspects; harmonious integration of both the particular and the general aspects should be inherent in these models;

(**r**) what influence innovative biotechiques will have on preservatory interventions.

Such problems can be solved only through a systematic approach (MATASSINO, 1984).

The reasons for preserving the existing genetic patrimony are numerous (MATASSINO and PILLA, 1976; MATASSINO, 1979). Here we note only some of them:

(**a**) an animal does not have to be identified only with its reproductive and productive functions, it is also a lot of things which can escape the attention of even an alert observer;

(**b**) in time the principal qualities evolve, under the influence of other variables, to such an extent that often they can disappear without leaving any trace for their individuation;

(**c**) as a result of insufficient information on the action and interaction of genes, little is known of the individual nature of animals and it is therefore advisable not to eliminate subjects from reproduction because of phenotypic expressions that are believed to be less essential. Thus conserving such subjects, we are able to preserve the largest possible gene spectrum, which could be very helpful in the future, given the dynamic nature of human needs and that of breeding techniques that tend to keep the animal in a dimension that is less ecological and, consequently, more cultural.

Preservation of animal germplasma, is thus an issue of public interest. It has to be faced as a function of improved knowledge about human nutritional needs. A nutritional policy should aim to reach more and more advanced targets in terms of diet. Such targets must also be dynamic in relation to the continuous acquisition of nutritional needs caused by the development of events in real life.

It is necessary to consider such a trend so that animal products can meet human physiological and nutritional needs in a satisfactory way.

It is obvious that the conservation of autochthonous animal populations (MATASSINO, 1979; ROGNONI *et al.*, 1990) must not and cannot be considered as a self-contained operation. On the contrary, it must be a first step in the zootechnical utilization of the preserved genetic patrimony. Thus, the project of conservation has two aspects: preservation and operative utilization of such patrimony.

## 3.0 POSSIBLE STRATEGIES FOR CONSERVATION

Conservation becomes a very complex issue if we consider the ways in which it can be achieved. Conservation cannot take place without the breeding, in their own environment, of a sufficient number of subjects for each of the different genotypes believed, today, to be useful for the near distant future. This choice is justified by the fact that the preserved genotypes will always be the result of the combined effects of genetical and environmental variables, the latter being peculiar to the breeding environment. We must not forget that these autochthonous genotypes can be properly utilized only if they preserve those biological traits that enable them to live and reproduce in the peculiar environmental conditions in which they have been shaped or, at least, in environments that are thought to be reasonably similar to the original ones. The methods of conserving the germplasm of local animal populations threatened by extinction include the following:

(**a**) cryoconservation of gametes or zygotes ;

(**b**) preservation of individuals (**i**) *in situ* or (**ii**) *ex situ*.

Probably the *non in vivo* preservation, can play its part in that gametes and/or zygotes can be used, in the future, for studies on the evolution of the gene order of these populations, thus assuming a function of witness of the evolution. In other respects such conservation is of limited value because (MATASSINO, 1989):

(**a**) the initial gene set of the preserved zygotes will not be affected by environmental factors and, hence, cannot change in accordance with the development of events and cannot undergo the effects of the temporal and spatial changes which are so indispensable in order to maintain the fitness of the taxonomic group ;

(**b**) the preserved gametes, which can also undergo homozygote diploidization, can give rise to animals with unwanted adaptive capabilities;

(**c**) the difficulty of identifying a really representative sample of the genetic variation in an existing population, which is preserved suggests that a high quantity of zygotes and/or gametes should be preserved.

## 4.0 CONSERVATION ON A GLOBAL LEVEL

In 1980 FAO (Food and Agriculture Organization of United Nations) and UNEP (United Nations Environment Programme) held a technical consultation on the conservation and management of animal genetic resources. FAO (HODGES, 1984) established an appropriate coordinating mechanism for conservation and management of autochthonous genetic resources, at national and international levels.

During 1980-90 all the programmes proposed by FAO/UNEP in the technical consultation in Rome in 1980, have been put into practice (HODGES, 1990). Furthermore, in 1989, the FAO Agricultural Committee reviewed the animal genetic resources programme and found

it scientifically sound, with appropriate infrastructures in place. These bodies within FAO now have to identify the animals that are available for cross-breeding or research in the new management and environmental system (HODGES, 1992).

## 5.0 THE PRODUCTIVE FUNCTION OF AUTOCHTHONOUS GENOTYPES IN THE MEDITERRNEAN AREA

In the Mediterranean area (MAR), on the basis of suggestions made by experts in the interested countries, 45 genotypes in need of protection have been identified (Table I).

Table II shows nutrition, area and breeding systems for the indigenous genotypes. Most of these systems are particurarly affected by environmental factors and the socio-economic conditions of the Country.

According to NARDONE (1992), in the MAR - which includes 18 countries - three production systems for cattle can be found, with the following levels: (**a**) intensive (**b**) intermediate and (**c**) extensive. In this area there are 78 genotypes, 17 of which, having less than 500 available cows, are in danger of extinction and do not participate in the above-mentioned production systems (NARDONE and VILLA, 1992).

The autochthonous genotypes and their cross-breeds participate:

(**a**) for milk production, in the intermediate system with a contribution of 17 percent, (**b**) for meat production, in the intermediate systems and in the extensive '*meat* 'and '*meat-milk*' systems with a contribution of 21percent.

For example, in Italy, with regard to the *podolian cattle* system, three subsystems have been found (pastoral, emipastoral and permanent wild) on the basis of criteria regarding the utilization of autochthonous grazing resources (MATASSINO *et al.*, 1989**a**).

Other studies on lactating podolian cows show: (**a**) milk production to be 1 000-2 200 kg 210 days after birth; (**b**) centesimal chemical composition: dry matter 14.20; proteins: 3.64; fat: 4.41; lactose: 5,45; minerals: 0.70.

According to VISSAC (1992), the use of local ecotypes, thanks to their high capacity of adaptation, is the *sine qua non* for the creation of breeding systems suitable to the great variability of the MAR'S eco-agro-systems.

Circello's Centre is contributing to the development of advanced services designed for zootechnical initiatives that are interested in using autochthonous ecotypes. It may be regarded as a system for spreading innovative biotechnics for ecologically friendly development. Such development must by achieved within a dynamic context which is able to utilize innovative biotechnics and techniques in order to stimulate the managerial capacities of zootechnical contractors to use the multiform endogenous resources (genetics, water, cultural inputs, etc.) charaterizing the Mediterranean region.

On the eve of the third millennium, the emergent social productive scenarios especially in the Mediterranean region, are inextricably linked to the challenges of internationalization. Environmentally sustainable development and the total quality of an alimentary product are increasingly major targets of global development projects. From this point of view competition will be stronger between territorial systems than between single enterprises. Therefore, the peculiar characteristics of the micro-environment (territorial system) in which the zootechnical enterprise is situated will increasingly determin the strategy to follow. From this it follows that endogenous resources (human, animal, vegetable, cultural, water, etc.) must be efficiently utilized, organized and managed (NARDONE and MATASSINO, 1989**a**, **b**). The competitive

capacity of the territorial systems will be determined by the degree of management of the biotechnical innovations and techniques designed to make the best possible use of autochthonous germplasm. This germplasm, therefore, constitutes and will constitute an irreplaceable and significative link in the so-called chain of innovation (MATASSINO, 1992**c**).

Valorization of endogenous animals resources, based upon the utilization of the above-mentionned innovations, is *the sine qua non* for an eco-compatible developmental process, wich will also considerably reduce the marginal status of large territorial systems of the agro-alimentary sector in the Mediterrenean basin (MATASSINO, 1992**d**).

## 6.0 THE TOWN OF CASALDIANNI IN HISTORY

Recent archaeological findings have shown that Casaldianni was inhabited in the Roman and Sannite periods.

According to MEOMARTINI (cited TARTAGLIA POLCINI, 1990) after the Sannite, Roman and Barbaric periods, Casaldianni appears in written history, in 855 as a Longobard dependence. Subsequently, it was owned by Montecassino's abbey.

In the period of the crusades it belonged to the Marotta family and was an inhabited village with a church dedicated to Saint Andrew. During the Angevin period it belonged to the county of Ariano and was under the possession of Ermingao Shabran, passing soon after to Ilaria of Sus.

In 1343, it was given as a dowry to Sancie, King Roberto d'Angio's wife, and shared the fortunes of the Kingdom of Naples and those of Circello's castle until 1528, when it was given to the di Somma family, natives of Naples.

The ancient village was destroyed in the war between the Angevins and the Aragonese on the 3rd July 1496.

In the 18th century it became a fief distinct from Circello, then on the 16th October 1809 Casaldianni's lands were assigned to the duke of di Somma who converted the ex fief into a model farm at the beginnings of this century.

*The main building of the Circello Centre*

## 7.0 AIM, ORGANIZATION AND ACTIVITY AT CIRCELLO'S CENTRE

### 7.1 Aim

Italy, which is a depositary of one of richest patrimonies of taxonomic unities and ethnic groups of Europe, has been the first to respond to the FAO's appeal by constituting the *Centre for defence of genetic resources of animal populations* of R.N.C. (National Research Council) (today known as the Institute for the defence and exploitation of animal germplasm), in Milan, and, in 1990 the *National centre for the preservation of germplasm of animals at risk of extinction*, thanks to the joint efforts of the Ministry of Agriculture and Forestry, of the Italian Breeders Association and Circello's comune (BN), with the scientific support of a technical committee. The Centre has the following objectives:

1. preservation
2. knowledge
3. multiplication
4. genetic improvement
5. zootechnical utilization

### 7.2 Organization

The Centre is located in Casaldianni farm on 310 ha used for the following purposes:

| | |
|---|---|
| - wood | 80 ha |
| - olive-yard | 30 ha |
| - fit for seed | 61 ha |
| - meadow pasture | 29 ha |
| - bushy pasture | 95 ha |
| - vine yard | 1 ha |
| - buildings, roads, unproductive tares | 14 ha |

At present, in the farm there are 281 animals:

(**a**) genetic types and/or breeds of cattle:

(**i**) 84 Brown
(**ii**) 16 Piemontese (two heterozygote translocation carriers 1/29)
(**iii**) 1 Marchigiana (homozygote translocation 1/29)
(**iv**) 2 monozygotic twins of Italian Friesian breed obtained by *embryo splitting*
(**v**) 6 Varzese
(**vi**) 5 Burlina
(**vii**) 4 Agerolese
(**viii**) 5 Ottonese
(**ix**) 5 White Padana or Modenese
(**x**) 4 Reggiana
(**xi**) 4 Pustertaler

(**b**) genetic types and/or breeds of sheep:

(**i**) 40 Laticauda
(**ii**) 15 Quadrella
(**iii**) 7 Bagnolese
(**iv**) 5 Alpagota

(v) 5 Lamonese
(vi) 6 Turchessa
(vii) 7 Cornella Reggiana or Bianca

(c) genetic types of goats:
(i) 7 Cilentana grey
(ii) 3 Cilentana tawny
(iii) 3 Cilentana black
(iv) 2 Napoletana
(v) 1 Pomellata
(vi) 5 Sarda primitiva (*Capra aegagrus hircus*)
(vii) 3 of Selvatica di Samotracia (*Capra aegagrus pictus*)
(viii) 3 Selvatica di Giura (*Capra aegagrus giurensis)*
(ix) 5 Selvatica di Montecristo (*Capra aegagrus aegagrus*)
(x) 3 Primitiva del Camerun
(d) several genetic types of pig
(e) severalgenetic types of horse

Other autochthonous genotypes of various species of the Mediterranean area are going to be collected; among these particular attention will be paid to the pig types *Mora Romagnola* and *Cavallina Lucana.*

7.2.1 ***ConSDABI***

The Centre for the protection of Animal germplasm at risk of extinction is connected with an Association called ConSDABI (Association for the Experimentation, Divulgation and Application of Innovative Biotechniques) founded thanks to financial support from the Ministry of Agriculture and Forestry, with the collaboration of the Italian Breeders Association, Comune of Circello and the Chamber of Commerce, Industry, Agriculture and Handcraft of Benevento. It is organized in internal and external sections.

7.2.2 ***Internal sections*:**

(a) cytogenetics
(b) embryology
(c) reproduction
(d) computer centre
(e) library

7.3 **The activity of the Centre**

The activity of the Centre is geared towards the achievement of the objectives referred to in paragraph 7.1., through the following steps:

7.3.1 ***Preservation***: the collection of different genotypes from various Italian and Mediterranean regions and the recording of all the morphological, functional and demographic characteristics.

7.3.2 ***Knowledge:*** *the* recording all the characteristics and/or *biological indicators* necessary for the individual typification of the animal, of the following kinds:

- **(i)** *genetic* (with particular regard to the genome stability)
- **(ii)** *metabolic*
- **(iii)** behaviour
- **(iv)** *adaptation*

On all subjects the following determinations are carried out: morphometric relief, cytogenetic typification (conventional and banded kariotype, heterocromatin, NOR'S, SCEs, micronucleus, etc.), metabolic and hormonal profiles, recording of the qualitative and quantitative characteristcs of production for:

- **(a)** *milk*
  - **(i)** proteic polymorphism
  - **(ii)** fat composition
  - **(iii)** yield
- **(b)** *meat*
  - **(i)** weight increase
  - **(ii)** different types of muscular fibres and their relations with some chemical, rheological and colourimetric characteristics of the meat.

7.3.3 ***Multiplication***: in order to increase the numbers of each genetic type, superovulation of donors, instrumental insemination and transfer of the embryos to suitable synchronized recipients (of the same or other genotypes is carried out). To accelerate the process of numerical increase other innovative biotechnics are being used, for example:

- **(a)** maturation and *in vitro* fertilization of oocytes;
- **(b)** microsurgical splitting to produce pairs of monozygotic twins;
- **(c)** cloning (nuclear transplantation).

7.3.4 ***Genetic improvement***: particular models of genetic improvement, in relation to the future utilization of each genotype, are being formulated.

7.3.5 ***Zootechnical utilization***: the knowledge and improvement of the productive and reproductive characteristics of the preserved subjects will allow a broader utilization of them, not only in the national context but also in the Mediterranean area, *Circello* being an environment,that is fairly representative of this area.

Thanks to the continuous technical and scientific acquisitions it will be possible to adopt production systems suitable to the different productive realities, and improve the management of the animal genetic resources, including water and soil, by involving totally; the animal genotype, feeding, availability and use of the water for irrigation, demographic structure of the breeding unit, structures, and infrastructures, animal health and the breeder (NARDONE and MATASSINO, 1989**a** and **b**). Such resources can be successfully used to produce typical foodstuffs which may help to solve the problems connected with nutritional disputes. This has a particular operative meaning in the light of the emergent concept ot sustainable agriculture and aims to typify of animal products and, therefore, institute a geographic DOC for zootechnical products (MATASSINO, 1992**a**).

These genotypes, having an incommensurable biological value, can be used as a gene bank from which it will be possible to derive information in order to obtain products diversified for either qualitative or quantitative aspects of their nutritional factors. The utilization of large alimentary resources will be a particular aim, especially by amplifying the use of specific molecules (somatothropins, etc.) in milk and meat animals (MATASSINO 1982; 1988; 1990**a** and **b**; BOYAZOGLU, 1990; ROGNONI *et al.*, 1990; JASIOROWSKI, 1990; NARDONE 1990, MATASSINO and GRASSO, 1991).

Preservation and multiplication of the autochthonous genotypes have and will have increasing importance, especially in the light of the marked increase in patents regarding innovations in processes and products on biological bases (transgenic), because these patents will contribute also to a dangerous impoverishment of the genetic diversity of animals engaged in zootechnical production.

The organolectic pecularities of the products furnished by the genotypically autochthonous animals constitute an important element for their broader utilization in difficult areas and also for the protection of the land and human traditions.

It is also likely that, in the near future, animals carrying particular chromosomal rearrangements will be able to provide alimentary products whose dietetic value will be superior to those produced by animals lacking such rearrangements.

These brief notes on some nutritional aspects emphasize the great complexity of the problems connected with the production of foods compatible with the different nutritional needs of human beings, according to the age and the daily activity that take place in a given micro-environmental context.

It must not be forgotten that the chemical composition of a food is never able to satisfy *in toto* the nutritional needs of an individual and, therefore, one of the most important aspects for which in the near future it will be possible to interfere positively with autochthonous genotypes, is the possibility of reconciling, as already mentioned, nutritional disputes (MATASSINO, 1991**b**, 1992**a** and **b**, 1993).

Until a few years ago, the selection of animals in zootechnical production was mainly aimed at increasing the milk yield, with a corresponding detrimental effect on the quality. This has brought about a decrease in genetic variability which is necessary for making any plans for improvement.

Individuation of the semantic factors affecting the physiology of the type of fibre is the *sine qua non* for teleological interventions aiming to improve meat quality.

In fact, it is known that the conversion of muscle into meat, which involves biochemical, physical and structural variations of the muscle fibre, is mainly a function of the type of fibre constituting the muscle itself at the time of slaughtering. It has to be remembered moreover, that the muscle fibre, even after the differentiation phase, can reversibly modulate its contractile properties in response to different internal and external stimulation (ALNAQEEB and GOLDSPINK, 1987; GOLDSPINK and MATASSINO, 1989; MATASSINO 1989; MATASSINO *et al*, 1989**b**). With the knowledge of the biochemical mechanisms responsible for lipo-genesis, and of the interested genes, it will soon be possible to obtain subjects of high dietetic value because of the meat's cholesterol content. Also regarding the production of

dietetic meat, autochthonous germplasm can play an important part, especially as regards the effects of genetic variability (polymorphism) on the physiological activity of the muscle fibre.

In conclusion, autochthonous animal germplasm will not have a merely secondary role in future cultural ecosystems. It will be an important link in the development of today's agro-ecosystem, especially where the necessity to reinstate the largest possible spectrum of genetic differentiation within the zootechnical species is concerened.

## 8.0 COLLABORATION IN COURSE

### 8.1 *'Porc méditerranéen'* Network

The Centre is collaborating with some Mediterranean countries (Spain, France, Portugal) in the *Porc méditerranéen Network* programme which is to study and improve breeding systems for autochthonous swine genotype.

### 8.2 Greece

The Regional Councillorship of the Agricultural Development of Epiro (Greece) wants to establish a similar structure in the country with our collaboration. An important aspect of this work will concern the cytogenetic typification and study of the enzymatic polymorphism of goat genotypes on some Peloponnese islands, such as Somatracia and Giura.

### 8.3 Portugal

The Biology Department of the University of Evora and the *Federação Portuguesa de Associacões de Suinicultores* of Lisbon requested the Centre's collaboration for the preparation of a plan of preservation and utilization of the autochthonous Portuguese swine genotypes.

### 8.4 Spain

The Centre is currently collaborating with the Depariment of animal Production, Genetics and breeding, Faculty of Veterinary Science, University of Murcia, on research themes in the field of experimental embryology and animal cytogenetics regarding autocthonous genotypes at risk of extinction.

### 8.5 Chair of General Zootechnic and Genetic Improvement and Chair of Physiology of Animals in Zootechnical Production at the University of Naples 'Federico II'

The Centre is collaborating with the above chairs in research work related to various programmes:

(a) National Research Council (NRC):

- (i) a finalized project: advanced research into innovation in agricultural systems (RAISA) to widen knowledge concerning the operative application of innovative biotechnics such as: splitting, nuclear transfer, *in vitro* fertilization, genome stability test;
- (ii) a strategic project: 'electromagnetical fieldS and bioinformation';
- (iii) a finalized project: 'the production of chimeras in cattle and swine';

(b) experimentation on 'Embryo transfer in cows', financed by the Lazio Region;

(c) utilization of metabolic and hormonal profiles for a better physiological characterization of various autochtonous genotypes kept at the Centre;

**(d)** Integrated Mediterranean Programme for the Marches, with the Provincial Breeders Association of Ancona, to increase the numbers of subjects carrying chromosomal rearrangements and to perform comparative tests between translocated (heterozygotes [59 chromosomes] and homozygotes [58 chromosomes]) and normal subjects, for their productive and reproductive efficiency;

**(e)** A Programme to initiate embryo transfer in the Piemontese breed in conjunction with the Regional Breeders Association of Campania, Campania Region, the Mountain Community 'Alto Tammaro' and the Comune of Circello.

8.6 **Department of General and Environmental Physiology at the University of Naples 'Federico II'** (Faculty of Mathematics, Physics and Natural Sciences)

There is currently work in progress to identify a cryoprotector peculiar to each genotype, in order to increase the efficiency of the whole system of 'instrumental insemination'.

In particular, such a cryoprotector should protect the structure and disposition of those membrane proteins which are known to modulate the capacitation processes of spermatozoon.

8.7 **Institute of Biochemistry of Macromolecules at the Univerity of Naples 'Federico II' and Institute of Biochemistry of Proteins and Enzymology of the National Research Council (NRC) of Naples**

The Centre is currently collaborating on sex predetermination and some aspects of the manipulation of spermatozoon and eggs of ecotypes at risk of extinction.

8.8 **Department of Evolutive and Comparative Biology at the University of Naples 'Federico II'** (Faculty of Mathematics, Physics and Natural Sciences)

The work in progress regards the study of enzymatic polymorphism of autochthonous genotypes, as irreplaceable indicators for the evaluation of biodiversity.

8.9 **Department of Zootechnical Sciences at the University of Torino and Institute of Clinical Surgery at the University of Pisa**

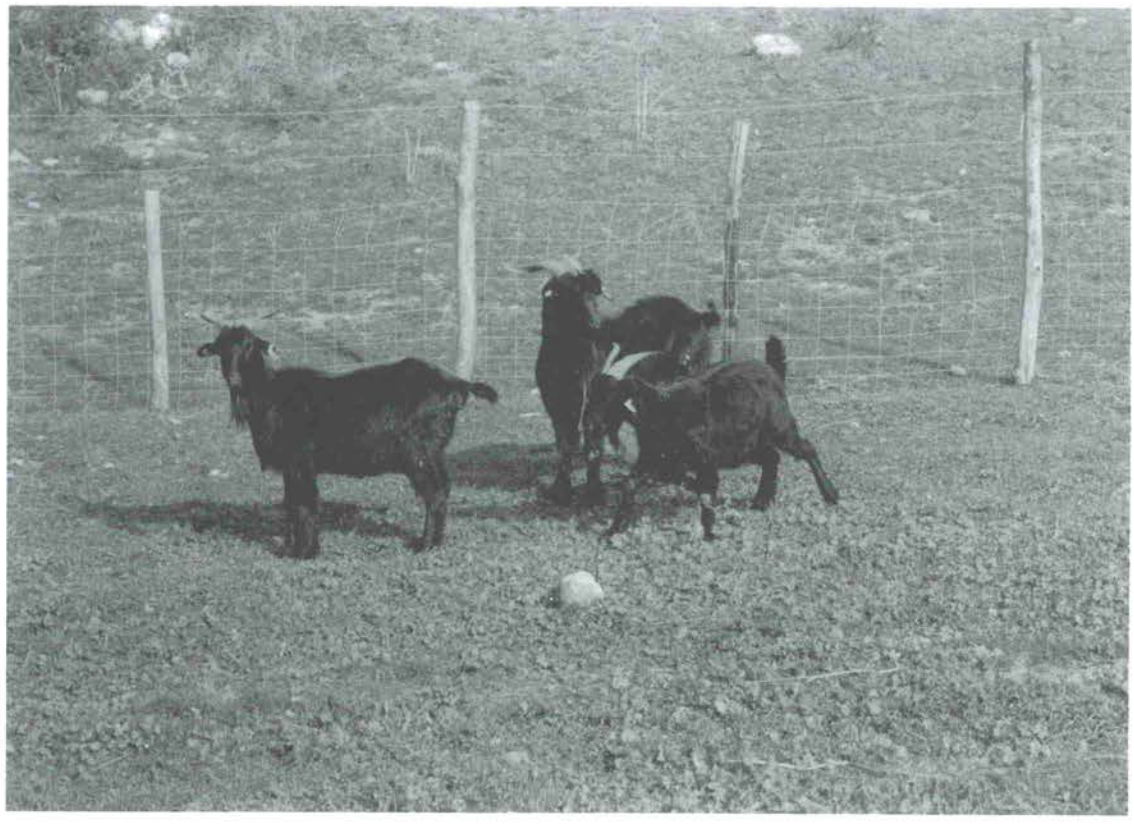
In the Programme on 'embryo transfer in Piemontese breed' and in the RAISA project 'Embryonal splitting and nuclear transfer', the researchers of these two institutes are collaborating to define the procedures peculiar to the Piemontese breed. In In fact, in relation to the complexity of the physiological mechanisms that regulate endocrine and gametogenic activity of ovaia and to the great variability of the interspecific, interraciae and individual response, it appears that protocols already experimented on other breeds are often not transferable in Piemontese breed in terms of ovulation rates as well as fertilization and tubaric transportation.

Such protocols need, perhaps, to be further refined and improved because it is known that the ovarian response to stimulation with FSH (follicle stimulating hormone) of cows belonging to meat genotypes is inferior to that obtainable in cows belonging to milk genotypes.

8.10 **International Institute of Genetics and Biophysics (IIGB) of the NRC of Naples**

Currently the collaboratory work inprogress regards the study of chromosomal rearrangements in ecotypes at risk of extinction.

*Local pig genotypes*



*Goat genotypes*

8.11 **Centre for the Study of Germinal Cells, NRC Siena**

The work regards some aspects of the biochemistry of the spermatozoon of autochthonous genotypes.

8.12 **Institute of Research for Electromagnetism and Electronic compounds (IRECE), NRC, Naples**

The Centre is currently collaborating in work on the influence of electromagnetical fields on the genome stability of autochthonous genotypes of the different species.

8.13 **Centre of Genetic Engineering (CEINGE), Naples**

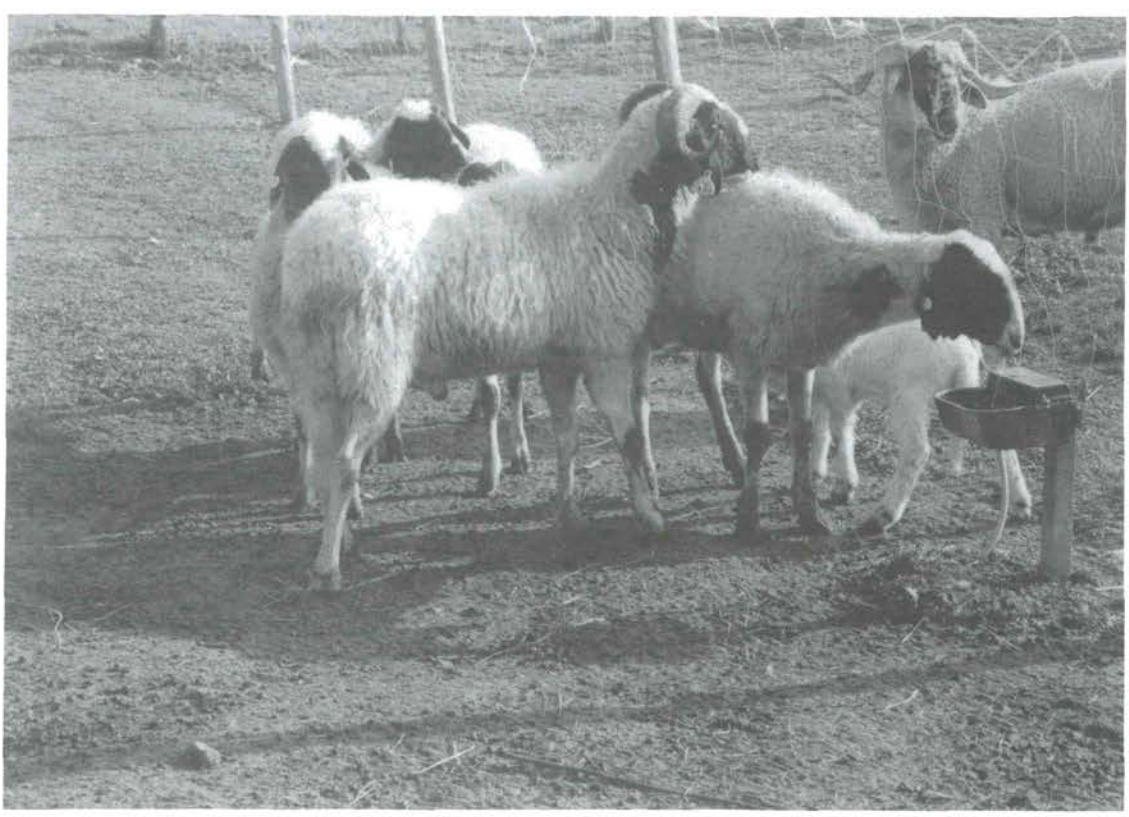
The work regards exchange of information concerning innovations in genetic engineering.

8.14 **Centre of Natural Science, Prato (FI)**

The Centre is currently collaborating in work aimed at rescuing the wild genotype of Greek goats and goats of the Montecristo Island (Italy).

8.15 **Naples, Research**

In the context of the competition for public funds on themes regarding original sectors (air-spatial, biomedical, biotechnologies, etc.) the theme of cloning has been awarded an amount of Lit 2,5 million (Centre of Circello study by a final-year student in Agricultural Sciences).



*Local sheep population*

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**Table I. Distribution of ecotypes of the Mediterranean Area (Villa, 1992)**

| Ecotypes | Country | Number of cows |
|---|---|---|
| Pontremolese | Italy | 16 |
| Cardena Andaluza | Spain | 20 |
| Lourdaise | France | 30 |
| Mallorquina | Spain | 44 |
| Murciana | Spain | 40 |
| Calvana | Italy | 50 |
| Garfagnina | Italy | 70 |
| Varzese-Ottonese | Italy | 70 |
| Aure et St. Girons | France | 70 |
| Bearnaise | France | 70 |
| Kea | Greece | 80 |
| Tinos | Greece | 80 |
| Mucca Pisana | Italy | 97 |
| Villard de Lans | France | 100 |
| Gasconne Areolée | France | 125 |
| Menorquina | Spain | 173 |
| Terrena | Spain | 200 |
| Vianesa | Spain | 200 |
| Blanca Cacxerena | Spain | 205 |
| Cachena | Spain | 220 |
| Cabannina | Italy | 231 |
| Betizu | Spain | 250 |
| Agerolese | Italy | 300 |
| Pajuna | Spain | 310 |
| Berrenda Negro | Spain | 389 |
| Frieiresa | Spain | 400 |
| Sykia | Greece | 500 |
| Cyprus | Cyprus | 500 |
| Keterini | Greece | 800 |
| Albera | Spain | 900 |
| Berrenda Colorado | Spain | 971 |
| Negrea Campinas | Spain | 897 |
| Limiana | Spain | 2 000 |
| Asturiana Montana | Spain | 2 000 |
| Caldelana | Spain | 2 000 |
| Monchina | Spain | 2 000 |
| Bazadaise | France | 3 000 |
| Marinhoa | Portugal | 3 005 |
| Camargue | France | 4 000 |
| Savaguesa | Spain | 4 000 |
| Alistana Sanabresa | Spain | 4 000 |
| Preta | Portugal | 4 000 |
| Arouquesa | Portugal | 5 007 |
| Maronesa | Portugal | 5 100 |
| Brachykeratiki | Greece | 6 000 |

**Table II. Cattle breeds with more than 100 cows in danger of extinction in the Mediterranean area: production purpose, nutrition, keeping of animals, breeding area (Villa, 1992)**

| Ecotypes | Feeding | | Stabling[1] | Breeding area |
|---|---|---|---|---|
| **1.0 Meat producing breeds** | | | | |
| **1.1 Not used for draft** | | | | |
| Betizu | grazing | | A | mountain |
| Terrena | " | | A | " |
| Blanca Cacerena | " | | A | hill |
| Berrenda Negro | " | | A | mountain |
| Negra Campinas | " | | A | hill / plain |
| Albera | " | | A | mountain |
| Berrenda Colorado | " | | A | " |
| Monchina | " | | A | " |
| Preta | " | | A | plain |
| Camargue | " | | A | " |
| Cachena | " | fodder | B | mountain |
| Sykia | " | " | B | hill / plain |
| Asturiana Montana | " | " | B | mountain |
| Alistana Sanabresa | " | " | C | " |
| **1.2 Occasionally used for draft** | | | | |
| Pajuna | grazing | | A B | mountain / plain |
| Vianesa | " | fodder | B | " |
| Frieiresa | " | " | B | " |
| Katerini | " | " | B | " |
| Maronesa | " | " | B | " / hill |
| Arouquesa | " | " | B | " |
| Brachykeratiki | " | " | B | " / hill |
| Gasconne Areolée | " | " | C | hill |
| Cyprus | " | " | C | " / plain |
| Caldelana | " | " | C | mountain |
| Limiana | " | " | C | " / plain |
| Bazadaise | " | " | C | plain |
| Sayaguesa | " | " | C | plateau |
| Marinhoa | fodder | | D | plain |
| **2.0 Milked breeds** | | | | |
| Menorquina | grazing | fodder | C | hill / plain |
| Vilalrd de Lans | " | " | C | plateau |
| Cabannina | " | " | C | mountain |
| Agerolese | fodder | | D | " |

[1] A: no stabling; B: stabling only in winter; C: Stabling with grazing only when possible; D: full stabling

# L'ÉLEVAGE DU YAK EN ASIE CENTRALE

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## RESUME

Le yak domestique, *Bos grunniens*, est un boviné à longs poils et à queue touffue élevé en Asie Centrale, dans les zones situées entre 3500 et 5000 mètres d'altitude.

Son aire de répartition correspond schématiquement aux régions montagneuses qui s'inscrivent entre les longitudes 70° à 115° Est et les latitudes 27° à 55° Nord, c'est à dire du Pamir à l'Ouest jusqu'à la région du lac Baikal à l'Est. En Mongolie à la latitude la plus septentrionale de l'aire considérée il descend jusqu'à 1500 mètres d'altitude.

En égard à son rôle central dans la vie des populations essentiellement pastorales d'Asie centrale, l'élevage du yak apparait comme un révélateur puissant et un intégrateur efficace des systèmes écologiques des zones d'altitude d'Asie.

Nous présenterons ici succintement, à partir de précedentes publications, les caractéristiques du yak, le fonctionnement des systèmes d'élevage et l'organisation spécifique du pastoralisme dans des milieux extrèmement contraignants.

## SUMMARY

The domestic Yak, *Bos grunniens*, is a long haired and bushy tailed bovid raised in Central Asia, between 3500 and 5000 m above sea level. It is found in mountainous regions between 70° and 115° East and between 27° and 55° North, from the Pamir on the West to the Lake Baïkal on the East. In Mongolia, in the Yak's most northern location, it is found as low as 1500 m above sea level.

Due to its central role in the way of living of pastoralist in Central Asia, Yak husbandry has a major importance for ecological equilibrium in Asian mountainous zones. This paper summarizes, using data from previous publications, the main characteristics of this species, of the livestock systems and of the particular organization of pastoralism in these extremely difficult environments.

## 1.0 INTRODUCTION

Dans la classification zoologique des bovidés, le yak fait partie de la sous-famille des bovinés à l'intérieur de laquelle il a souvent été considéré comme constituant un genre à part - le genre *Poëphagus* - à côté des genres *Bison*, *Bos* et *Bubalus*. Il possède 30 paires de chromosomes comme Bos taurus et autres Bos. Actuellement on tend, du point de vue zoologique, à classer le yak comme un sous-genre du genre *Bos*, avec la dénomination suivante pour le yak domestique : *Bos* (*Poëphagus*) *grunniens L.* Ce nom lui vient du grognement caractéristique qu'il émet, très semblable à celui du bison.

Il existe un yak sauvage qui vit au Nord du 33° latitude Nord, dans les régions les plus élevées du Changthang au Tibet et dans le Qinghai [1].

L'origine du yak est assez mal connue. Le berceau de cette espèce parait être le plateau tibétain et les régions avoisinantes. C'est là qu'elle a évolué et acquis cette remarquable adaptation au climat froid et à l'altitude. Il semble que sa domestication soit relativement ancienne (plus ancienne par exemple que celle du cheval) : elle serait contemporaine de l'apparition de l'agriculture et de la domestication d'espèces telles que le bovin (*Bos taurus*).

## 2.0 DISTRIBUTION DU YAK

L'aire de répartition du yak domestique correspond aux hautes régions du système montagneux qui couvre l'Asie centrale : le Plateau tibétain et les montagnes qui le limitent, Himalaya et Karakorum au Sud, Kunlun, Nan-Shan, Altyn Tag et Quilian au Nord, le massif du Pamir à l'Ouest, la zone Ouest et Nord de la Mongolie (Monts Altai, Hangay et Khentei) et la région du lac Baikal à l'Est.

On compte environ 14 millions de yaks. La plus grande partie du cheptel de yaks se trouve en Chine, 12 millions exploitant 87 millions d'hectares de pâturages d'altitude (au-dessus de 3000 mètres et jusqu'à 5500 mètres), répartis dans les provinces du Quinghai, du Gansu, du Sichuan, du Yunnan et des deux régions autonomes du Xizang (Tibet) et du Xinjiang (ZHANG-RONG-CHANG, 1989).

La Mongolie compte un cheptel assez important (500.00 animaux) ainsi que l'ex-URSS (Tajikistan, Kirghizie, Tuva).

L'élevage dû yak joue aussi un rôle important dans les hautes vallées de l'Himalaya (Inde du Nord, Nepal, Bhoutan).

## 3.0 DESCRIPTION DU YAK

Si on le compare aux bovins, du point de vue morphologique, on peut observer que le yak présente un certain nombre de traits particuliers caractéristiques de l'espèce.

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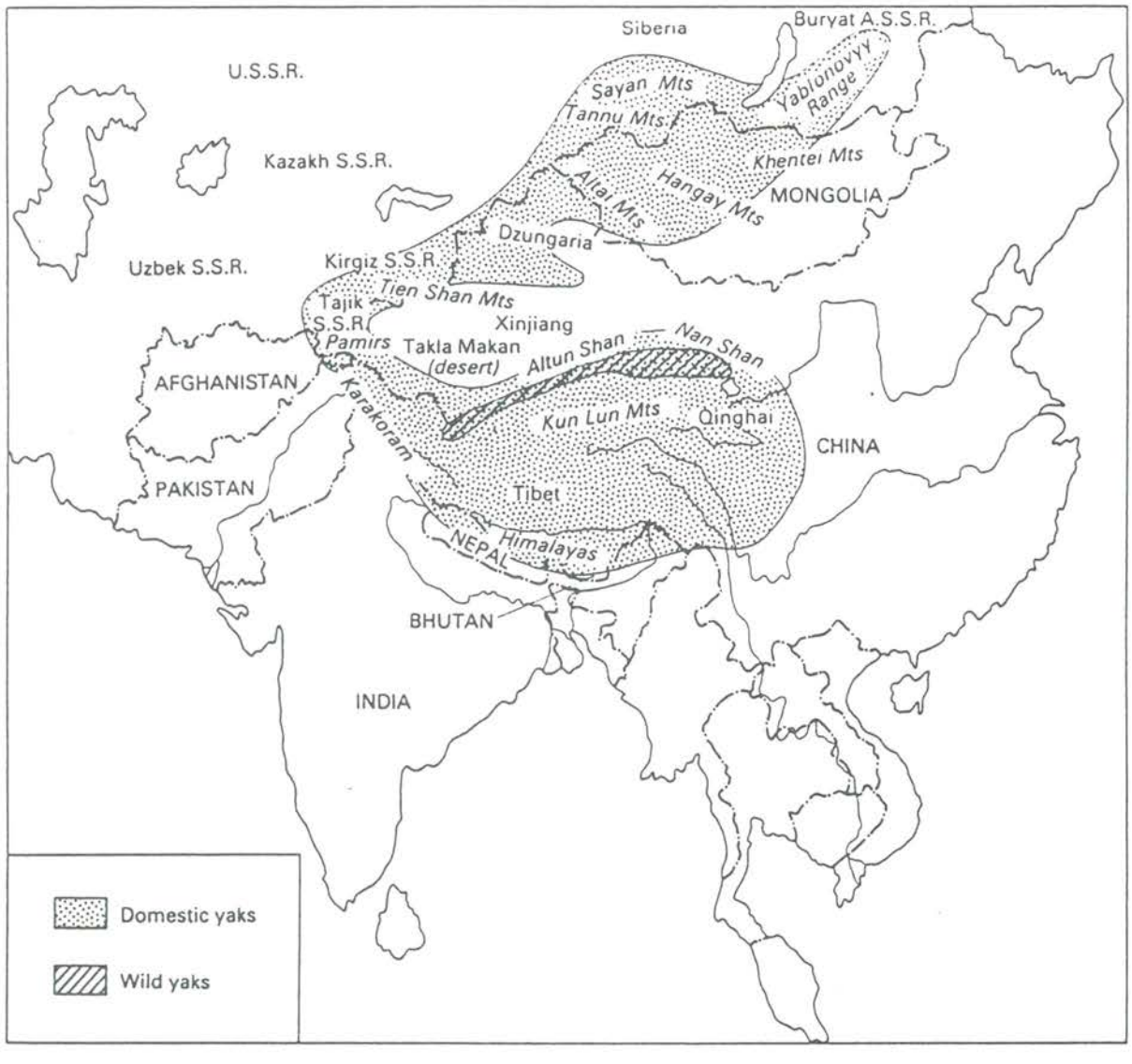
(1) Le yak sauvage, est plus grand que le yak domestique, avec une hauteur de 1,50 à 2 mètres au garrot ; il a un poids de 500 kg et plus, avec une toison de longs poils sur l'ensemble du corps. Les cornes de très grande taille peuvent atteindre 90 cm. Il arrive que des yaks sauvages paissent avec des yaks domestiques qui peuvent être ainsi fécondés.




*Aire de répartition des yaks*

L'ensemble du corps offre dans son allure générale un aspect allongé, compact et particulièrement développé dans sa partie antérieure. Le yak possède d'ailleurs 14 à 15 paires de côtes (comme le bison) au lieu de 13 chez le bovin domestique. Les pattes sont plus courtes que chez le bovin, les aplombs très bons, et les onglons sont d'assez grande dimension et d'une exceptionnelle dureté. La queue est caractéristique mais garnie de très longs poils en abondance depuis la base, touffue et soyeuse.

La ligne de dos n'est pas droite comme chez la plupart des bovins, mais ondulée : le garrot est haut et proéminent par suite de l'allongement des apophyses épineuses vertébrales à partir de la dernière vertèbre cervicale et jusqu'au milieu du dos ; la croupe courte et étroite est inclinée vers l'attache de la queue située très bas. L'arrière main est en conséquence plutôt léger. La poitrine est large, profonde et bien descendue. L'encolure est courte, fine à l'attache de tête et présente la particularité de ne pas porter de fanon.

La tête présente un aspect lourd et massif, le profil est légèrement concave et les orbites saillantes. Le front est large, le chanfrein long et droit, le mufle est assez étroit, la lèvre supérieure est plus fine que chez le bovin et très mobile, ce qui permet au yak de brouter une herbe très rase. La denture présente une usure moins rapide que chez le bovin. La forme des cornes est caractéristique : celles-ci se développent en effet d'abord légèrement vers l'arrière et latéralement puis remontent en une courbure les dirigeant plus ou moins vers l'avant. Le cornage est moins développé chez la forme domestique du yak que chez la forme sauvage. Chez les yaks domestiques on trouve même souvent une certaine proportion d'animaux sans cornes (90 % du cheptel en Mongolie, où on l'a fortement sélectionné sur ce caractère). Au Népal il n'y a pas d'animaux sans cornes.

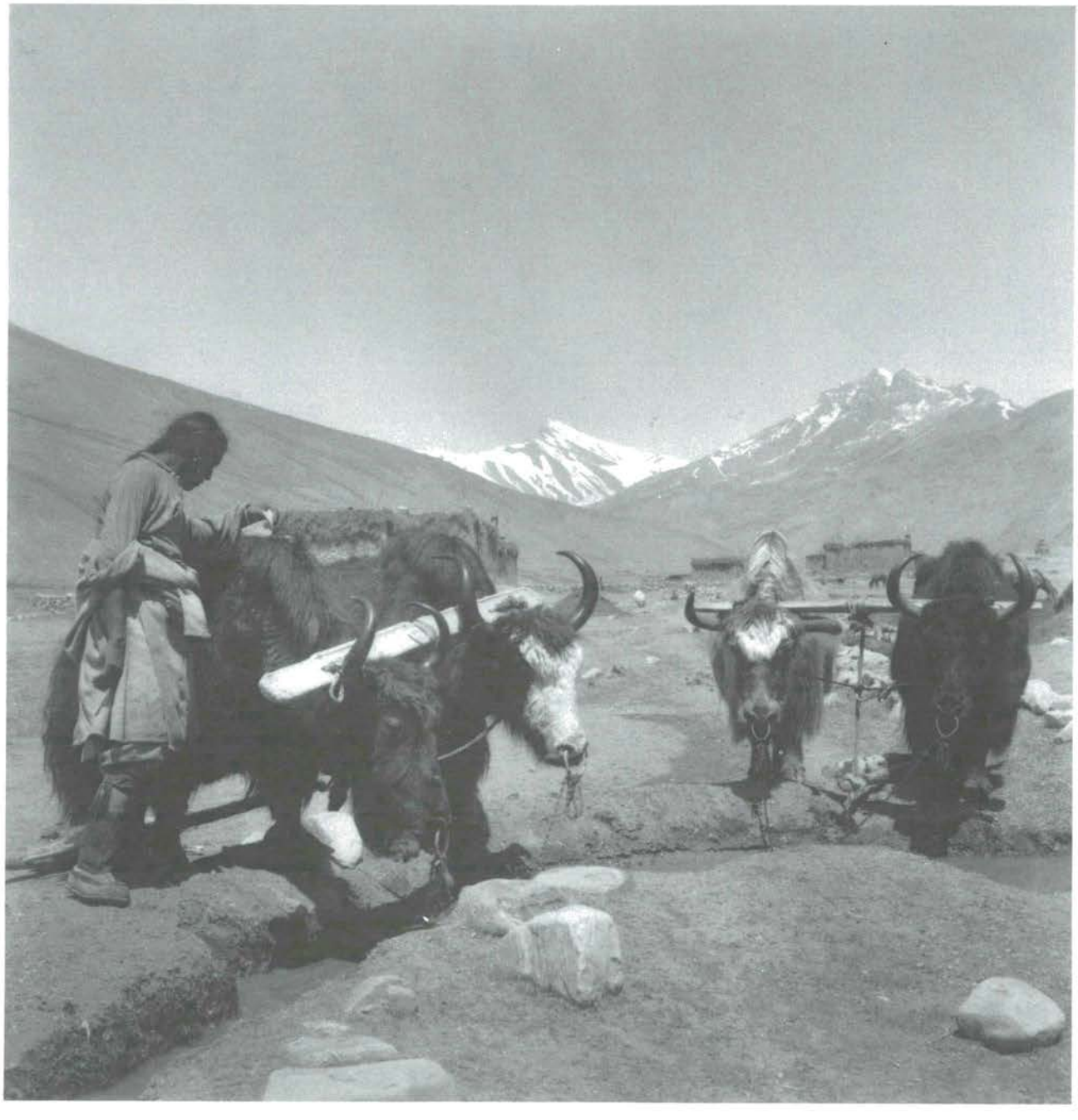
Les femelles ont une mamelle de petite dimension et couverte de poils : la traite est faite à la pincée.

Le pelage du yak se compose de deux parties : un sous-pelage duveteux et feutré et un pelage externe constitué de poils plus grossiers lustrés plus ou moins longs selon les régions anatomiques. Ce pelage externe est développé en une belle frange de longs poils de 20 à 50 cm sur la partie inférieure du corps, tout le long des flancs et de la partie médiane externe des membres. Ils sont très développés au niveau de la queue.

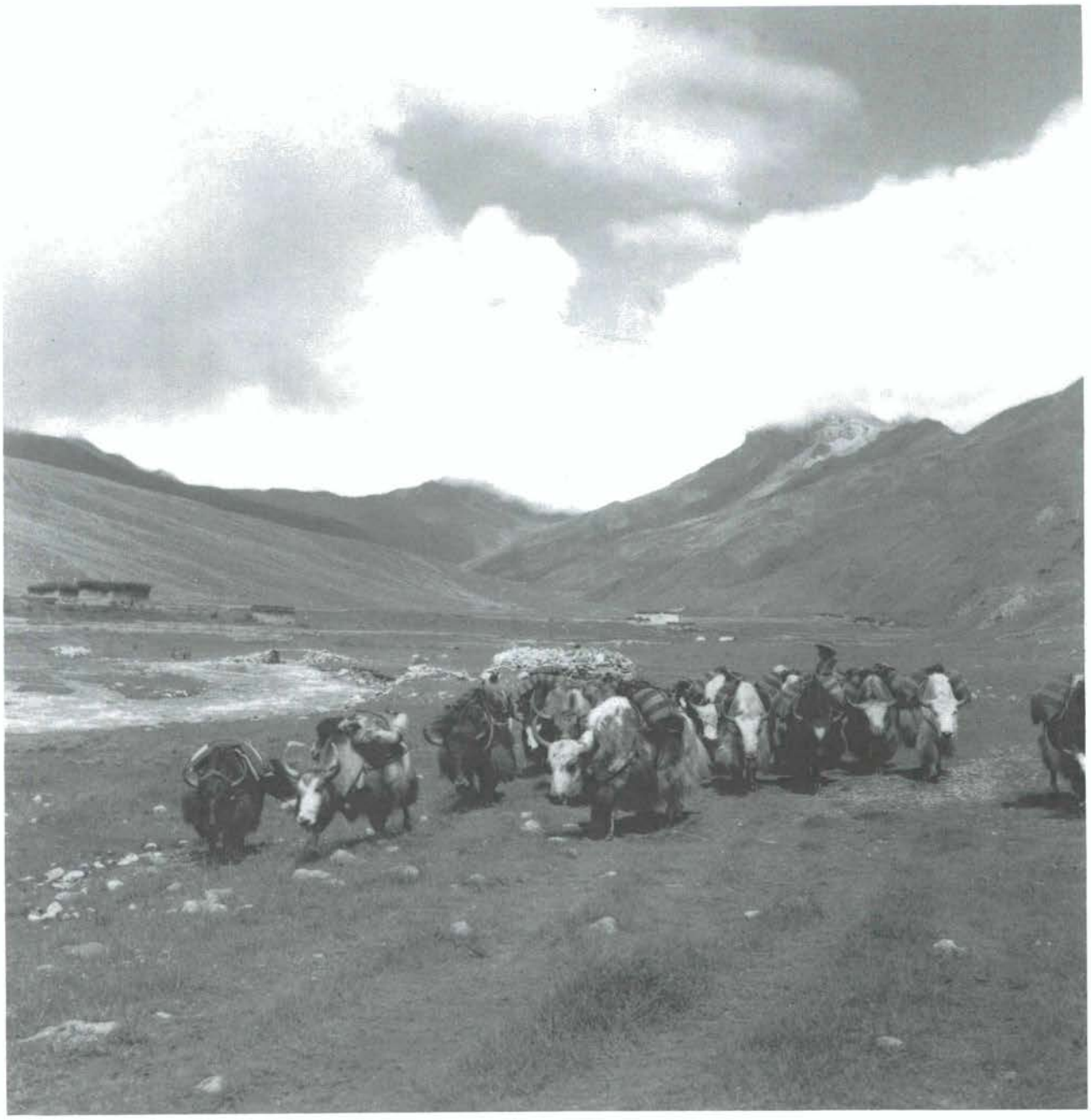
La robe noire avec une teinte brunâtre d'intensité variable est la plus répandue chez le yak domestique. Les autres couleurs habituelles sont le blanc, le brun, le gris argenté, le bleu rouan. La domestication a très certainement favorisé, chez le yak comme chez les autres espèces, la diversification des couleurs de la robe, le choix des reproducteurs faisant intervenir des critères esthétiques. Les pourcentages respectifs de yaks de robe unie et de yaks de robe mélangée paraissent assez différents selon les régions, les yaks de robe unie ne sont que de l'ordre de 20 % en Mongolie.

## 4.0 UTILISATIONS DU YAK

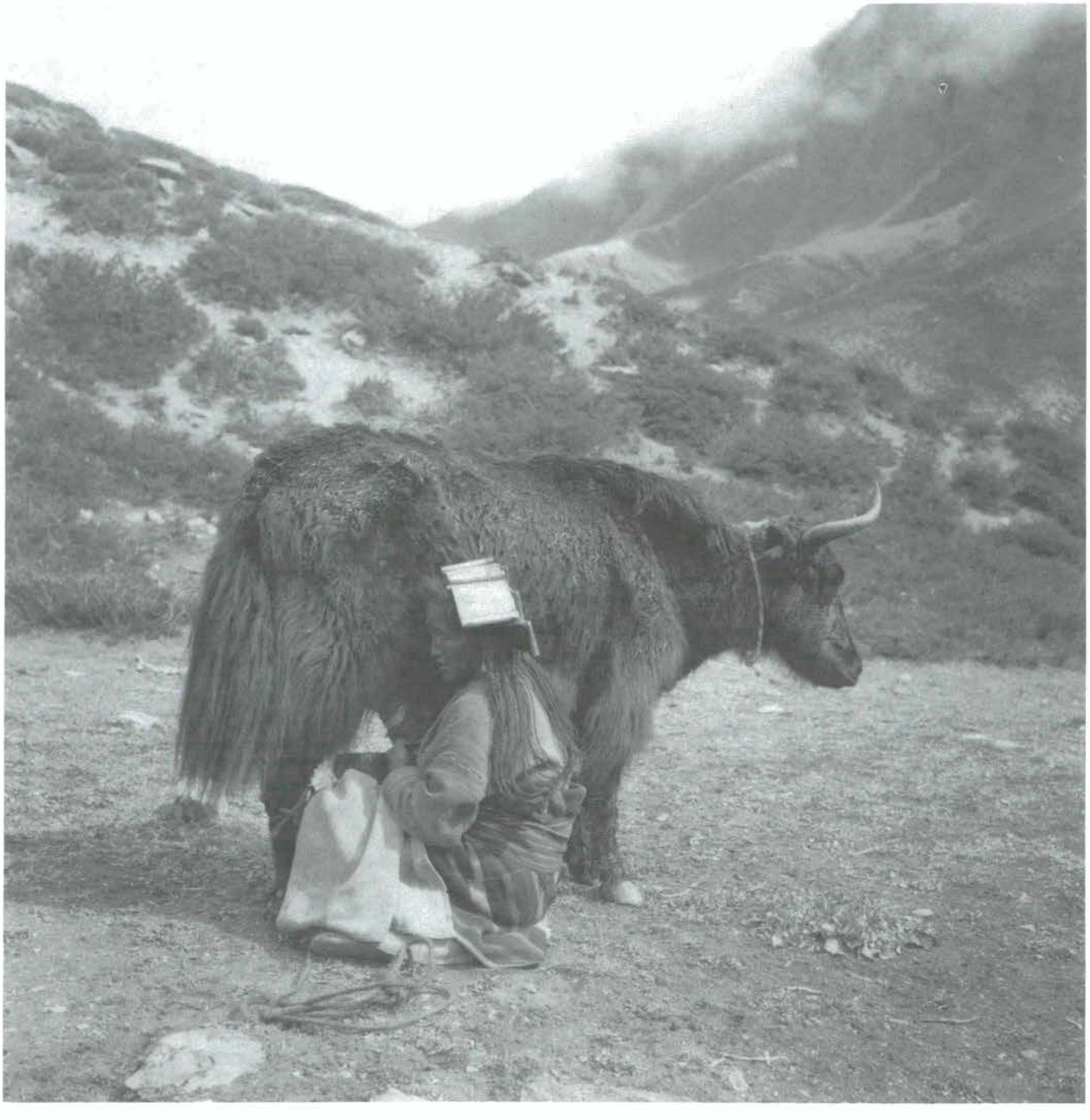
Le yak a toujours joué un rôle important dans la mythologie des peuples d'Asie centrale : on le trouve associé aux montagnes, aux dieux et aux démons, aux légendes d'origine des rois, aux festivités religieuses. En outre certains de ses produits (beurre et autres produits laitiers, viande, coeur, cornes...) sont utilisés en médecine tibétaine. Le



*Yak au labour au Nepal*



*Transport du sel au Tibet*



*Traite d'une dri*

beurre de yak est utilisé dans certaines cérémonies bouddhistes (lampes à beurre, offrandes...).

Le yak domestique est exploité à plusieurs fins dans la vie matérielle des sociétés pastorales d'Asie Centrale.

Dans la plus grande partie de l'aire d'élevage du yak, notamment dans les zones de haute altitude où l'élevage bovin se révèle impossible, une des fonctions essentielles est de produire du lait. A ce titre il occupe une place décisive dans l'économie agro-pastorale.

Avec un faible coût d'entretien le yak produit pratiquement autant de lait que les races bovines locales : en moyenne de 450 à 600 kilos de lait par lactation de 180 à 300 jours, les deux tiers à la moitié de cette production étant directement tétés par le jeune à l'allaitement. Le lait de yak est plus riche que le lait de vache, de 6,5 à 7 % de matières grasses (gros globules gras facilitant la fabrication du beurre) et 5,3 % de protéines.

Dans toute l'aire considérée on fait du beurre à partir du lait et ensuite, à partir du petit lait un fromage de caséine destiné à être séché et stocké pour l'hiver. Le beurre entre notamment dans deux aliments de base de la population, d'une part mélangé à de la *tsampa*, farine d'orge grillée, d'autre part dans le thé local qui est une émulsion obtenue par barattage de beurre dans du thé longuement bouilli auquel on ajoute du sel.

Il se révèle difficile de connaître avec précision la production laitière. En effet cette production est grandement fonction des conditions d'alimentation et celles-ci souvent difficiles à définir précisément, peuvent varier considérablement. De plus la femelle yak en lactation est en même temps allaitante (la présence du jeune veau est nécessaire comme stimulus au moment de la traite). La production de viande à faible coût de production contribue largement à la rentabilité de l'élevage du yak dans de nombreuses zones notamment en ex-URSS, en Mongolie et en Chine ; or cette dernière ne représente pas toujours la même part de la production totale, en particulier selon que les animaux sont traits une ou deux fois par jour et selon la durée de la période de traite.

La viande est caractérisée par un important taux de protéines et peu de graisse ; de qualité médiocre et fibreuse elle est le plus souvent séchée pour être conservée.

La viande de yak a une grande importance en Mongolie et en ex-URSS. Dans ces pays il est apparu qu'il coûtait deux à cinq fois moins cher de produire de la viande avec des yaks qu'avec des bovins dans les mêmes zones de montagne. A certaines époques de l'année (en général à la fin du printemps), les Tibétains pratiquent une saignée sur les yaks, ce qui est une manière simple de récolter des protéines dans un système d'élevage où le coût annuel est très faible.

Les poils des yaks, tondus ou étrillés au printemps, sont utilisés pour la fabrication de tissus, cordages et feutre.

Le duvet est très recherché pour fabriquer des tissus épais, vêtements et couvertures. La production (1/3 de sous-poil, 2/3 de poil) est de l'ordre de 2 kg par animal, parfois davantage comme dans le cas du yak blanc, particulièrement prisé, de race Tianshu dans la province chinoise du Gansu.

Le cuir sert à de multiples usages : lanières, semelles de bottes, récipients et parois de bateaux. Les bouses séchées constituent l'unique combustible local dans les régions de très haute altitude.

Le yak est utilisé comme animal de trait pour les labours et de bât en raison de son habileté à se déplacer dans les reliefs montagneux difficiles. Il peut porter couramment des charges de 50 à 80 kilos. Il est aussi utilisé comme animal de selle.

## 5.0 CARACTÉRISTIQUES DE L'ÉLEVAGE ET ADAPTATION AU MILIEU

Les yaks domestiques sont élevés dans les régions d'altitude où le climat est particulièrement rude, sec et froid et la végétation très pauvre. Les animaux restent en plein air toute l'année et doivent trouver leur nourriture sur de maigres et difficiles parcours. En hiver les yaks creusent la neige pour se nourrir en la piétinant et en l'écartant avec le mufle ; ils passent ainsi des heures à lécher le sol pour consommer quelques débris végétaux morts, prouvant leur capacité à survivre dans des conditions où des bovins et des chevaux ne le peuvent pas. Traditionnellement ce n'est qu'aux femelles en lactation et aux tous jeunes animaux et dans des cas extrêmes de disette prolongée qu'on leur apporte un complément alimentaire, fourrage sec ou buvée chaude contenant des plantes cuites et du sérum de lait.

En ce qui concerne le comportement des yaks sur les aires de pâturage souvent très accidentés, il faut souligner la très grande vivacité et sûreté de leurs mouvements.

Animal docile mais aussi très craintif, le yak se laisse approcher assez facilement.

Les yaks au pâturage recherchent de préférence en été les zones ventées ; ils se dispersent davantage que les bovins et utilisent les pentes escarpées et endroits inaccessibles aux autres animaux.

Quelles sont les particularités anatomiques et physiologiques qui confèrent au yak son extraordinaire aptitude à vivre toute l'année en plein air et sur des pâturages très pauvres ? Outre les caractéristiques de son abondante toison on note d'abord que la peau est plus épaisse que chez les bovins avec une partie dermique et un tissu conjonctif sous-cutané bien développés. La structure des onglons lui facilitent tous les déplacements et celle de sa lèvre supérieure qui lui permet de saisir le moindre brin d'herbe, le développement très important de la cage thoracique, contribuent aussi à cette adaptation.

Les propriétés du sang jouent aussi un rôle important dans l'aptitude de l'organisme envers une utilisation efficace de l'oxygène de l'air en haute montagne : le sang de yak contient davantage d'érythrocytes (de l'ordre de 20 % à 30 % de plus) et ceux-ci sont plus riches en hémoglobine et de dimension légèrement plus grande (DENISOV 1958).

Le yak présente une maturité sexuelle assez tardive ; chez les génisses elle intervient dans les conditions traditionnelles d'élevage entre 24 et 30 mois. Dans le choix des reproducteurs une place prépondérante est accordée au jugement de conformation et aux variations du poids pendant l'hiver au pâturage.

## 5.1 Hybridation

Le yak domestique est réputé pour son exploitation très répandue en croisement avec les bovins ou les zébus, principalement dans les secteurs périphériques de son aire de répartition. Chez les hybrides de première génération (F1) qui peuvent vivre à des altitudes plus faibles (1800-3000 mètres) que celles du yak lui-même, les mâles sont stériles et les femelles fertiles. Etant donné les possibilités de croisement en retour à partir des femelles hybrides FI on aboutit souvent dans la réalité à des structures de troupeaux d'une grande complexité génétique (BONNEMAIRE et TEISSIER, 1976). Les hybrides FI présentent un aspect extérieur intermédiaire entre les souches parentales. Ils sont très recherchés par les éleveurs parce qu'ils représentent en général une supériorité sur la moyenne des souches parentales en ce qui concerne des critères de production tels que : la format et le poids vif (+ 18 %) ainsi que l'aptitude à l'engraissement ; la force de travail des mâles ; la fertilité des femelles (par exemple dans les conditions du Nord du Népal, intervalle entre vêlages de 425 jours en moyenne pour les femelles hybrides FI contre 660 jours pour les femelles de yak) ; production laitière (+ 66 % en quantité en Kirghizie).

L'hybridation entre le yak et le bovin, si elle est courante, ne se réalise cependant pas spontanément et naturellement à une échelle élevée sans l'intervention de l'homme pour orienter les accouplements : dans des conditions naturelles d'élevage, en monte libre, le taux de fécondation interspecifique reste très faible (de l'ordre de 9 à 12 %). Parmi les hybrides FI on distingue les hybrides directs (mâle bovin x femelle yak) et les hybrides "inverses" (mâle yak x femelle bovine). Outre le poids à la naissance et une viabilité néo-natale supérieurs, les hybrides directs, qui se développent mieux que les hybrides inverses, paraissent présenter un certain nombre d'avantages zootechniques qui les font préférer à ces derniers.

Les hybrides de yak sont appelés *dzo* en tibétain, *pien niu* en chinois, *hainag* en mongol et *haynik* en russe.

## 6.0 LES MODES D'ÉLEVAGE DU YAK

Pour illustrer notre propos nous présenterons brièvement les modes d'élevage du yak dans les hautes vallées himalayennes du Nord du Népal.

Dolpo regroupe quatre vallées situées au Nord de la haute chaîne de l'Himalaya plus précisément du massif du Dhaulagiri, à une altitude moyenne de 4000 mètres (JEST 1975). La population, de culture tibétaine, possède sa propre langue, des traits ethniques et un mode de vie qui l'apparentent fortement au Tibet proche.

Les habitants de Dolpo pratiquent l'agriculture, cultivant l'orge, unique céréale, et élèvent des yaks, des ovins, caprins et des chevaux.

L'association de l'agriculture et de l'élevage correspond à un système de production que les Tibétains appellent *sa-ma-drog*, littéralement "à la fois agriculteur et pasteur".

Le yak est considéré comme l'élément dominant du cheptel (1/3 de yak ; 2/3 ovins-caprins).

La saillie a lieu en général en juillet/août dans les pâturages d'été. Certains mâles sont castrés à 3 ans. On pratique des croisements avec un bovin d'origine tibétaine. Dans le cas du croisement yak male x bovin femelle, le FI mâle (stérile) est utilisé pour le transport et la FI femelle est médiocre laitière.

Dans le cas du croisement Bos taurus x yak femelle, le FI mâle est très robuste et utilisé pour le transport et la FI femelle est bonne laitière avec un % de matières grasses supérieur à celui de la vache.

Les connaissances vétérinaires qui permettraient la lutte contre les épizooties sont pratiquement nulles à Dolpo. C'est d'abord et surtout l'intervention d'un religieux (lecture de textes sacrés) ou l'action d'un chamane qui peuvent prévenir ou guérir. Par divination on détermine la cause du mal souvent extérieur à l'animal : offense d'une divinité des sources, présence d'un démon, mauvais sort ...

La pratique préventive la plus courante est la saignée "pour renouveler le mauvais sang".

Intervenir en cas d'accident, prendre soin des animaux ne suffit pas, il faut aussi les protéger et pour cela l'éleveur fait appel aux religieux. Des lamas éloignent les maladies, des banderoles de prières protègent les campements, les enclos du bétail, la caravane ; des tas de pierres éloignent les démons et les esprits malfaisants. Une fois l'an, on orne les yaks avec des tissus des cinq couleurs bénéfiques.

## 7.0 CONCLUSION

Dans toute la zone d'élevage du yak, le pastoralisme présentait jusqu'au début du XXème siècle des caractéristiques spécifiques et se trouvait entièrement soumis aux aléas d'un climat continental rigoureux et à des pratiques indigènes.

Brutalement les éleveurs nomades d'Asie Centrale (ex-URSS, Mongolie, Chine) ont été forcés de modifier, souvent de façon radicale et sous la contrainte, leur mode de vie et les pratiques ancestrales d'élevage. Une sédentarisation forcée se traduisant par des regroupements de population, un changement de régime de propriété des animaux et des terres de parcours, a entraîné des conséquences incalculables pour les éleveurs.

La politique délibérée en matière d'élevage poursuivie depuis cette époque et mise en place à des dates variables selon les états concernés a conduit à une évolution notable de l'élevage, en le transformant en une activité organisée à l'échelle du pays, tant sur le plan zootechnique et sanitaire que sur le plan de la propriété des animaux.

Ainsi en URSS dans les années trente, une politique de sédentarisation des pasteurs nomades Kirghiz et Kazakh a été suivie d'une collectivisation du cheptel ; il en a été de même en Mongolie puis en Chine à partir des années soixante.

Les autorités des Etats pour lesquels l'élevage du yak représente une importante ressource ont été conscients du fait que cet animal est le plus adapté à des conditions difficiles et ils ont entrepris de promouvoir des recherches zootechniques, en gestion des pâturages et développé des programmes d'hybridation.

D'importants travaux conduits sur différents terrains et notamment en ex - URSS, en Chine et en Mongolie ont démontré ses aptitudes et son intérêt économique si bien que des actions de sélection et d'amélioration de son élevage ont été entreprises dans ces pays. En ex - URSS et en Mongolie, la sélection semble surtout orientée vers l'amélioration du format et de la croissance aux différentes saisons ainsi que vers l'obtention de différents hybrides, l'objectif principal étant d'accroître la production du lait, de la viande et du poil. Récemment, en recourant à l'insémination artificielle, les Chinois se sont engagés dans la production d'hybrides directs, à partir de femelles de yak et de taureaux de différentes races exotiques (Pie noire, Aberdeen Angus, Charolais ...).

Une actualisation permanente des analyses de situations est plus que jamais nécessaire en mettant l'accent sur l'insertion des activités pastorales dans les systèmes agraires considérés globalement (milieux naturels et structures sociales ; productions, consommations, transformations, échanges et modes de vie...) et sur des points techniques souvent différents de ceux que l'on privilégie en milieu artificialisé, par exemple : questions de maintenance des animaux et de calendrier, de carrière productive et reproductive des femelles, de fonctions des troupeaux et de leur conduite, de valorisation des produits, de viabilité des jeunes animaux et problèmes sanitaires en général, phénomènes de régulation à tous niveaux.

*Mongolie Extérieure*

En ce qui concerne le yak sauvage et sa préservation, la situation est grave. Dans les dernières décennies les yaks sauvages ont été tués par centaines surtout pour leur viande et le sang qui entre dans la composition de la pharmacopée tibétaine. Des mesures ont été prises pour les protéger, et deux réserves crées l'une dans l'Arjin Shan au Xinjiang l'autre dans le Changtang, région autonome du Tibet (Communication personnelle de G. SCHALLER, Director for Science; Wild Life Conservation International, New-York, USA).

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## 9.0 RECHERCHES EN COURS CONCERNANT LE YAK

En 1976, des chercheurs de l'INRA et du CNRS ont fait un point des connaissances concernant le yak. Numéro spécial de la revue Ethnozootechnie (n° 15).

Quelques institutions concernées par l'étude du yak.

Chine :

Gansu Agricultural University, Dt of animal husbandry
Wuwie, Gansu.

Research Institut of Animals Sciences, Cattle Sciences Departement
Academy of Agriculturals Sciences
Lanzhou, Gansu
Chine

Région autonome du Tibet :

Département de l'élevage, Lhasa.

Inde :

National research centre on Yak (Indian council of agricultural research (ICAR).
Dirang, Arunachal Pradesh.

Bhoutan :

Département de l'Elevage, Gouvernement du Bhoutan, Thimphu.
Centre d'étude du yak, Bumthang.

Mongar, Highland Civestock
Developpement Project,
Mongar Bhoutan

Mongolie :

Station d'élevage d'Ekhtemer, Ar Khangai District.
Académie des Sciences de Mongolie, Institut de biologie et génétique.

Kirghizie :

Departement de l'élevage.

# YAK (*POEPHAGUS GRUNNIENS* L) OF INDIA

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## SUMMARY

The staggering population of 40 thousand from an imposing number of 132 thousand of 1977 in the Himalayan states of India has evoked a concern for adopting measures for conservation and improvements. The dwindling population is triggering the highlander's economy from bad to worse. Rearing in the precinct of high hills in very small population units conjoint with the absence of any scientific breeding policy has resulted in visible diversification of physical conformation (colour, shape, size of body and horn characteristics) and deterioration in productive proficiency of the yaks of India.

## RESUME

La chute rapide des effectifs de Yak de 132 000 en 1977 à 40 000 dans les états Himalayens de l'Inde a provoqué une prise de conscience de l'urgence de mesures de conservation et d'amélioration. Cette diminution tire l'économie des montagnards de mauvais à pire. L'élevage de petites populations dans le milieu clos des hautes montagnes, joint a l'absence de plans d'accouplements, entraîne des changements phénotypiques perceptibles (couleur, taille, conformation, forme des cornes) et une détérioration des performances des Yaks en Inde.

## 1.0 ORIGIN

Yak (*Poephagus grunniens*) a large bovid of cold environment and high altitude is a native of Tibetan Plateau in the People's Republic of China. It was domesticated, simultaneously with the advent of agriculture. Its wild counterpart (*Poephagus mutus* Przewalski) is confined to the higher reaches of the Tibetan Plateau and has been entered in the Red Data Book to revive the dwindled population. Since the days of domestication its multipurpose utility (transport, milk, wool, meat and fuel) has made it an indispensable animal in the hills of Kun Lun Shun, Tien Shun, Altai, Pamir and Himalayas which are inter connected with snow caped peaks approximate in between 70°-105°E longitude and 29°-50° N latitudes. Yaks are, thus, remained confined in these mountain ranges of the Asian Continent. China has the largest population of (in thousands) 12300 followed by Mongolia 500, Russia 60, Kazakistan 60, Tazakistan 17, Gorgia (North Caucassus) 3, India 40, Nepal 10 and Bhutan 52. The Himalayan countries have recorded a drastic decline in their yak population in the last few decades for a number of varied reasons (Pal 1992). This has adversely affected the productivity as well as the self-employment opportunity.

Yaks of the different countries have not been adequately described/categorized into different types/breeds except that of China which has been shown as six types (CHENG PEILIEU 1984). Available information on Mongolian yaks revealed two types, the bareback and the common which can either be polled or horned. The polled are hefty with long hanging coarse hairs from the bellyline, longer but shorter at the wither and are more preferred.

## 2.0 DISTRIBUTION

The Indian yaks have a diversified physical forms and are distributed in two distinct eco-environments, viz, the north western part (Himachal Pradesh and Jammu & Kashmir) with arid dry climate and the eastern (Arunachal Pradesh and Sikkim) with wet cold environment. The geographical distribution of yaks in India is presented in Fig 1 and their number in Table 1.

Table 1. **Yak population of India**

| State | Male young | Male adult | Female young | Female adult | Total |
|---|---|---|---|---|---|
| Arunachal Pradesh . | 919 | 2426 | 2018 | 3117 | 8,480 (1988-89 Census) |
| Sikkim | N.A. | N.A. | N.A. | N.A. | 5,354 (1989 Census) |
| Uttar Pradesh | " | " | " | " | 318 (1988 Census) |
| Himachal Pradesh | " | " | " | " | 3,495 (1992 Census) |
| Jammu & Kashmir | 456 | 5690 | 690 | 6000 | 12,836 (1990 Census) |

(Source : Director, Animal Husbandry & Veterinary Services of respective states).

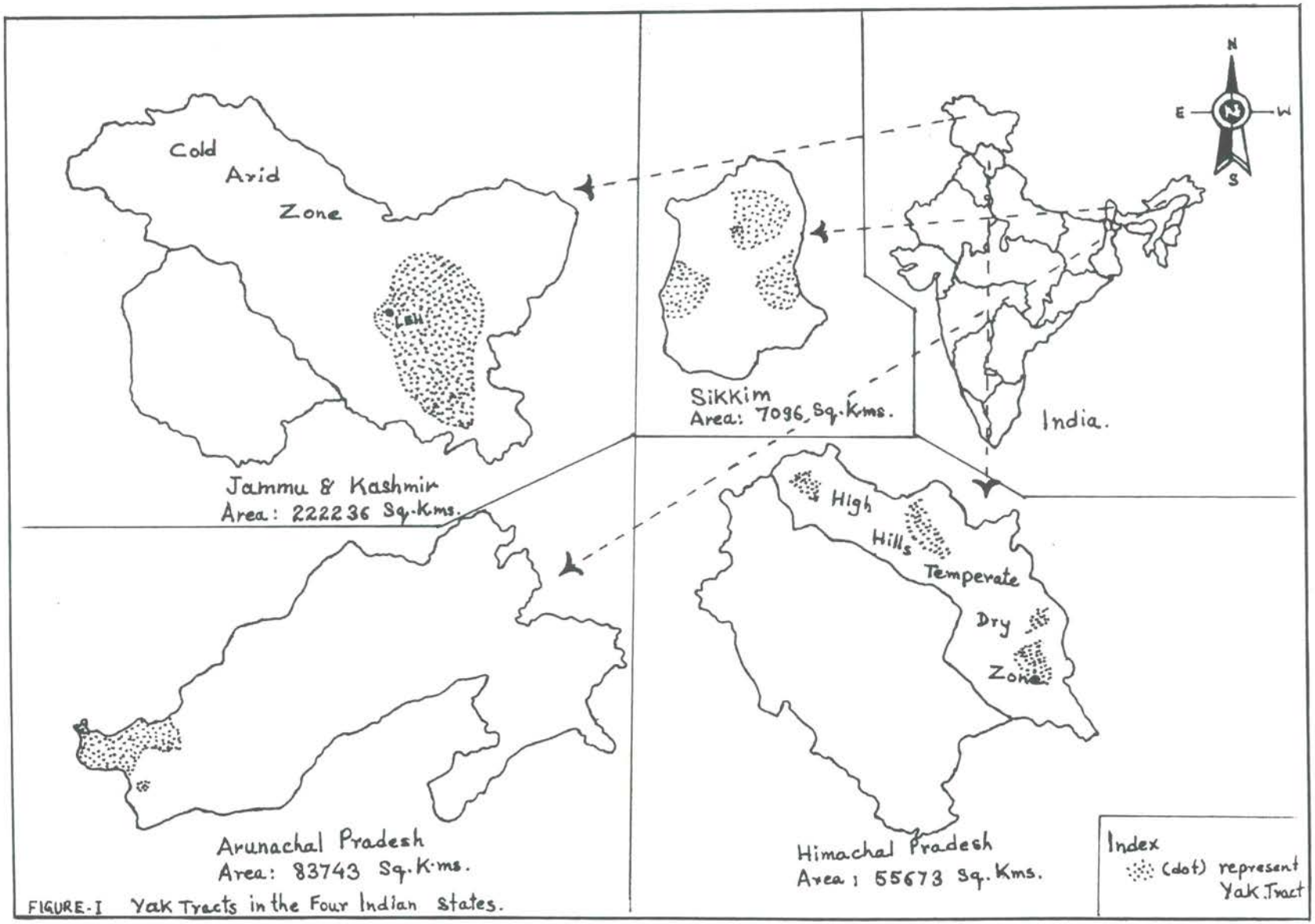



FIGURE-I Yak Tracts in the Four Indian states.

*Indian yak types*

*Indian yak types*

The yak rearing tracts in the states of Himachal Pradesh and Jammu & Kashmir (Laddak) are in between 78 - 79 E longitude and 31 to 35 N latitude where as that of Arunachal Pradesh and Sikkim 91 40 to 92 30 and 88 to 89 E longitude and 27 to 28 N longitude. The total geographical area in the four states (approximately) shown in table 2.

Table 2. **Yak tracts in different states**

| State | Total geographical area sq. km | Approx. area yak tract (sq. km) | % of total geographical areas | Yak population (x '000) |
|---|---|---|---|---|
| Arunachal Pradesh | 83,743 | 2500 | 3.0 | 8.48 |
| Sikkim | 7,096 | 1500 | 21.1 | 5.35 |
| Himachal Pradesh | 55,673 | 14000 | 30.0 | 3.5 |
| Jammu & Kashmir (Laddak) | 222,236 | 23300 | 10.5 | 12.8 |

The 14,000 sq. km area of Himachal Pradesh from 2,000 m and above remain snow covered more than 7-8 months of an year with limited scope of grazing. The area being stoney accompanied with less rainfall (25 cm) and dryness, the vegetative growth is scarce to sustain the yaks in the high altitude (GANGOPADHYAY, 1991). Almost a similar, if not still harsh a climate of Laddak make the availability of grazing facilities worse. The yak tract of Laddak even experience -40 C temperature in severe winter. 'Drass' a yak rearing valley in Laddak is one of the coldest inhabited village in the world (GANGOPADHYAY, 1991a). On the contrary, the hills of the Arunachal Pradesh and Sikkim are more wetty (rainfall 150 cm) and favours growth of vegetation.

## 3.0 CHARACTERISTICS

(a) Conformation - A field study on a number of pasture grounds indicated that the existing yaks can be broadly categorised into three types (i) Common yak (ii) Bisonian and (iii) Bare Back (Fig. 2, 3 and 4) (PAL *et al* 1993). The common yaks are comperatively smaller in size, the appearance of head and other body conformation are like cattle. The bisonian are hefty animals with compact head connected by strong and short neck to the main trunk which is groundish in shape. The bare back yaks are bodily rectangular with short hairs on rump and wither. The rosette of hairs hangs down the bellyline and almost touching the gtound. The per cent of the respective population are found to be 56.2%, 29.8% and 14.0%.

(b) Colour pattern - Black (29.6%) and white (1.6%) are the only two unicolour encountered in yaks besides grey (14.5%), black with white patches (40.3%) and brown with white patches (4,8%) and rest are admixtures (PAL *et al* 1993a). Majority of the bare back type yaks are of black colour while the cattle types are black with white patches, grey or brown with white patches, though complete black is not uncommon. The bison types in majority of cases have white face or with variable white markings on black face with curly hairs. The white yaks (Figure 5) are a replica of the Tianzho white yak of China.

(c) Horn : Thirteen per cent of the animals are found to be polled and rest are adorned with horns of variable size and shape. No particular relationship could be noticed as to which type of animal has what types of horns. The typical yak horn arising horizontally and twisted to grow up and backward and outward are more common in the bareback type. The average diameter at base and length are found to be 24.4 and 48.o cm, the length and diameter in female being smaller to some extent.

## 4.0 PRODUCTIVITY

Productivity status of the Indian yaks have so far not been ascertained on large number of animals. Some snap studies on limited number of animals indicate that the milk production varies from 130 to 500 kg in a lactation period of 90 to 270 days with fat content variable from 6.5 to 10.9 per cent. The lucrative business of yak trains in the trans-Himalayan routes had since been stopped, the utility as transport has been eroded to a great extent and is only confined for inter village journey and to summer pasture. Besides these, the production of fine wool and coarse wool is of great importance to the farmer, the yield being from 400-600g and 4-7 kg annually respectively. The production of meat is of secondary importance, as yaks are normally not slaughtered except for some religious dictum. Fluid milk is converted into butter and cheese by age old methodology resulting in short shelflife and are generally not sold but bartered. The fine wools are made into garments while the coarse wools are knitted for carpet, bags, head gear, rope, tent etc. (Fig 6).

## 5.0 HYBRIDIZATION

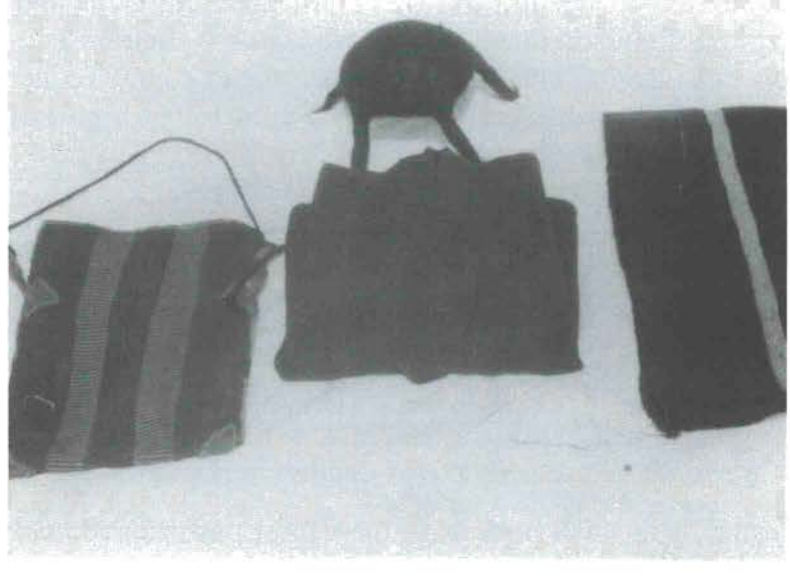
Hybridization between male hill cattle ♂ and female yak ♀ is common in Arunachal Pradesh and Laddak but only on a limited scale in Sikkim and Himachal Pradesh. The F1 males are known as Dzo and the females as Dzomo. The number of crossbreed animals in the states of Arunachal Pradesh is 6281 of which 2448 are male and rest female. In Laddak region of Jammu & Kashmir the Dzo and Dzomo are 3269 and 4632 respectively. The exact figure of Sikkim and Himachal Pradesh is not available. The milk yield and the lactation period is enhanced in crossbreed but the fat per cent is reduced by 10 to 15 per cent. The F1 male exibiting heteroses (Fig 7) are used for transportation in the mid and high hills. The male offsprings from F1 onwards are sterile. The size and productivity of crossbreed animals from F2 onwards decrease substantially.

## 6.0 DISCUSSIONS AND CONCLUSIONS

The yak population in India is declining at an alarming rate threatening the economy of the highlanders, whose, substantial income is generated from yak rearing. The present population of 40 thousand is the remanent of 132 thousand of 1977 census. The truncated use as transport coupled with hard semi-nomadic life of yak herdmen, which the present generation shun are some of the reasons for decline in population.

Close inbreeding in small pockets in the winter pasture and breeding of the rest of the animals in the summer pasture where small units from different pockets get together, has resulted in a wide variation in physical conformation and productivity.

*Yaks carrying wood*



*Handycraft made of yak hair*

The pasture land in the high hills are owned by the villagers. Yak owners pay royalty, preferably, in kind viz. butter or local cheese for their grazing right in summer. They also pay some royalty to the Monasterry. The rates and other conditions are fixed by the village Heads and other Members. The concept of maintenance and improvement of pasture is non-existent resulting in unproductiveness due to over grazing.

Breeding policy is nonentity. Crossbreeding with cattle in which, save except F1, rest can be put to culling due to poor genetical make up, some farmers show ingenuity in crossbreeding their stock and derive maximum benefit. Age old technologies are followed for processing of raw milk for production butter and local cheese which has a very short self life.

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# THE "GAROLE" - MICROSHEEP OF BENGAL, INDIA

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## SUMMARY

In the Sundarbans area of West Bengal (India) there is a breed of microsheep (adult weight 10-14 Kg.) with a very high prolificacy (227%).

This breed may be a valuable source of prolificacy for sheep in India. There are also reasons to believe that it is resistant to footrot. A conservation policy is necessary to preserve this hitherto neglected animal genetic resource.

## RESUME

Dans la région de Sundarbans, dans le Bengale Occidental (Inde) est décrite une race de moutons nains (poids adulte 10-14 kg) très prolifiques (227%).

Cette race pourrait constituer une source valable de prolificité pour les ovins en Inde. Il existe aussi des raisons de penser que ces animaux sont résistants au pietain. Un programme de conservation est nécessaire pour cette ressource génétique négligée.

## 1.0 INTRODUCTION

When the Nimbkar Agricultural Research Institute initiated research on sheep four years ago, it found the rearing of sheep as practiced by shepherds in Maharashtra to be uneconomic (RATH, 1992). The institute felt that a major reason for this was that all sheep in Maharashtra produce only one lamb per year. We felt that the introduction of a higher prolificacy would increase the profitability of sheep rearing. However no efforts have been made in India to introduce prolificacy from any source.

The well-known geneticist Dr. Helen Newton Turner has spent a great deal of effort encouraging people to select for twinning in India. In a personal communication (1991) she writes "We had some very prolific sheep from Bengal in Australia in the early days (late 18th century) and I speculated that they might have contributed to our prolific Booroola Merino after it was established that the high incidence of multiple births in Booroolas was due to a single gene - the flock from which the Booroolas originally came was descended from a stud which had some Bengal Sheep last century."

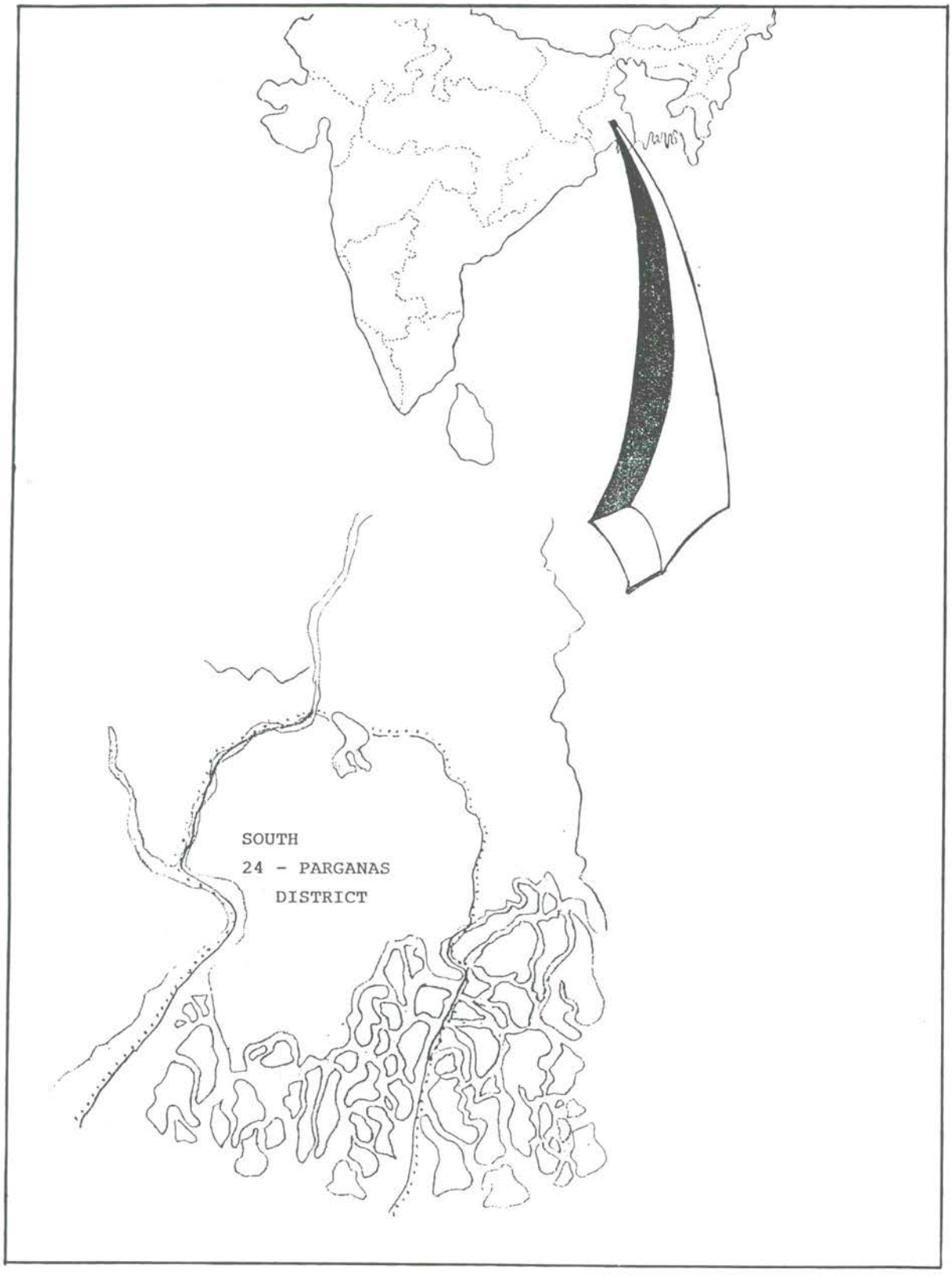
The Garole breed is not mentioned in either ACHARYA (1982) or MASON (1980). Small sized sheep are discussed in Chapter 3 of the book Microlivestock (B.O.S.T.I.D., 1991), but the breeds described are about twice the size of the Garole. The authors do, however, stress that "lesser known breeds are rapidly becoming extinct (especially in developed countries) although scattered efforts are being made to preserve them. Elsewhere, genetic resources have not been properly evaluated, and potentially valuable stock is being lost before it is even understood."

At a presentation made by Kamal Kar and C. Prasad at the 5th International Conference on Goats in New Delhi, India, it was pointed out that peasants in the Sundarbans area of West Bengal known as 24-Parganas preferred rearing small sheep rather than goats. Hence efforts to popularize the rearing of goats had failed. The reasons given for the popularity of the sheep were that the sheep were as prolific as goats and unlike goats, grazed in standing water and falling rain. They were called the Garole Sheep.
The senior author of this paper visited the Sundarbans region in February 1993 and this report is based on his observations.

## 2.0 LOCATION AND NUMBERS

These sheep are found in the part of West Bengal known as the Sundarbans located south of Calcutta in the southern part of the district of 24-Paraganas. It is located at latitude 22 degrees and 30 minutes North and between longitudes 88 and 89 degrees East. This is the low-lying region at the mouth of the Ganga river with the highest elevation being 200 meters above the sea level. Part of the region is in Bangla Desh. It was not possible to investigate in Bangla Desh but most probably the Garole sheep exist there also.

The sheep are bred by a community called "Haldar" in flocks of between 2 and 8 ewes. Very few males are kept in each village. In 12 villages out of 60 villages in Mathurpur block II, there were 14,900 sheep as per a census conducted by the Farm Science Center at Nimpith in January 1993. It is estimated that in total there are about 50,000 sheep of this breed in West Bengal.


SOUTH
24 - PARGANAS
DISTRICT


*Garole rams*

## 3.0 CLIMATE

The climate is humid with summer temperatures not rising above an average of 36°C and a winter minimum of 13°C. There is some rain in every month of the year with most of the rainfall concentrated between the months of May and October. Rainfall is between 3000 mm and 4500 mm per annum. The average daily temperatures in °C and number of rainy days is as follows:

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg. Daily High | 27 | 29 | 34 | 36 | 36 | 33 | 32 | 32 | 32 | 32 | 29 | 26 |
| Avg. Daily Low | 13 | 15 | 21 | 24 | 25 | 26 | 26 | 26 | 26 | 23 | 18 | 13 |
| No. of Rainy Days | 1 | 2 | 2 | 3 | 7 | 13 | 18 | 18 | 13 | 6 | 1 | 1 |

## 4.0 BREED CHARACTERISTICS AND HUSBANDRY INFORMATION

The Garole can be characterized as a true microsheep. Males are usually horned and females polled. Measurements of 27 adults and lambs were as follows:

| | |
|---|---|
| Length from shoulder point to pin bones (cm.) | 45 to 50 |
| Height at withers (cm.) | 43.75 to 50 |
| Heart girth (cm.) | 56.25 to 61.25 |
| Adult weight (Kg.) | 10 to 14 |
| Birth weight (Kg.) | 0.6 to 0.9 |
| Weight at 6 months (Kg.) | 6 to 7 |

These sheep are reared solely for meat and are never sheared, nor milked. The wool is quite coarse. No medication of any kind is given to the sheep and they are never fed concentrates. They graze along field boundaries and on the verges of roads. While grazing, they are usually tended by a young girl. At night they are kept inside the shepherd's hut or in a shed near by the hut.

## 5.0 REPRODUCTION

Observations were taken on 19 flocks consisting of 69 adult ewes and are recorded (table 1). Multiple births were 92.7% (on the basis of ewes lambed) with 65.45% twins, 21.8% triplets and 5.45% quadruplets; only 7.3% were single births. Age at first lambing is between 11 to 13 months and lambing interval is 8 months. These sheep breed all year round with no pronounced breeding season. The average number of lambs born per ewe was 2.27.

**Table 1.**
**Observations on Prolificacy**

| Flock No. | Flock Adult ewes | Composition Adult Rams | No. of Lambed ewes | Classification of lambings by type of birth | | | |
|---|---|---|---|---|---|---|---|
| | | | | Singles | Twins | Triplets | Quadruplets |
| 1 | 6 | - | 5 | 1 | 3 | 1 | - |
| 2 | 5 | - | 4 | - | 3 | 1 | - |
| 3 | 4 | - | 4 | - | 2 | 1 | 1 |
| 4 | 2 | 1 | 2 | - | 1 | 1 | - |
| 5 | 3 | 1 | 3 | 1 | 2 | - | - |
| 6 | 2 | - | 1 | - | 1 | - | - |
| 7 | 2 | - | 2 | - | 2 | - | - |
| 8 | 3 | 1 | 2 | - | 2 | - | - |
| 9 | 5 | 1 | 4 | 1 | 2 | 1 | - |
| 10 | 6 | 1 | 5 | - | 3 | 1 | 1 |
| 11 | 4 | - | 4 | - | 3 | 1 | 1 |
| 12 | 3 | - | 2 | - | 2 | - | - |
| 13 | 5 | 1 | 3 | - | 2 | 1 | - |
| 14 | 2 | - | 2 | 1 | 1 | - | - |
| 15 | 2 | - | 2 | 1 | 1 | - | - |
| 16 | 3 | - | 2 | - | 1 | 1 | - |
| 17 | 3 | - | 2 | - | 1 | 1 | - |
| 18 | 5 | - | 4 | - | 3 | 1 | - |
| 19 | 2 | - | 2 | - | 1 | 1 | - |
| Total | 69 | 6 | 55 | 5 | 36 | 12 | 3 |

## 6.0 CONCLUSION

The Garole could be a most valuable breed because of its high prolificacy, ability to graze in standing water and suitability to hot and humid climates. It is desirable to try and preserve this breed and use it in crossbreeding projects with the other breeds in India to see if any of its prolificacy traits can be incorporated into these other populations.


*One year old Garole ram*

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# THE GOATS AND SHEEP OF THE DECCAN PLATEAU IN THE MAHARASHTRA STATE OF INDIA

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## SUMMARY

Small ruminants are important in the agricultural economy of Maharashtra. They convert poor quality roughages into milk for home consumption, highly prized meat, skins, excellent manure and coarse wool. The local breeds of goats and sheep have not been adequately defined and not much has been done for their genetic improvement. All the sheep belong to the Deccani breed type while there are three recognized goat breeds, i.e. Osmanabadi, Sangamneri and Surti. Both the goats and sheep are hardy animals, well adapted to harsh conditions but have a low production potential.

## RESUME

Les petits ruminants sont importants pour l'économie agricole du Maharashtra. Ils transforment les fourrages grossiers en lait pour la consommation familiale, en viande recherchée, en peaux, en fumier et en laine. Les races locales d'ovins et de caprins n'ont pas encore été décrites, et très peu a été fait pour leur amélioration. Tous les ovins sont de type Deccani et trois races de chèvres sont identifiées, Osmanabadi, Sangamneri et Surti. Tant les ovins que les caprins sont des animaux rustiques, bien adaptés aux zones difficiles mais avec un faible potentiel de production.

## 1.0 INTRODUCTION

The state of Maharashtra is situated on the western coast of India near the top of the peninsular region. According to the 1987 livestock census, there were 9.195 million goats and 2.873 million sheep in Maharashtra. The sheep population has increased by 30 per cent since 1966 while the goat population has gone up by 79 per cent over the same period. This gives us an idea of the relative importance of small ruminants in Maharashtra.

The average size of a family sheep flock is 50 to 75 whereas a goat keeping family usually keeps only one to five goats (D.A.H.1993). A few large flocks of 30 or more goats exist and mixed flocks of sheep and goats are also encountered. Traditionally, sheep are mainly reared by the Dhanagar community. Half of the sheep keeping households (51.4 per cent) have 0.4 to 4 hectares of land while 33.5% are large farmers with more than 4 hectares of land (RATH, 1992). Large farmers keep sheep mainly for the manure. Most of the goat keepers, on the other hand, are either landless labourers or small and marginal farmers. Thus , the goat is definitely the animal of the "poorest rural poor" and it is usually looked after by the woman of the house.

There is no recording of sheep and goat performance at the village flock level. There is almost no reliable performance evaluation or systematic characterization of either the sheep or the goats. The only attempts at genetic improvement have been through crossbreeding on a small scale, with the Saanen and Angora breeds and some other Indian breeds in the case of goats and with the Cape Merino, Corriedale and Dorset breeds in the case of sheep. But none of these programmes have brought about any substantial change in the productivity of the majority of animals or in the way they have been managed traditionally.

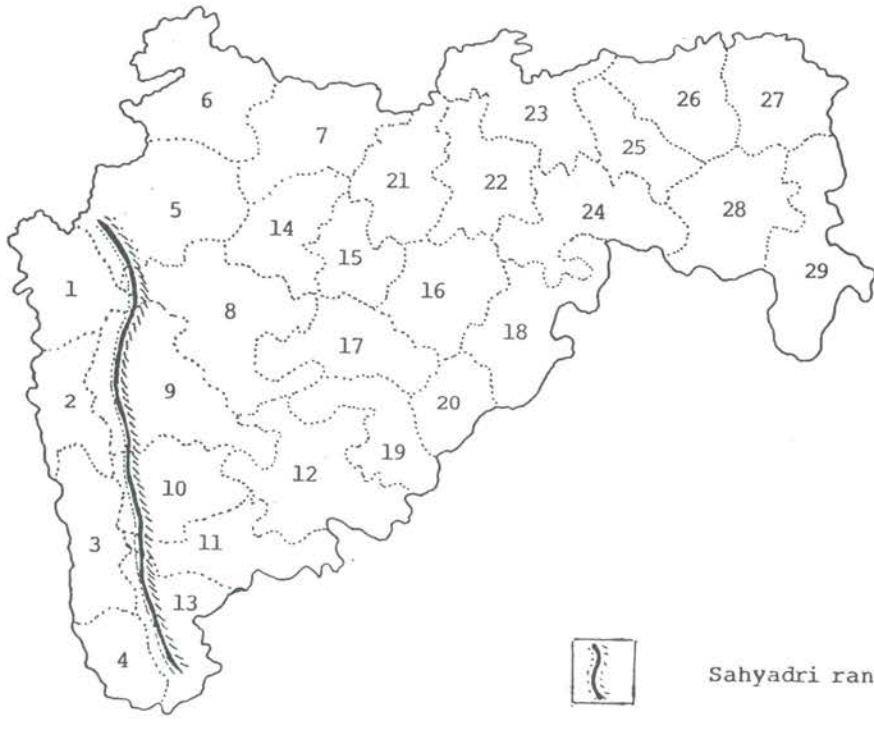
## 2.0 PHYSICAL AND AGROCLIMATIC FEATURES

Maharashtra is entirely tropical. It is located between latitudes of 15 and 22 degrees north and longitudes of 78 and 81 degrees east. The Sahyadri mountain range runs parallel to the Arabian sea coast at a distance of 24 to 40 km. It has divided the state into two unequal parts: the narrow coastal strip of Konkan and the Deccan plateau. The Deccan plateau slopes gradually from the west to the east with elevations of 650 meters near the Sahyadris to about 300 meters in the east. 21% of the sheep flocks from the plateau migrate to the Konkan from October to June every year. But on a year-round basis, less than one percent of the total sheep and goats in the state are found in the coastal region.

The state could be divided into three parts on the basis of the annual rainfall.

1. The coastal region and western areas of some districts on the plateau get heavy monsoon rains (2000 to 3000 mm) from June to September.
2. The eastern parts of the above districts on the plateau are in the rainshadow area and get only 400 to 700 mm of rain mainly in the months of September and October from the retreating monsoon. Even this little rain is unreliable and unevenly distributed.
3. The districts near the eastern boundary of the state get about 700 to 1250 mm of rainfall during the monsoon.

MAHARASHTRA STATE



The average maximum temperature on the plateau is 33.4° C with a range of 29.4-42.6° C while the average minimum temperature is 18.6° C with a range of 8.2-27.2° C.

Goats are widely reared in all the regions mentioned above. Sheep are concentrated in the rainshadow and drought-prone tracts. Around 95% of the villages in the state have goats while only about 18% have sheep (RATH, 1992).

## 3.0 SMALL RUMINANTS THE RURAL ECONOMY

Sheep keeping is confined to a very small proportion of rural households (less than 1%) while about 26% of the rural households have goats (RATH, 1992). It is estimated that the state's income from sheep and goats is about Rs. 3985 million per year. This forms about 14% of the state's income from the animal husbandry sector (D.A.H., 1993).

These versatile ruminants utilize to the maximum the poor quality grasses and shrubs on large tracts of marginal and degraded lands that are fit for little else other than grazing sheep and goats. They are also fed weeds from irrigated crops,crop residues and stubble. They convert such low quality roughages into useful products. They provide milk for home consumption, but the major source of income from both goats and sheep-rearing is the selling of kids and lambs,as also the culled adults,for meat. Since there is great demand for goat and sheep meat,the investment in these ruminants is readily recoverable with a good margin of profit. Goats are more profitable than sheep because about 50 per cent of the local goats give twins and around 6% have triplets while the sheep mostly have single lambs. Individual goats giving even four to five kids per kidding are also found. The skins and manure fetch good prices. Goats and sheep are an integral part of the local farming system.

## 4.0 THE GOATS

In India, a population of goats or sheep in a given locality, with characters distinct from the other populations in the vicinity and with a distinct local name has usually been considered as a breed (ACHARYA, 1982). These breeds are, however, not very clearly defined. There is large within-breed variability and crossing between breeds is also common. There are three so called "recognized breeds" of goats in Maharashtra: Osmanabadi, Sangamneri and the less important Surti. But the majority of the goats are just indigenous non-descript goats. They have been called Deccani goats and the Sangamneri is considered a strain of the Deccani goats. The local goats are of medium size and weight and have originated from a mixture of the goats of the plains (C.S.I.R., 1970).

Only these three breeds have been studied to some extent. These studies were done on small populations kept on university, government or research institute farms. There is no performance recording under village conditions and the non-descript local goats have not been characterized at all. Local goats have developed more through genetic isolation and natural selection than through deliberate intervention by man. Consequently, though they are hardy animals with excellent disease resistance qualities, they do not have a very high production potential.

The Nimbkar Agricultural Research Institute has submitted a project to the Indian Council of Agricultural Research for evaluation of the production performance of local

*Osmanabadi goats*

The Nimbkar Agricultural Research Institute has submitted a project to the Indian Council of Agricultural Research for evaluation of the production performance of local goats. This project has not yet been accepted. There seems to be some reluctance to fund the performance evaluation of non-descript goats (not belonging to a "breed").

The following is a description of the three breeds found in this province; information on size, reproduction and performance data can be found in ACHARYA (1982):

### 4.1 *The Osmanabadi breed*

The Latur, Tuljapur and Udgir talukas of Osmanabad district in south east Maharashtra are the home tracts of these goats. They have now spread into other parts of the state. In one survey of this breed, 73% of the animals were black and the rest were white, brown or spotted. The number of goats of this breed is estimated to be just over 200,000. It is considered to be a dual purpose breed. The average weight of adult males is around 34 kg and that of females 32 kg; 50% of all births are single.

The Osmanabadi goats are divided into short and long haired types, the latter possessing fairly long hair all over the body, but particularly on the thighs and hind-quarters (KAURA, 1961); they are rather tall animals (about 78 cm height at withers for the males and 75 for the females). Most males are horned; females may be horned or polled in almost equal proportions. The udder is small and round with small teats placed laterally. The average milk yield is estimated at 15 kg.

### 4.2 *The Sangamneri breed*

These goats are mainly prevalent in the rain shadow areas at the foothills of the Sahyadri, mainly in Pune and Ahmednagar districts. They are medium sized animals (75 cm height at withers for adult males and 68 cm for the females. Body colour may be white, black or brown, with spots of other colours. Ears are medium sized and drooping. Both sexes have horns, directed backward and upward. The tail is thin and short and the hair coat is extremely coarse and short. The average weight is just over 38 kg for the males and 29 kg for the females.

The population of this breed was reported to be 5.692 million (ACHARYA, 1982). Thus most of the goats of the Deccan plateau belong to this "type." The average daily milk yield is estimated at less than 1 kg and nearly 75% of all births are single.

### 4.3 *The Surti breed*

This is a breed found in small numbers in north west Maharashtra but is mainly prevalent in the adjoining state of Gujarat. This is considered to be a good dairy breed. The does yield 2.5 kg milk per day on average. These goats are generally kept stall-fed, with only one or two animals per household. They are predominantly white. The average weight of females is 30 to 35 kg.

## 5.0 THE SHEEP

The sheep of the Deccan plateau are called Deccani sheep. The Deccani is one of the most important Indian breeds as far as the total number and distribution are concerned; they are also found in the adjoining states. These sheep have evolved naturally through adaptation to the local agro-ecological conditions and no serious consideration has been given to their genetic improvement.

*Flocks of Deccani sheep*

**Table 1: Characteristics of Deccani sheep**

**Size (Data From Shepherds' Flocks)**

| | Adult Male | Adult Female |
|---|---|---|
| Body Weight (Kg) | 42.0 ± 9.3 (7) | 25.6 ± 1.8 (60) |
| Body Length (Cm) | 78.1 ± 6.3 (7) | 70.2 ± 2.8 (7) |
| Height At Withers (Cm) | 73.0 ± 5.0 (7) | 65.7 ± 3.8 (7) |
| Chest girth (Cm) | 89.8 ± 3.1 (7) | 77.4 ± 1.7 (60) |

**Reproduction**

| | |
|---|---|
| Lambing Percentage (%) | 82.2 |
| Litter Size | Single |
| Age at first lambing (Days) | 1149.5 |
| Lambing Interval (Days) | 433.5 |
| Oestrus periods | March-April, June-July, October-November. |

(Source: Network survey project and various post graduate research projects carried out at the Mahatma Phule Agricultural University,Rahuri during 1990-91 and 91-92).

**Performance**

| **Meat** | **Male** | **Female** |
|---|---|---|
| Birth Weight (Kg) | 2.2 ± 0.1 (70) | 2.1 ± 0.1 (76) |
| Weight At 3 Months (Kg) | 9.9 ± 0.3 (66) | 10.4 ± 0.3 (69) |
| Weight At 6 Months (Kg) | 14.8 ± 0.4 (54) | 14.6 ± 0.4 (63) |
| Weight at 12 Months (Kg) | 19.8 ± 0.6 (20) | 20.2 ± 0.3 (50) |

(Source: A research project carried out at the Marathwada Agricultural University, Parbhani.)

**Wool** (Six-monthly greasy fleece weight)

| **University Farm** | **Male** | **Female** |
|---|---|---|
| January clip (Kg) | 0.689 ± 0.147 | 0.490 ± 0.009 |
| June Clip (Kg) | 0.657 ± 0.108 | 0.457 ± 0.079 |

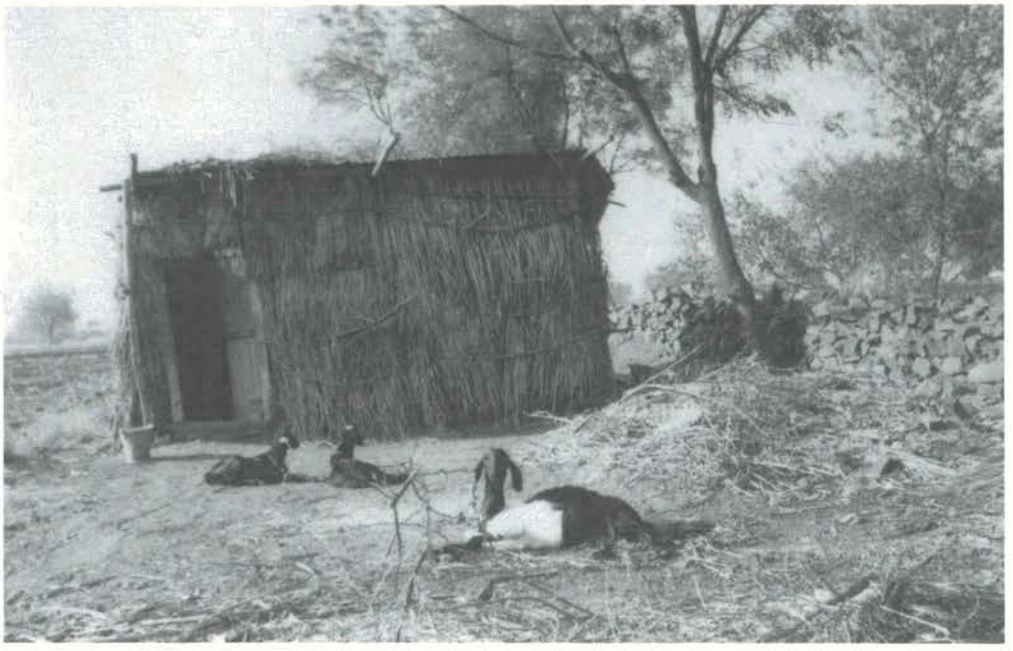
**Shepherds' flocks**

Average 0.492 ± 0.1

*Deccani ram and ewe of the Dhor strain*

Although the Deccani is classed as a separate breed, the general appearance of these animals is heterogeneous. Their colour may be black, white with a black face or black patches elsewhere or all white (KAURA, 1961). There are various types within the breed: Lonand, Sangamneri, Sangola, Kolhapuri etc. They are extremely hardy sheep that evolved out of an archaic or primitive stock. The Deccani is a long-legged rangy animal, poor in chest with a long thin neck. It lacks depth of body. It has a flat forehead and a distinct Roman nose with a short, pointed muzzle and depressed nostrils. The ears are of many shapes from short tubular to broad flat with medium length. The average adult weight of the rams is estimated to be around 42 kg and that of the ewes 26 kg. The height at withers is respectively 73 and 66 cm.

The Deccani represents a transition between the coarse-wooled sheep of Rajasthan to the north and the hair sheep of Andhra Pradesh and Tamilnadu to the south. They are small and well adapted to scanty pastures and very harsh conditions (DEVENDRA and McLEROY, 1982). In the summer months, one can often see them grazing on land that seems to have only stones and little grass on it. The wool is of a low grade and is a mixture of hair and fine fibers (average staple length estimated at 8.6 cm and fibre diameter 52.4 $\mu$; the fibre density is 735 $cm^2$). It is mostly used for the manufacture of kambals (rough blankets) that are widely used locally as well as bought in large quantities by the Indian army. Income from the sale of wool forms only a fraction of the total income derived from the rearing of these sheep. Wool prices fluctuate and if prices are very low, the shearing costs may actually be higher than the sale proceeds from the wool. In table 1 are given some indicative production and reproduction characteristics of the Deccani sheep (AGRESCO, 1992).



*Local goats in front of owner's hut*

## 6.0 CONCLUSIONS

The goats and sheep utilize resources such as 'natural' grazing, crop residues, stubble and tree leaves and pods which would otherwise be wasted.Genetic improvement concurrent with improvement in nutrition, health care, and other aspects of management will go a long way towards increasing the productivity of these useful animals. A beginning has been made through the *'Network Project for sheep improvement'*. In the case of goats, immediate steps are needed to evaluate the performance of local goats.Selection should then be done to exploit the vast variability.

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# EL CERDO IBERICO Y SU SISTEMA DE PRODUCCION

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## RESUMEN

El cerdo ibérico constituye la población más amplia entre las pertenecientes al tipo mediterráneo y se mantiene en el S.W. de la Península Ibérica con un sistema productivo estrechamente ligado al medio natural. En los últimos años ha experimentado un auge asociado al establecimiento de un mercado propio para sus productos. Aunque el número de cabezas sea aparentemente considerable, la alta proporción de los cruzamientos con Duroc hace peligrar la supervivencia de algunas de sus variedades. En este trabajo se describen las características de la raza y de sus particulares sistemas de producción tanto en el campo como en la industria, así como la estructura de la población en relación con los problemas de su conservación.

## SUMMARY

The iberic pig constitutes the largest population among those of the mediterranean type and is hold in the S.W. of the Iberic Peninsula with a productive system closely tied to the natural environment. In last years it has experienced a rise associated with the establishment of a particular market for its products. The number of animals is aparently high. However, crossbreeding with Duroc is a common pratice and the survival of some varieties is not out of danger. In this work the breed characteristics and its peculiar production system both in field and in industry are described, as well as the population structure in connection with the need of its conservation.

## 1.0 CARACTERIZACION DE LA RAZA

La población de cerdo ibérico es la más extensa de los tipos de cerdo del área mediterránea. Se acepta comunmente que la mayoría de las razas europeas cuentan, en diferente medida, con ascendientes asiáticos a partir de la introducción masiva de cerdos del Este a finales del siglo XVIII (CLUTTON-BROCK, 1981). El cerdo ibérico puede ser uno de los escasos tipos europeos libres de sangre oriental. En cambio parece fuera de toda duda su contribución en la formación de la mayoría de las poblaciones criollas americanas y en el origen de la raza Duroc (BRIGGS Y BRIGGS, 1980), sin que falten especulaciones que conecten al cerdo ibérico con los principios del Tamworth británico (WISEMAN, 1992).

La raza ibérica ha sido mantenida durante siglos con un elevado tamaño efectivo en amplias zonas del S.W. de la península ibérica (Extremadura, Alemtejo, Andalucía Occidental ...), bajo un clima continental semiárido. El hábitat característico del cerdo ibérico es la dehesa, bosque mediterráneo dominado por árboles del género Quercus, encinas y alcornoques, sobre pastizales herbáceos anuales, que da lugar a una fuerte estacionalidad de los recursos nutritivos. Esta circustancia, unida a un clima poco favorable para la conservación de alimentos, configura el animal ideal para satisfacer las necesidades humanas: un animal capaz de subsistir con una alimentación pobre y de engordar rápidamente cuando los frutos del encinar maduran, para ser sacrificado en una época concreta del año, al término de la producción de bellotas coincidiendo con las temperaturas más bajas; asimismo sus piezas deben tolerar un largo proceso de curación en un clima seco y caluroso para poder suministrar alimento ininterrumpidamente a través de todo el año.

El cerdo ibérico reune estas características alcanzadas durante siglos de adaptación a un sistema de producción condicionado por el medio natural. Su temprana madurez y metabolismo reducido le permiten resistir largos periodos de escasez. La gruesa capa de grasa subcutánea y su abundante grasa intramuscular hacen que sus productos puedan curarse y conservarse durante mucho tiempo en un clima adverso sin que se estropeen o se sequen excesivamente. En cuanto a su morfología externa, la finura y longitud de patas, grandes orejas y hocico largo, junto con la coloración oscura de su piel facilitan su adaptación a las altas temperaturas (MOUNT, 1979). Algunas de estas características compartidas con el jabalí europeo (hocico largo, color oscuro) tienen otras evidentes ventajas adaptativas más acusadas en el estado silvestre y, probablemente, no se deben a la labor selectiva del hombre, salvo en lo que concierne al hecho de haber sido respetadas a lo largo del proceso de domesticación.

## 2.0 CENSO Y ESTRUCTURA DE LA POBLACION

La estructura tradicional de la población de cerdo ibérico se caracterizaba por la presencia de diversos tipos locales bien diferenciados, controlados por un número relativamente grande de ganaderos. Cada una de estas ganaderías solía completar el ciclo productivo y sólo ocasionalmente se producía intercambio genético entre ellas. Mientras se ha mantenido esta estructura tradicional reticulada el número de cabezas ha sido elevado. Los censos oficiales españoles de 1955 señalan la existencia de 567.424 cerdas ibéricas de vientre. El tamaño efectivo, con una estructura de tales características, también era grande.

Esta estructura de la población de cerdo ibérico comienza a quebrarse cuando en 1960 irrumpe en la Península Ibérica la peste porcina africana que obliga al sacrificio de un gran número de piaras. Simultáneamente los cambios en los hábitos sociales agravan la crisis de la raza: las grasas animales experimentan una fuerte depreciación, la cuantía de las matanzas familiares desciende con la reducción del autoconsumo en el medio rural, la implantación de regadíos y la mecanización creciente termina con muchas dehesas y rastrojeras. Esta mal entendida modernización del campo conlleva la importación incontrolada de razas extranjeras que invaden el sector porcino. Como consecuencia, y sin ningún tipo de control público o privado, se ensayan cruzamientos del cerdo ibérico con muchas de estas razas, principalmente las de capa oscura: Tamworth, Wessex Saddleback, Large Black, Berkshire, Duroc-Jersey, incluso Large White.

Se desarrolla una nueva estructura piramidal basada en el cruzamiento industrial, en el que el cruce con Duroc termina imponiéndose. El censo se reduce drásticamente: en 1986, según fuentes oficiales, el número de cerdas de cría es en España de 72.000 y tan solo de 5.000 en Portugal. Sin embargo la reducción ha sido realmente mayor dados los cambios producidos en la metodología de elaboración de los censos y, sobre todo, porque han sido incluidas erróneamente muchas cerdas cruzadas. Desde un enfoque conservacionista, las consecuencias son aún más graves. Algunas variedades de ibérico (rubio andaluz) desaparecen con la consiguiente pérdida de variabilidad genética. La nueva estructura da lugar a una reducción dramática del censo efectivo puesto que muchos reproductores ibéricos únicamente se destinan al cruce. Sólamente subsiste en pureza un pequeño número de ganaderías de élite como suministradoras de reproductores ibéricos.

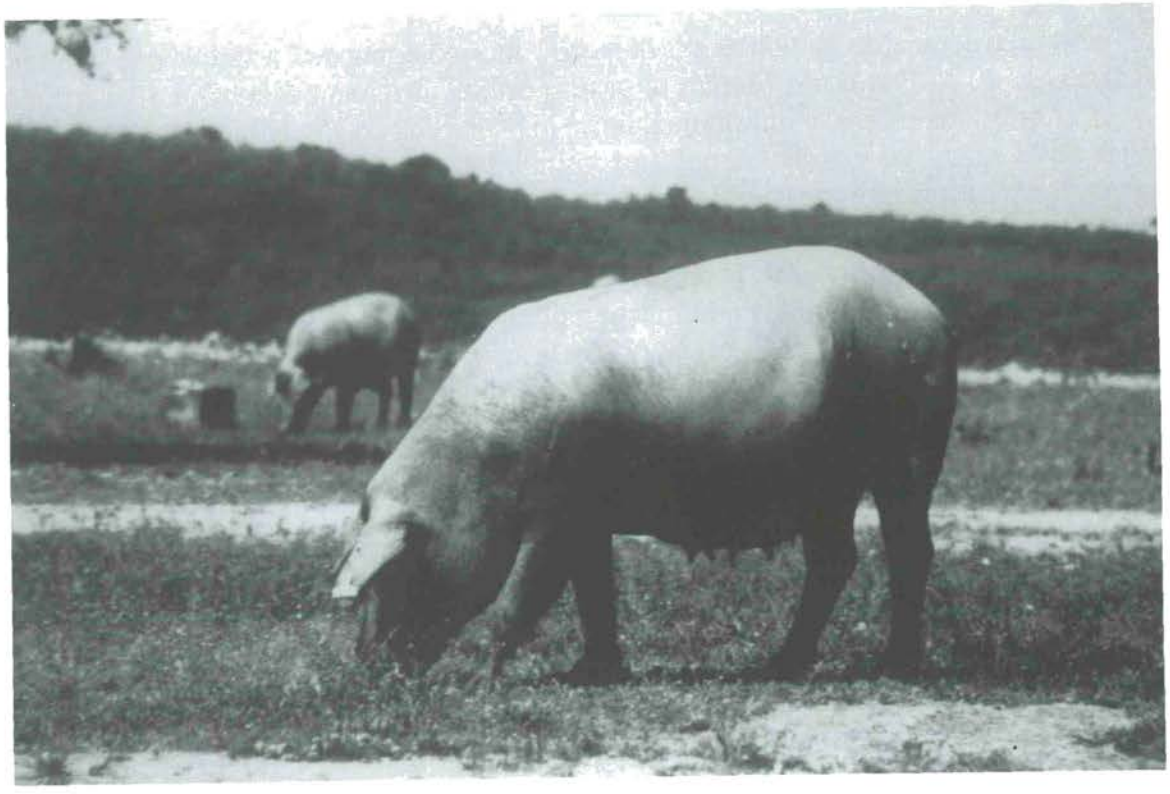
TABLA 1
Censo de ♀♀ reproductoras ibéricas puras y cruzadas en 1988

| REGION | ♀♀ Ibéricas | | ♀♀ Cruzadas | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Extremadura | 24.466 | 34.8 | 45.822 | 65.2 | 70.288 | 72 |
| Andalucía | 8.416 | 30.8 | 18.882 | 69.2 | 27.298 | 28 |
| TOTAL | 32.882 | 33.7 | 64.704 | 66.3 | 97.586 | 100 |

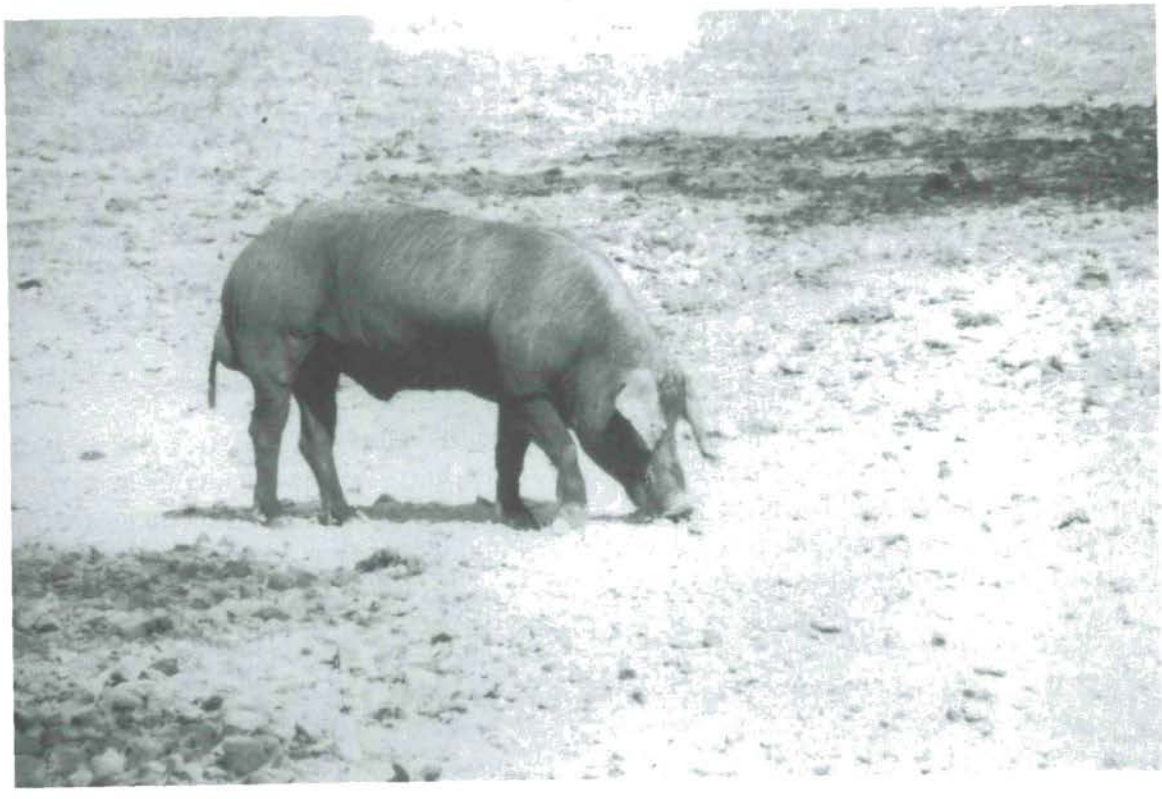
Actualmente se mantiene dicha estructura. Según estimas de la Asociación Española de Criadores de Cerdo Ibérico (AECERIBER) dos de cada tres cerdas de vientre son cruzadas, como queda reflejado en la Tabla 1 (DIÉGUEZ, 1992). Afortunadamente la reducción del censo se ha detenido y están en marcha iniciativas para la conservación del todavía importante remanente genético disponible.

## 3.0 PRODUCCIONES Y SISTEMAS DE PRODUCCION

El sector productivo del cerdo ibérico muestra unos modos de producción bien diferenciados de los correspondientes a las explotaciones intensivas.



*Cerda Ibérica*



*Verraco Ibérico*

## 3.1 Cría

Las cubriciones se realizan en régimen de libertad, agrupando durante un mes los machos con las hembras en una proporción aproximada de 1:10. Tanto los verracos como las cerdas son utilizadas por primera vez como reproductores a partir de los 8 meses de edad. Los partos tienen lugar en alojamientos cerrados con pequeños corrales exteriores para cada camada o en cabañas movibles de chapa galvanizada distribuidas en cercados con una densidad de unas 10 cabañas por hectárea. La época de partos es variable según la conveniencia de cada ganadero y su disponibilidad de recursos naturales. La prolificidad es baja, dependiendo de la estirpe, del régimen de la explotación y del ordinal de parto. En la Tabla 2 se presentan valores medios del número de lechones nacidos y nacidos vivos por camada registrados en 1.411 cerdas de la estirpe ibérica *Torbiscal* (RODRÍGUEZ et al., 1992).

TABLA 2
Tamaño de camada de cerdas ibéricas según ordinal de parto

| Ordinal de parto | Nº de Camadas | Total nacidos | Nacidos vivos |
|---|---|---|---|
| 1 | 1.411 | 7.25 | 7.03 |
| 2 | 1.017 | 7.91 | 7.68 |
| 3 | 712 | 8.65 | 8.31 |
| ≥4 | 1.998 | 9.01 | 8.49 |

El número de mamas está fuertemente canalizado en el cerdo ibérico hacia un valor modal de 10 (TORO et al., 1986). La cría, con una duración inferior a 2 meses, se desarrolla en el mismo recinto en que se ha producido la paridera, aunque con el sistema de cabañas, los lechones, pasados unos días del parto, comparten territorio con sus coetáneos de otras camadas.

## 3.2 Parámetros reproductivos

El cerdo ibérico tiene una producción espermática inferior a las razas de producción intensiva asociada a un menor tamaño de testículo. Las medias de la motilidad y estado del acrosoma en el semen de verracos adultos son 85% y 77% respectivamente. El volumen del eyaculado es de 170 ± 13 $cm^3$, siendo 55 ± 8 la fracción rica y 115 ± 17 $cm^3$ la fracción postespermática. La concentración de espermatozoides es de 225.000 por $mm^3$, correspondiendo 600.000 a la fracción rica y 99.000 a la posetspermática (PÉREZ-MARCOS, 1986). La conservación de semen refrigerado no presenta diferencias respecto a otras razas (PÉREZ-MARCOS et al., 1987).

En las hembras, el inicio de la pubertad tiene lugar a los 210 ± 16 días de edad. La duración media del ciclo sexual es de 19.5 ± 0.2 días y la del periodo de celo de 2.3 ± 0.7 días (GARCÍA CASADO, 1992). La tasa media de ovulación es de 16.4 ovocitos siendo la respuesta a los tratamientos con progestágenos similar a la observada en razas intensivas (MARTÍN RILLO et al., 1985).

### 3.3 Recría

El largo periodo de 16-22 meses entre destete y sacrificio característico del antiguo sistema de producción se ha reducido considerablemente, y en la actualidad el peso aproximado de sacrificio de 160 kg se alcanza a la edad de 12-14 meses en los ibéricos y a los 10-12 meses en los animales cruzados (DOBAO et al., 1988). Este periodo se subdivide de una forma natural en otros dos. La recría comprende desde el destete hasta los 90-100 kg de peso y su duración, más variable que la de la ceba, viene determinada por la época de nacimiento. El objetivo principal en la recría es aplicar al máximo los pastos, rastrojos y siembras específicas disponibles. No obstante la suplementación de cereales es muy frecuente, particularmente en verano, para poder alcanzar el peso requerido cuando comienza a madurar la bellota. Esto ocurre a finales de octubre y señala el inicio de la montanera que normalmente se prolongará hasta el sacrificio.

### 3.4 Ceba

La ceba en montanera tiene lugar a lo largo de unos 3 meses, aunque su duración óptima no está definida (BENITO et al.,1992). Consiste fundamentalmente en el consumo de la bellota a pie de árbol, bien desprendida de forma natural o mediante la ayuda de un vareador al cuidado de la piara. La producción de bellota es muy variable, oscilando entre 10 y 20 kg/árbol con una densidad de 30-50 árboles/Ha. El consumo diario por cabeza varía de 6 a 10 kg con una ingesta adicional de 1-1.5 kg de hierba. Las condiciones meteorológicas o la escasez de bellota pueden obligar a una suplementación con concentrados durante el periodo de ceba o a prolongar el engorde con piensos comerciales en aquellos casos en los que, al término de la montanera, los animales no hayan alcanzado el peso de sacrificio, en el sistema mixto de ceba llamado recebo. Según datos de AECERIBER, el porcentaje de cerdos de tipo ibérico cebados en régimen de montanera o recebo es del 40%. El 60% restante es finalizado con pienso comercial bien en cebaderos al aire libre con un máximo de 25 cabezas por hectárea o en régimen intensivo.

## 4.0 CURACION E INDUSTRIA DE LOS PRODUCTOS DERIVADOS

En la actualidad la raza ibérica se destina exclusivamente a la elaboración de productos curados. En los comienzos de los años 80 se sacrificaban anualmente unos 400.000 cerdos. Este número se ha incrementado considerablemente y en las últimas campañas se han cebado en España más de 1.000.000 de cabezas por año. Al intervalo de pesos habituales de sacrificio de 140-180 kg se corresponden pesos de canal de 115-145 kg.

Sólo un 25% de los animales sacrificados son ibéricos puros. El resto son cruzados con razas extranjeras, principalmente con Duroc. Se estima que el 35% de las canales proceden de animales 1/2 ibéricos y el 40% restante de 3/4 ibéricos. Las diferencias en características de canal de estos tres tipos genéticos se resumen en la tabla 3 elaborada a partir de datos de mataderos comerciales.

TABLA 3
Características de canal de cerdos ibéricos puros y cruzados

| % Canal | Ibéricos | 3/4 Ibéricos | 1/2 Ibéricos |
|---|---|---|---|
| Jamones | 13.7 | 14.7 | 15.6 |
| Paletas | 9.4 | 9.8 | 10.3 |
| Lomos | 2.6 | 2.8 | 3.1 |
| Magro | 9.2 | 9.8 | 10.6 |
| Grasa | 53.8 | 51.0 | 48.3 |
| Hueso | 9.7 | 10.3 | 10.4 |
| Otros | 0.6 | 0.6 | 0.6 |

Los jamones, paletas y lomos suponen un 25% del peso canal pero su precio se aproxima al 80% del valor de la canal en el mercado. El resto de la canal se destina a la fabricación de embutidos de gran diversificación regional (chorizos, morcones, salchichones, etc.), donde el buen criterio para la condimentación y condiciones de procesado desempeñan un papel al menos tan importante como el de la materia prima.

El proceso de curación de las piezas nobles es prolongado, con duraciones en torno a 7 semanas, 9 meses y 2 años para lomos, paletas y jamones respectivamente. La pieza más importante, el jamón, necesita un lento proceso de maduración: el salado, después de la eliminación de los restos de sangre, tiene una duración aproximada de 1 dia/kg de peso de la pieza y su objetivo es crear unas condiciones que inhiban la acción de gérmenes nocivos. El postsalado se realiza a temperaturas en torno a los 5ºC durante 40-60 dias. Los jamones se trasladan después al secadero donde, de abril a junio, tiene lugar una intensa hidrólisis de proteinas y lípidos, con temperaturas ascendentes hasta alcanzar los 26-30º provocando el goteo de la grasa fundida y marcando el momento del descenso del jamón a la bodega.

En la bodega, con temperaturas más bajas (12-16º), hay una reducción de las reacciones degradativas. La fase final de la maduración en bodega, el segundo verano, da lugar de nuevo a una mayor acumulación de sustancias derivadas de la ruptura de proteinas y lípidos, con formación de aminoácidos libres y de productos secundarios responsables del sabor y aroma (VENTANAS, 1992). Las variaciones de sabor y aroma entre jamones procedentes de cerdos cebados en montanera, recebo o pienso no parecen obedecer a diferencias cualitativas de compuestos volátiles sino a las importantes diferencias encontradas en la concentración de dichos compuestos (LÓPEZ et al., 1992).

## 5.0 COMERCIALIZACION

Existe un interés creciente por la calidad de los productos elaborados que se asocia a los sistemas de producción más tradicionales. El mercado de productos derivados del cerdo ibérico es capaz de discernir entre sistemas de ceba y tipos genéticos asignando

precios diferentes a los animales de distinto origen. Mediante diferentes sistemas, como contratos homologados entre industriales y ganaderos, se intenta garantizar la materia prima de la industria. Los precios mínimos acordados en estos contratos para la campaña 1992/93 expresados en Pesetas por kilogramo de peso vivo se presentan en la tabla 4.

TABLA 4
Precios mínimos (Pts/kg) según sistema de ceba y tipo genético

| | **Ibéricos** | **3/4 Ibéricos** | **1/2 Ibéricos** |
|---|---|---|---|
| Montanera | 326.8 | 300.8 | 285.4 |
| Recebo | 264.6 | 249.0 | 241.3 |
| Pienso extensivo | 232.8 | 222.6 | 222.6 |
| Pienso intensivo | 202.4 | 202.4 | 202.4 |

Para evitar posibles fraudes se han propuesto diversos métodos de control sobre canal del sistema de alimentación a que ha sido sometido un lote de cerdos en su acabado. El análisis de la fracción lipídica y de triglicéridos de grasas hepáticas es el método más prometedor de discriminación post mortem del régimen de alimentación administrado en el periodo de ceba (ORDOÑEZ y HOZ, 1992).

El valor económico de la producción anual de cerdos ibéricos ha alcanzado una considerable dimensión que puede estimarse en 48.000 millones de Pts. El valor de los productos elaborados por la industria supera los 80.000 millones dado el alto valor añadido de los mismos.

## 6.0 CONSERVACION Y MEJORA

A pesar de que los censos referidos y la dinámica de sus producciones indiquen claramente que el cerdo ibérico no está en riesgo inmediato de desaparición, la conservación de sus recursos genéticos es objeto de atención. No hay que olvidar que el mercado de productos de cerdo ibérico, hoy satisfactorio, se apoya en la comercialización de productos de alta calidad muy sujetos a la moda. Por otra parte los cambios en los hábitos alimenticios se suceden rápidamente.

La alta tasa reproductiva del cerdo permite que una población porcina que atraviese por un cuello de botella se reponga con mayor facilidad que una perteneciente a otra especie doméstica. Sin embargo esta misma característica hace que sea rápido y sencillo sustituir una población por otra. De ambas situaciones tiene experiencia la raza ibérica. Como se ha dicho anteriormente hemos asistido en el pasado a estrangulamientos agudos de la población de cerdo ibérico que han acabado con algunas de sus mejores variedades (rubio andaluz o dourado alemtejano) y llevado a tamaños efectivos críticos a otras (negro lampiño).

La conservación de los distintos tipos supervivientes preocupa a las Comunidades Autonómas de Extremadura y Castilla-La Mancha, que mantienen programas de

conservación de la línea *Valdesequera* (tipo retinto) y de las estirpes *Torbiscal*, fusión de cuatro tipos tradicionales, y *Guadyerbas* (tipo negro lampiño).

En cuanto a la mejora genética, la variedad de líneas y ganaderías y su alta endogamia, sugiere que la utilización de sus cruces es un procedimiento efectivo para aumentar los rendimientos sin merma de la calidad. Los resultados de cruzamientos entre estirpes mostrados en la tabla 5 demuestran que existe una importante heterosis tanto para caracteres productivos (GARCÍA-CASCO y SILIÓ, 1991) como reproductivos (RODRIGUEZ et al., 1992). En términos de porcentajes de la media de los parentales estos valores superan los que se encuentran en cruces entre razas.

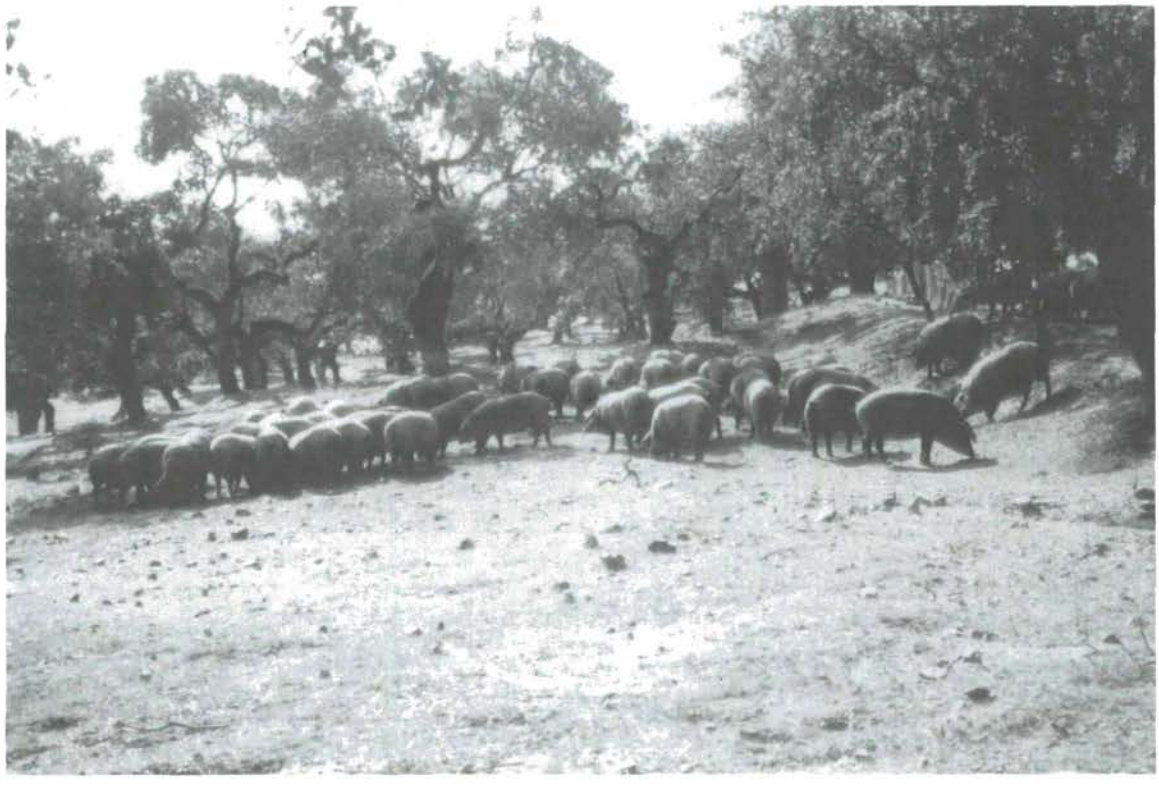
TABLA 5
Estimas de heterosis entre cuatro estirpes de cerdo ibérico

| | **Unidades** | **% Media** |
|---|---|---|
| Nº nacidos | 0.48 lechones | 6.2 |
| Nº nacidos vivos | 0.57 lechones | 7.9 |
| Crecimiento recría | 29.3 g/dia | 14.2 |
| Crecimiento ceba | 43.7 g/dia | 7.1 |
| Peso recría | 10.2 kg | 14.7 |
| Peso sacrificio | 15.4 kg | 10.1 |

Existen diversos problemas en la posible selección del cerdo ibérico: definición de objetivos, interacción genotipo x medio y respuestas no deseadas en caracteres de calidad de carne. Por ello parece descartable el interés de un programa nacional de selección aunque pueda ser conveniente la selección en ciertas líneas con objetivos limitados. En este sentido se vienen realizando trabajos preparatorios que incluyen el análisis de tácticas de selección o la estimación de parámetros genéticos y ambientales como los que se presentan en la tabla 6 (SILIÓ et al., 1992).

TABLA 6
Estimas de heredabilidades ($h^2$) y coeficientes
de ambiente común ($c^2$) y permanente ($m^2$) en cerdos ibéricos

| **Carácter** | **Registros** | **($h^2$)** | **($c^2$)** | **($m^2$)** |
|---|---|---|---|---|
| Peso 50 d | 26.913 | 0.17 | 0.33 | - |
| Peso 120 d | 1.175 | 0.23 | 0.31 | - |
| Peso 240 d | 1.674 | 0.26 | 0.18 | - |
| Nº mamas | 30.928 | 0.19 | 0.11 | - |
| Nacidos vivos | 3.517 | 0.06 | - | 0.06 |
| | 2.018 | 0.07 | - | 0.12 |



*Lote de Cerdas Ibéricas en ceba en montanera*

Recientemente se ha aprobado un esquema de valoración genética apoyado por la Asociación de Ganaderos (AECERIBER) y el Ministerio de Agricultura Pesca y Alimentación. El método de evaluación genética utilizado es el BLUP-Modelo Animal, aunque las dificultades en el control genealógico obligan al empleo de métodos de parentesco incierto. La falta de conexión y los recelos que suscita en los ganaderos el empleo de machos de referencia o de inseminación artificial limita el alcance de las evaluaciones genéticas al ámbito de cada ganadería por lo que se han iniciado pruebas complementarias de comparación de rendimientos entre las más importantes.

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