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ANIMAL GENETIC RESOURCES INFORMATION

BULLETIN D'INFORMATION SUR LE RESSOURCES GÉNÉTIQUES ANIMALES

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

Food and Agriculture Organization of the United Nations
Organisation des Nations Unies pour l'alimentation et l'agriculture
Organización de las Naciones Unidas para la Agricultura y la Alimentatción

UNEP

Initiative for Domestic Animal Diversity
Initiative pour la Diversité des Animaux Domestiques
Iniciativa para la Diversidad de los Animales Domésticos

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Editorial
AGRI – Looking Forward

In 1980, FAO and UNEP (UN Environment Programme) jointly convened a Member Country Expert Consultation in Rome on *The Conservation and Management of Animal Genetic Resources (AnGR)*. This consultation was not one for experts in their own right; the *experts* participating were nominated by their governments and attended as representatives of the relevant FAO and / or UNEP member countries. This implied that the recommendations reached were meant to be addressed by the two international organisations concerned.

At the time, the conservation of AnGR with reference to the livestock farming sector was quite a novel idea to many of those opinion-makers who considered the sustaining of local domestic animal resources to be contrary to livestock improvement and modern animal agriculture development. *In contrario*, today the term *AnGR and Biodiversity* are fully *a la mode*.

In the late 1970s little information was available, in both developed and developing regions of the world. The 1980 consultation recommended unanimously that FAO, in collaboration with UNEP, must consider AnGR as a priority sector and find the funds to develop it and that FAO should involve all interested and relevant parties and take the leadership to establish:

- classification criteria for endangered breeds;
- technical methods and standards for live (*in-situ*) and cryogenic (*ex-situ*) conservation;
- methods of conservation;
- regional data- and gene banks;
- comprehensive documentation of livestock breeds in China and the USSR;
- training in conservation methods;
- a Newsletter to be published regularly.

These are the origins of AGRI (Animal Genetic Resources Information Bulletin), that evolved from a simple technical Newsletter in 1983 to a full fledged specialised publication. Today it is recognised world-wide as the only acknowledged livestock genetic resources journal.

It is the intention of the Animal Production and Health Division (AGA) of FAO to accentuate and develop further this position regarding AGRI, with the sustaining support of all relevant INGOs, as the mouthpiece for animal genetic resources conservation and utilisation and confirm AGRI's role in the dissemination of information on populations of AnGR, farming systems conditions and genetic parameters.

From No. 32, further effort will be made to sustain this indispensable publication, allowing colleagues from all over the world to share and exchange, even further, their information and know-how on farm animal populations. This will also strengthen AGRI as a media for presenting the FAO and other international programmes, past, present and future, and actions in the conservation and use of genetic material.

The Editors

Editorial
AGRI – Un regard sur le passé

En 1980 la FAO et l'UNEP (Programme des Nations Unis pour l'environnement) ont organisé une Consultation d'experts des pays membres à Rome pour discuter de la *Conservation et la Gestion des Ressources Génétiques Animale (AnGR).* Les experts qui ont participé à cette consultation avaient été només par leur gouvernement et prenaient part en tant que représentants de leur pays auprès de la FAO et/ou de l'UNEP. En conséquence, les recommendations établies avaient pour but l'application au niveau des deux organisations concernées.

A l'époque, la conservation des AnGR, en particulier du secteur de l'élevage, représentait une nouveauté pour la plupart de ceux qui forment l'opinion publique qui considéraient la conservation des ressources génétiques des animaux d'élevage contraire à l'amélioration de l'élevage en soi et au développement moderne de l'agriculture animale. *In contrario,* aujourd'hui les termes *AnGR et Biodiversité* sont à la mode.

Vers la fin des années 70 il existait très peu d'information à ce sujet aussi bien pour les régions développées que pour celles en voie de développement. En 1980 une consultation a recommendé à l'unanimité que la FAO, en collaboration avec l'UNEP, considère les AnGR comme un secteur prioritaire et, à ce propos, puisse trouver les fonds nécessaire pour son développement. Pour cela, la FAO devait se proposer comme leader du secteur et impliquer toutes les institutions importantes intéressées afin d'établir:

- les critères pour la classification des races en danger;
- les méthodes techniques et les standards de conservation *in situ* et de la conservation cryogénique (*ex situ*);
- les méthodes de conservation;
- les banques de gènes et de données au niveau régional;
- une documentation compréhensible des races d'élevage en Chine et en USSR;
- la formation en méthodes de conservation; et
- une Newsletter à publier régulièrement.

Voilà l'origine de AGRI (Bulletin d'Information pour les Ressources Génétiques Animales) qui a évolué d'une simple Newsletter technique en 1983 jusqu'à devenir une publication spécialisée. Aujoud'hui elle est reconnue dans le monde comme la seule revue consacrée aux ressources génétiques des animaux d'élevage.

C'est la volonté de la Division de Production et Santé Animale (AGA) de la FAO de mettre l'accent et de développer ultérieurement la position de AGRI, à travers le soutien de toutes les INGO intéressées, pour le rendre le porte-parole de la conservation des ressources génétique et de leur l'utilisation, et confirmer ainsi le rôle de AGRI dans la vulgarisation de l'information sur les populations AnGR, sur les conditions des systèmes d'élevage et des paramètres génétiques.

A partir du No. 32 un effort supplémentaire sera fait pour soutenir cette importante publication qui permet à nos collègues dans le monde de partager et d'échanger leurs informations et connaissances sur les populations d'animaux d'élevage. Ceci permettra aussi de renforcer AGRI en tant que outil de communication pour présenter les projets de la FAO et d'autres programmes internationaux; passé, présent et futur, et plus globalement les actions entreprisent dans le cadre de la conservation et l'utilisation du matériel génétique.

Les Editeurs

Editorial
AGRI – Un vistazo al pasado

En 1980 la FAO y la UNEP (Programa de las Naciones Unidas para el Ambiente) organizaron una Consulta para expertos de los países miembros en Roma para discutir de la *Conservación y la Gestión de los Recursos Genéticos Animales (AnGR)*. Los expertos que participaron en esta reunión habían sido nombrados por sus gobiernos y tomaban parte en ella como representantes de los países ante la FAO y/o la UNEP. Por ello, las recomendaciones acordadas tenían como objetivo su aplicación a nivel de las dos organizaciones implicadas.

En aquella época la conservación de AnGR, y en particular referida al sector de la producción animal, representaba una novedad para la mayor parte de los opinionistas, que consideraban la conservación de los recursos genéticos de animales domésticos contraria a la mejora de la producción animal en sí y al desarrollo moderno de la agricultura. *In contrario,* hoy en día los términos *AnGR y Biodiversidad* están más bien *à la mode*.

Hacia finales de los años 70 existía muy poca información a este respecto, tanto para las regiones desarrolladas como para aquéllas en vía de desarrollo. En 1980 una consulta recomendó por unanimidad a la FAO, en colaboración con la UNEP, que considerase los AnGR como un sector prioritario y, a tal propósito, pudiera encontrar los fondos necesarios para su desarrollo. Para ello, la FAO debía proponerse como líder del sector e implicar todas aquellas instituciones importantes interesadas, para establecer:

- los criterios para la clasificación de las razas en peligro;
- los métodos técnicos y los estándars para la conservación *in-situ* y la conservación criogénica (*ex-situ*);
- los métodos de conservación;
- las bases de datos y bancos de genes a nivel regional;
- una documentación comprensible sobre las razas domésticas en China y en URSS;
- la formación en métodos de conservación; y
- una Newsletter de publicación regular.

Y este fue el origen de AGRI (Boletín de Información sobre los Recursos Genéticos Animales), que ha pasado de una simple Newsletter técnica en 1983 hasta convertirse en una publicación especializada. Hoy en día está reconocida a nivel mundial como la única revista dedicada a los recursos genéticos de animales domésticos.

La División de Producción e Higiene Animal (AGA) de la FAO tiene la intención de impulsar y desarrollar ulteriormente la posición de AGRI, a través del apoyo de todas las INGO interesadas, para convertir la revista en el porta voz de la conservación de los recursos genéticos y su utilización, confirmando así el papel de AGRI en la difusión de la información sobre las poblaciones AnGR, las condiciones de los sistemas de explotación y los parámetros genéticos.

A partir del No. 32 se llevará a cabo un esfuerzo suplementario para sostener esta importante publicación que permite a nuestros colegas en el mundo compartir e intercambiar sus informaciones y conocimientos sobre las poblaciones de animales domésticos. Esto permitirá también reforzar AGRI como herramienta de comunicación para presentar los proyectos de la FAO y de otros programas internacionales; pasado, presente y futuro, y más globalmente las acciones llevadas a cabo en el marco de la conservación y la utilización del material genético.

Los Editores

The State of the World Animal Genetic Resources. The Logical Step Forward in the FAO Animal Genetic Resources Programme

An article in AGRI 29 by Dr. Bhat (India) and the full AGRI 30 issue in Arabic, English, French and Spanish described the objectives and process of the State of the World (SoW) of Animal Genetic Resources (AnGR). The objective of this paper is to recap the salient features in those two documents and report on the overall progress made towards achieving the SoW-AnGR objectives, particularly during these past six months. To be efficiently conclusive, this project will most probably be longer than that indicated in the original planning stage.

The FAO AnGR program was started with two main components in mind, the first is documentation of what AnGR exist and establish national, regional and global structures to deal with AnGR issues, and the second, what should be done about these AnGR to enhance their role in the development of agriculture. The former was carried out by asking individual countries about their AnGR and documenting the data that came from the countries in the Domestic Animal Diversity Information System (DAD-IS) that was made available on the internet and off-line on CDs in different editions. Also that work resulted in the publication of three editions of the World Watch List for the Domestic Animal Diversity (WWL-DAD), documenting livestock breeds and their risk status. In a project of such enormity, not all data could be verified at the country level but some iteration did take place with the fact remaining that the data quality differed from one country to another.

National and regional structures were formed by establishing national and regional focal points beside the global focal point which is at FAO in Rome. An important output of these activities was increasing the degree of awareness among countries and the donor community and involving all true stakeholders. At that stage it was only logical to proceed towards realizing the second major component of the program; i.e. " *what should be done about these AnGR to enhance their role in the development of agriculture*". Table 1 shows the list of the activities, SoW planned time-frame and status.

Table 1. List of the activities, SoW planned time-frame and status.

Activities	Proposed time line*	Status
Preparation of tools and guidelines	Sep 2000 - Jun 2001	Completed
Regional training	Jul 2001 - Feb 2002	Partially completed
NCC[a)] begins CR[b)] development	Sep 2001- Apr 2002	In the pipeline
In-country training	Sep 2001- July 2002	Gradually initiated
Supporting-data collection	Aug 2001 - July 2002	Gradually initiated
Drafting CR and consultation	Feb 2002 - Jul 2002	

[a)]NCC = National Co-ordinating Committee.
[b)]CR = Country Report.
*Indicative dates.

Proposed Submission of Country Reports: August 2002

For SoW reports to gain credence and act as an instrument for the facilitation of global actions to utilize and conserve AnGR the governments of the world have been involved in the process since the early inception of SoW and their engagement is continuously perused through FAO intergovernmental mechanisms/fora. Table 2 shows the governmental commitments to the program and their targeted involvement.

Country Reports

Country Reports are the basic elements of SoW. They are an opportunity to create a vision and strategic directions for the better management of AnGR and to clearly establish priorities for action and needs. Their preparation is very important both in content and in the process itself.

Structure of Country Reports

The country report should comprise six main parts as reported in table 3.

The Country Report is meant to be a **Strategic Policy Document.** It should provides answers to three basic questions:

1. Where we are?
2. Where do we need to be?
3. How to get to where we need to be?

Table 2. The governmental commitments to the program and their targeted involvement

	ITWG-AnGR[a)]	CGRFA[b)]
Adoption of SoW-AnGR	2nd meeting, 2000	9th meeting, 2001 (postponed to 2002)
Progress evaluation Strategic Priority Actions Report and Follow-up Mechanism	3rd meeting 2002	
Format of the SoW-AnGR Report	4th meeting, 2003	10th meeting, 2003
Draft of the SoW-AnGR Report Preceded by a review by Stakeholders		
Negotiated First SoW-AnGR Report and options for implementation	5th meeting, 2005	11th meeting, 2005
Anticipated CGRFA reporting to Convention on Biological Diversity (CBD):	2004	and 2006

[a)]Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture.
[b)]Commission (FAO) on Genetic Resources for Food and Agriculture.

Table 3. The six main parts of the Country Report

1	State of Farm Animal Genetic Resources
2	Changing Demands on National Livestock Production
3	State of National Capacity
4	National Priorities for the Conservation and Utilization of AnGR
5	International Co-operation in Farm Animal Biodiversity
6	Other Elements

It should then consider the **Priority Issues** surrounding these questions, and **Needs**. However, a Country Report:

- is not an inventory of AnGR
- is not an update of the WWL-DAD
- is not a report to satisfy international reporting commitment

Training

Training is a crucial component of SoW. The plan is to train some 320 national professionals by the end of March 2002. The objectives, programme and expected outcomes of the training programme are:

- Develop a group of experts for supporting the SoW-AnGR process, to assist countries to:
  - Organise and manage preparation of Country Reports (CR); and
  - Enhance regional co-operation and co-ordination.

Training workshops make use of material especially prepared for that purpose both in printed form and in Sow-AnGR Module in DAD-IS on-line.

Funding of SoW

Funding for SoW indeed imposes a great challenge. All parties concerned must cooperate to find sufficient funding to fulfil the objective of the program. The main sources of funding are:

- FAO Regular Program;
- extrabudgetary resources, i.e. trust fund donor countries, development organisations like UNDP and World Bank etc.; and
- direct national contributions.

Communication with countries

FAO AnGR Group had released Communication No. 1 in April 2001. Now, upon completion of regional trainings, FAO is releasing the Communication No. 2, in order to assist countries in their follow-up activities. The document is reproduced in this article.

Preparation of the Country Report for the State of the World's Animal Genetic Resources Communication # 2

This communication follows the letter of invitation sent by the Director-General of FAO on 7 March 2001 and Communication #1 sent in April 2001. The purpose of this document is to update you on the status of the process leading to the first *Report of the State of the World's Animal Genetic Resources* (SoW-AnGR).

Participation and essential steps forward

The invitation letter was sent to 180 member nations, one member organization and 8 countries which are not members of FAO. To-date 100 responses were received, out of which 97 countries indicated their interest to participate in the State of the World's Animal Genetic Resources process. In view of a good progress made so far, we suggest you to consider the following actions:

- Countries, ministries, which did not respond yet to the invitation of the Director-General of FAO, dated 7 March 2001, are requested to follow-up the matter with appropriate government authorities.
- Countries which responded positively to the invitation by the Director-General, are advised to allocate appropriate human and financial resources to successfully complete the task
- It is important to note, that in particular the recommendation in the "Guidelines for the Development of Country Reports" to form a broad and balanced National Consultative Committee (NCC) with a Chairperson and a National Technical Secretary as the driving force for developing the Country Report.
- We ask you to inform FAO on the name and full address of the Chairperson and a National Technical Secretary of NCC. This will allow FAO's SoW-AnGR secretariat to provide technical assistance as required for the Country's preparatory process, and to effectively communicate with the respective persons in each participating country. Correct address will also facilitate mailing of relevant technical materials to the person in the country.

Regional Training of Trainers Workshops (RTOT WSs)

To-date 8 Regional Training of trainers (RTOT) Workshops (WS) have been conducted with participants from approx. 140 countries.

RTOT WSs have been conducted for the following regions:

- Anglophone Africa in Ethiopia, in June 2001.
- South and Central America in Mexico, in September 2001.
- North Europe in Denmark, in October 2001.
- South Europe in Hungary, in October 2001.
- North America in United States in November 2001.
- South-East Asia in Bangkok, in November 2001.
- West Africa in Senegal, in December 2001.
- North Africa in Tunisia, in January 2002.

The following RTOT WSs are planned:

- Near East in Egypt, in February 2002.
- Russian speaking group in Russia, in March 2002.
- Caribbean to be determined.
- Pacific Islands to be determined.

Training and other materials to support within country process

Training Pack

A comprehensive Training Pack to support regional and country training activities is now available in all (five) official languages of the Organization, namely English, French, Spanish, Arabic and Chinese. The Training Pack is available in hard copy and will be also made available in the DAD-IS SoW-AnGR on-line module at http://www.fao.org/dad-is. Training Packs will be mailed in January 2002 in quantities as requested by participants of the RTOT WSs.

DAD-IS SoW-AnGR Module (off-line)

In addition to the Training Pack, reporting software has been developed. The DAD-IS SoW-AnGR Module is available on CD-ROM. It is operational in all official languages.

DAD-IS SoW-AnGR Module (on-line) at http://www.fao.org/dad-is

The on-line DAD-IS SoW-AnGR Module has been developed in addition to the stand-alone system provided on CD-ROM. The on-line Module is focused on up-to-date information for all stakeholders beyond the NCC.

It provides on-line support to countries starting when countries are considering their action of the FAO D-Gs invitation through acceptance of the invitation and establishing their National Consultative Committee, to taking first action to mobilize the necessary financial resources, and initial work to the first Regional Training Workshop and NCC, with the address as for the parent DAD-IS system (http://www.fao.org/dad-is/). It will need to be developed further over time and e.g. provide for the follow-up mechanism.

The on-line DAD-IS SoW-Module will contain the following features:

- *What's New on the State of the World's AnGR Process*: global and regional events and activities; summary of library updates; suggested actions now.
- *SoW-AnGR Library*: key documentation supporting the SoW-AnGR Process
- *Resource Mobilization*: sample project proposals; donor contributions, and links to funding agencies.
- *Stakeholders, Countries, National Co-ordinating Committees and International Non-Governmental Organizations*: contact details and SoW-AnGR progress.
- *SoW-AnGR Module Stage 1*: information on DAD-IS software assisting countries to develop Country Reports.

All stakeholders are encouraged to regularly monitor the information provided in this Module.

Guidelines for the Development of Country Reports

These Guidelines have been approved by the Intergovernmental Working Group on Animal Genetic Resources (see also: http://www.fao.org/ag/cgrfa/AnGR.htm#ITWG) and are available in all official languages of FAO. You may request the printed copies or see the electronic version at http://www.fao.org/dad-is.

SoW Brochure

The Brochure titled "Conserving and Developing Farm Animal Diversity" is available in all official languages of FAO. This brochure has been developed to inform decision-makers. You may request the printed copies or see the electronic version at http://www.fao.org/dad-is.

SoW-AnGR process and the Convention on Biological Diversity

The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) recommended in its seventh meeting that the Conference of the Parties of the Convention on Biological Diversity at it's Sixth meeting in The Hague, 7-19 April 2002 is:

"Considering the importance of animal genetic resources for sustainable agriculture and food security, the serious erosion of these resources, and the need for measures for their conservation and sustainable use,

a) Welcomes the process initiated by the Food and Agriculture Organization of the United Nations for the preparation of the first Report on the State of World's Animal Genetic Resources, as a contribution to the Convention's programme of work on agricultural biodiversity, as adopted by decision V/5;

b) Encourages Parties to participate in the development of the first Report on the State of World's Animal Genetic Resources, in particular through the preparation of country reports;

c) Underlines the need for countries to be able to participate fully in the preparatory process for the first report on the state of world's animal genetic resources, and implement follow-up actions identified through the process".

Further information

We will keep you continuously posted on the further developments. Updates will also be regularly posted in the SoW area of DAD-IS at http://www.fao.org/DAD-IS**.** We recommend that your NCC regularly consult this Web page.

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The role of Rare Breeds International as a global organization for the conservation of farm animal genetic resources

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Summary

Rare Breeds International (RBI) is the global non-governmental organization (NGO) concerned with the conservation of animal genetic resources (AnGR). It works in conjunction with FAO and with other organizations associated with livestock production. RBI members form a grassroots network that is rich in experience and knowledge of native breeds and affiliated national organizations maintain a valuable database of AnGR. Information is disseminated through major international conferences which are held at intervals of three years and through annual regional meetings. The cumulative expertise of the RBI membership facilitates a wide variety of projects, which range from policy interaction with governmental agencies to emergency rescue action and breeding programmes for relic breeds. RBI communicates mainly through publication of proceedings of major conferences and also by dedicated and linked websites.

Résumé

Rare Breeds International (RBI) est une organisation non gourvenementale (NGO) qui s'occupe de la conservation des ressources génétiques animales (AnGR) au niveau mondial. L'organisation réalise son travail en collaboration avec la FAO et d'autres organisations associées à la production animale. Les membres de RBI forment la base d'un réseau riche d'expérience et de connaissance des races natives et les organisations nationales qui adhèrent maintiennent une base de données importante de AnGR. L'information est divulgée à travers des conférences mondiales au niveau international qui se tiennent tous les trois ans et à travers des réunions annuelles régionales. L'ensemble d'expertise rassamblé grâce aux associés de RBI facilite la mise en oeuvre de projets d'une grande variété, qui vont de l'interaction politique avec les agences gouvernementales concernées par les actions de récupération d'alerte aux programmes d'amélioration des races en disparition. RBI communique surtout à travers la publication de compte rendu des conférences mondiales mais aussi à travers son site Web et les différents liens à l'intérieur.

Keywords*: Rare breeds, Native breeds, Genetic resources, Genetic conservation.*

Introduction

The significant development of national organizations established to identify and conserve endangered breeds of farm livestock began in the 1960s. In some countries, such as Hungary, conservation programmes were developed through State agencies, but in most countries the initiative was taken by NGOs. Work on the conservation of endangered animal genetic resources started in Britain by a group of committed individuals in a working party in 1968, before being

formalized as a recognized body in 1973. It stimulated the creation of similar organizations in other countries and by the late 1980s the movement had become widespread. There was some flow of information and interchange of ideas between national organizations, but in general they operated in isolation. At an international conference organized by one of the authors (LA) at Warwick University in England in 1989, it was determined to establish a global organization and a Working Committee was created leading to the formation of Rare Breeds International (RBI) in 1991.

Delegates at the conference, representing many national and international organizations and associations, covered a wide spectrum of opinion and cultures, but they agreed that there was a need for a global NGO to facilitate and monitor the conservation of endangered breeds of domestic livestock. It was envisaged that this NGO would coordinate the activities of national and local groups and act as a focus to stimulate conceptual progress and encourage improved methodology. Most of the major national breed conservation organizations, such as Traditional Livestock Foundation (UK), Rare Breeds Survival Trust (UK), SERGA (Spain), American Minor Breeds Conservancy (USA), Pro Specie Rara (Switzerland) and many others, subsequently joined RBI.

The objective of this paper is to give information on the structure, activities and action mechanisms of RBI.

Structure of RBI

RBI is governed by an elected Board of Directors, each of whom must be resident in a different country and are assisted by the Founder Trustees and an Advisory Council. The administrative secretariat is based with European Association of Animal Production (EAAP) in Rome. The cumulative expertise and experience of the directors and members, details of which are held on a database of subject matter specialists, provides a valuable resource for the application of genetic conservation programmes in any part of the world.

The mandate adopted by RBI is to prevent the loss of diversity in animal genetic resources of farm livestock. It fulfils its objectives by providing a framework for the exchange of ideas and experience, by the dissemination of new concepts and programmes and by holding regular international meetings. It augments this work by facilitating and supporting the work of regional, national and local organizations, or working with individuals if necessary. It encourages the formation of conservation groups in countries and areas where no such activity exists and can undertake direct conservation work in such areas.

Information network

The membership network, which RBI has developed to collect and disseminate information, is based on grassroots activity of individuals or groups working with national populations of a breed, or with special groups within a breed. Delegates at major conferences and annual regional meetings are drawn largely from these members and the programmes are designed to facilitate interaction and exchange of information relating to the conservation of AnGR.

Grassroots activity

There are several problems associated with the collection of information on global animal genetic resources, but a particular problem arises where this function is carried out by an individual or an organization that is only in contact with governmental institutions. Information obtained from quasi-governmental sources may be remote from reality and information provided by breed societies has a natural bias. As a result, published statistics have often been derived from misleading data which can lead to flawed policy. Important information on the hierarchical structure or numerical status of a breed, which can be sourced from the

knowledge of indigenous peoples, has been overlooked. In addition, systems of animal husbandry, value-added traits and the marketing of unique products and by-products, which contribute to the meaningful characterization of domestic animal genetic resources, are frequently not considered relevant and have been omitted from the database. The FAO programme on the management of farm animal genetic resources seeks to bridge this gap and it is here that RBI plays an important role.

Local interest groups have access to essential information on local breeds. RBI members at grassroots level are able to carry out data collection and cooperate with national coordinators where an FAO initiative is in operation, or they may obtain information and transmit it to FAO directly. RBI is concerned with all endangered breeds of livestock, but it has a particular interest in native adapted breeds, known variously as landraces, indigenous breeds and autochthonous breeds. However, it recognizes that exotic breeds may be globally endangered in some cases and they must also be monitored.

Global conferences

The activities of RBI fall into a framework of international conferences which are held at intervals of three or four years. These provide a forum for the dissemination of information and for peer scrutiny of conservation programmes. They usually comprise sessions on national or regional reports, breed reports, philosophy and methodology of conservation and the application of new technologies. The first conference in Britain (Warwick, 1989) was followed by major meetings in Hungary (Budapest, 1991), Canada (Kingston, 1994), Nepal (Kathmandu, 1998) and Brazil (Brasilia, 2000).

The Millennium Congress in Brasilia in 2000, which was organized by EMBRAPA of Brazil, the University of Brasilia and RBI, attracted 150 delegates from all continents. A pre-Congress tour to the Pantanal region demonstrated the practical application of programmes for the specially adapted breeds of Pantaneiro cattle and horses and there was a satellite meeting of the Ibero-american group. Topics covered in plenary sessions and poster sessions alerted delegates to the status of native breeds in various countries and regions and on another level described the latest developments in biotechnology. The programme included information on *in situ* conservation through both national and breed reports, genetic and phenotypic characterization, the relevance of biotechnology for conservation, utilization of AnGR and the social and educational implications of rare breeds. There was close interaction with FAO and the official programme included a meeting of national coordinators.

Annual meetings

In the years intervening between major conferences, annual meetings are held in conjunction with another appropriate conference or symposium in order to enable local members to become more involved and to maximize the opportunity for cooperation with other organizations. Meetings have been held in Spain (Cordoba, 1992), Denmark (Aarhus, 1993), Czech Republic (Prague, 1995), South Africa (Pilansberg, 1996), Tanzania (Arusha, 1997) and Austria (Zurich, 1999).

In August 2001 RBI returned to Hungary for its annual meeting, which took place immediately before the annual meeting of EAAP. An associated tour in Hortobagy National Park in eastern Hungary enabled delegates to see conservation programmes for native breeds such as Grey Steppe cattle, Mangalitza pigs and Racka sheep, followed by a symposium in Budapest and a meeting of FAO National Coordinators for Animal Genetic Resources

Projects

RBI identifies and explores issues which have a broad application to the conservation of endangered breeds of livestock. These are

developed where appropriate into a programme of activity from which principles of policy and procedures of application can be derived. It also identifies specific local problems and the opportunity to foster cooperation between members and these offer opportunities for national or regional projects.

Major projects

Two essential projects were initiated early in the life of RBI. The first created a structure for an ongoing census of endangered breeds that had breeding populations in several countries. This had great significance both for seriously endangered breeds, where global population statistics might provide a wider range of conservation options and for breeds where major populations exist outside the country of origin. For example, in the first case, several small populations of Red Poll cattle provide the basis for an international breeding policy, while in the second case a large population of Berkshire pigs in the USA moves the global population of the breed outside the parameters of vulnerability. The second project sought to define agreed criteria of population size of breeds of livestock on which standards of vulnerability could be based.

Papers on both these projects were presented at the international conference in Kingston in 1994 (Alderson, 1995; Bodo, 1995). The breed census is now up-dated by the FAO World Watch List and future efforts will be directed to working with FAO on an accurate consolidated listing of endangered breeds.

Two other major projects are ongoing and are closely related to the pool of expertise represented within RBI. The first seeks to provide guidance on the creation of national NGOs with the intention of increasing the number of countries with an active national programme. The second is concerned with the preparation and refinement of a protocol for genetic impact studies, which will form an essential ingredient of RBI advice to government departments to alert them of the dangers of importation of foreign breeds. This will serve to prevent the erosion of the pool of native livestock as a result of substitution by exotic breeds.

Other projects

On a more local level, activity concentrates more on issues not being addressed directly by other agencies. RBI is approached to provide specialist advice and to facilitate donor funding for selected projects of regional or national importance. Projects currently under consideration include:

- characterization of East African sheep and goat breeds;
- survey of multi-horned (polycerrous) sheep;
- global survey of endangered European multi-national breeds, such as Lipizzaner horses, Red Poll cattle, Ushant sheep and Tamworth pigs;
- collection and collation of knowledge of indigenous peoples to evaluate potentially endangered landraces;
- development of programme for maintenance of biodiversity in native breeds in Nepal;
- status and conservation of Turkoman horses in Iran;
- utilization of native adapted breeds in sustainable systems of livestock production; and
- establishment of an electronic communication network on the conservation of farm animal genetic resources.

Communications

The publication of proceedings of the major international conferences are the most important and permanent record of the work of RBI (Alderson, 1990; Alderson and Bodo, 1992; Crawford *et al*., 1995; Mariante, 2000). They have become acknowledged references in the field of genetic conservation and give the movement recognition in both scientific and political circles.

Papers from annual meetings are carried in other journals. AGRI is an important medium and three papers from the 1999 meeting in Zurich were included in AGRI 27, but RBI papers also appear in many other journals. They serve to strengthen the link between original research and its application in practical breed conservation programmes.

A brochure and a dedicated website both provide information on RBI and serve to encourage membership and support. An exhibition in London in October 2001 of bronze sculptures of endangered breeds was supported by RBI, as a powerful extension of the concept of conservation through promotion.

Cooperation

The effectiveness of much of the work of RBI relies on cooperation and the development of active partnership with other organizations. RBI has created links with FAO, UNEP, IUCN, WWF and WAAP, which ensures that duplication is avoided and productivity is enhanced. Annual meetings have brought RBI into direct cooperation with EAAP, the South African Society for Animal Science and the Tanzanian Society for Animal Production. Participation of RBI in stakeholder meetings of SOW-AnGR and observer status at sessions of the FAO Commission on Genetic Resources for Food and Agriculture, links genetic conservation to sustainable food security and rural development.

RBI is involved with committees and groups of the Convention of Biodiversity (CBD) of the United Nations concerned with the conservation of domestic animal diversity and was represented at the first conference of the Parties in 1994. This has enabled it to take proactive steps to ensure that its policies and programmes are compatible with the broad principles of the CBD.

Conclusions

The cornerstone of current initiatives for the conservation of domestic animal genetic resources on an international level is the Domestic Animal Diversity Information System. This global databank is a valuable aid to the formulation of effective conservation programmes, but its efficacy will depend upon the validity of raw data. RBI will play a major role in facilitating the network of grassroots activity necessary to collect and collate this information. In view of its status as the specialist global NGO for the conservation of farm animal genetic resources, RBI can achieve its objectives through the following actions:

- assistance with the creation of national or local organizations for genetic conservation;
- ongoing communication through leaflets, website, specialist papers, annual meetings and global conferences;
- identification of critical conservation needs and facilitation of assistance for key projects;
- professional advice on *in situ* and *ex situ* conservation;
- maintaining effective communication and working with FAO to realize Domestic Animal Diversity initiatives.

The transfer of administrative responsibilities to EAAP has given RBI further impetus as an effective global NGO and has enabled the directors to focus more clearly on developmental and technical activity.

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Motives for utilizing the Blacksided Trønder and Nordland: A native cattle breed in Norway

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Summary

A survey was conducted in order to investigate what motives farmers have to utilize one of the old, native cattle breeds in Norway, Blacksided Trønder and Nordland Cattle (STN). The questionnaire, which was sent to 1 772 farmers who inseminated with the STN breed from 1987 to 1997, revealed clear opinions on the differences between this breed and the predominant breed of the country, the Norwegian Cattle (NRF).

The farms in the survey were characterized by having herd sizes above the national average, as well as having owners interested in extensive farming and to a certain extent aware of the special breeding challenges of small populations. The results showed that the STN breed was regarded as being significantly different for traits that may be considered as important in extensive production systems. The more idealistic motives linked to the genetic resources aspect showed a high priority.

The survey also revealed an obvious need for more research and objective information about this old native breed.

Résumén

On a mené une enquête pour étudier les raisons pour lesquelles les éleveurs utilisent une des races bovines les plus anciennes en Norvège, la race Blacksided Tronder et Nordland Cattle (STN). Le questionnaire, qui a été envoyé à 1 772 éleveurs qui utilisent l'insémination avec STN depuis 1987 à 1997, a révélé les différences essentielles entre cette race et la race prédominante en Norvège, la NRF.

Les élevages de l'enquête se caractérisaient par la taille des troupeaux qui était dans la moyenne des tailles nationales et par l'intérêt montré par ses éleveurs pour l'élevage extensif et le défi que représente la conduite d'une race spéciale d'une petite population. Les résultats ont montré que la STN était surtout considérée pour les différences significatives qui la rende importante dans des conditions de production extensive. Les raisons d'idéologie liées à l'aspect des ressources génétiques ont également montré une grande priorité.

L'enquête a aussi révélé le besoin essentiel d'une recherche plus approfondie et d'une vulgarisation plus objective au sujet de cette vieille race native.

Keywords*: Cattle, Breeding goals, Alternative breeds, Blacksided Trønder, Nordland Cattle.*

Introduction

For a couple of decades there has been renewed interest in the old native cattle breeds in Norway. Conservation work has been carried out during the last fifteen years and several initiatives have been undertaken to save the remaining animals of six old cattle breeds. Both governmental and private initiatives have been put into conservation and breeding strategies. For all breeds, there has been a remarkable increase in the number of farms, population sizes and the amount of frozen semen collected.

The documented scientific information on the specific traits of these old, native cattle

breeds is at present, very scarce. With the renewed and increasing interest in these breeds and the emerging more extensive farming systems, there is an obvious need for such information and for new research. At the start of this work, it was important to investigate the motives the farmers had for choosing the old, native breeds, which are expected to be smaller framed and lower producing, rather than the predominant modern Norwegian Cattle (the NRF-breed).

The most popular of the old native breeds, Blacksided Trønder Nordland Cattle (STN), was chosen as the research target, both in order to gain new knowledge about an alternative, native old breed, and to improve the possibilities for stronger and more sustainable development of the breed. To obtain answers to why farmers breed and utilize STN, a questionnaire was developed with the purpose of investigating the farmers' expectations and experience with this breed. This paper presents the result of the enquiry which was sent to farmers who inseminated with STN-semen in the period 1987-1997.

Description of the STN Breed

Historical background

In Norway, in the late 1800s, the cattle population was divided into a large number of local breeds, assumed to be superior to "imported" breeds and specific to the region where they were bred. At the World Fair in Oslo 1918, more than 20 breeds of cattle were shown. Each valley, fjord and district had developed their own breed, normally based on uniformity in colour and patterns, etc. Obviously it was impossible to develop an active breeding policy with more than 20 breeds of cattle, even if the total cattle population was 1 050 000 in 1918 (Berge, 1950). During the following decades the number of cattle breeds was reduced through merging of breeds into a synthetic breed, the

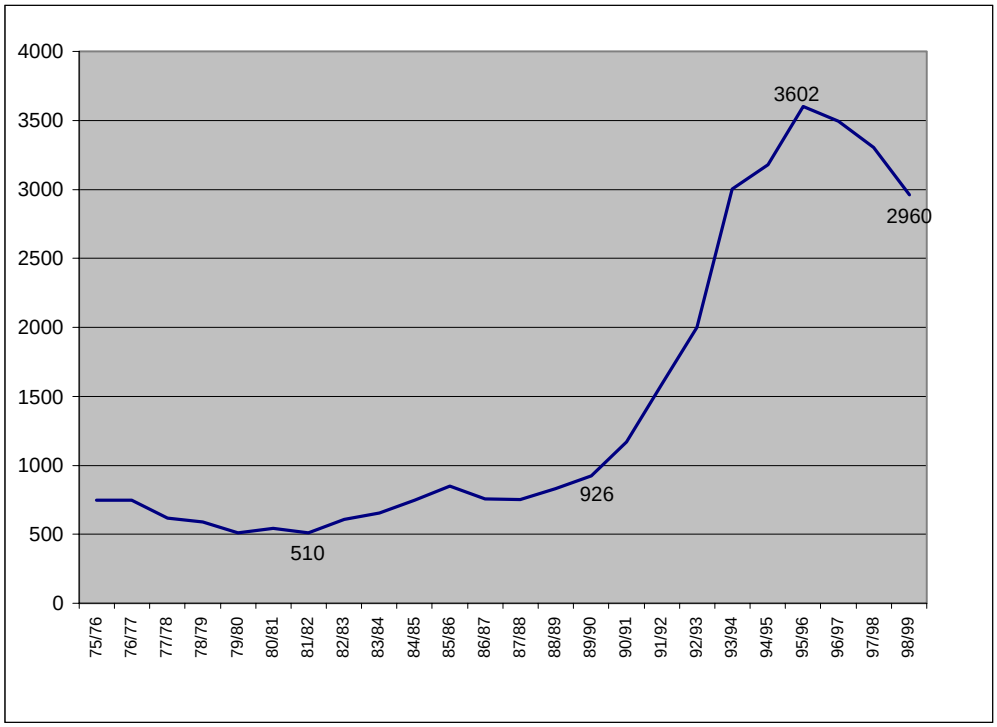

Figure 1. First inseminations with Blacksided Trønder and Nordland Cattle (STN) 1976-1999.

NRF, ending up in 1970 in one dominating breed and a few minor breeds where a few farmers maintained some low numbers of pure-bred animals (Skjervold, 1981). This was the situation when the conservation work started in Norway during the 1980s.

Population size and development

STN is the most popular of the old native cattle breeds in Norway today. The population is estimated to be approximately 1 000 cows and 75 bulls. During the last decade there has been a remarkable increase in insemination with this breed, as seen from figure 1. After many years with a relatively constant number of inseminations, the situation changed around 1990. The number of inseminations peaked in 1996 to 3 602, partly in pure-breeding and partly in cross-breeding with NRF. The total number of first inseminations (excluding beef cattle) in the country was reduced by almost six percent in the same period (1990-1996). Since 1996 there has been a slight decline in the use of semen from the STN breed.

Breed characterization

STN cows are polled, fine boned and colour-sided, mainly black-sided (Figure 2, 5 and 6), however, red-sided animals do occur and they have an estimated milk production of about 4 500 kg / year. The breeding standard (Rasestandard for sidet trønderfe og nordlandsfe, 1997) described the breed as a typical mountain breed, adapted to the conditions of the mountain and valley districts. It is a dual-purpose breed with the main emphasis on milk and with a liveweight between 350 and 500 kg for cows.

Material and Methods

The questionnaire

A questionnaire was developed with the purpose of investigating the motives,

Figure 2. The Blacksided Trønder and Nordland Cattle (STN) cow.

expectations and experiences that farmers have with the breed. The first part of the questionnaire dealt with a description of the participating farms, a recording of pasture and growing season, intensity of production and whether they produced conventionally or organically. The questionnaire also included questions on herd size, number of STN cows versus NRF in the herd, yearly production records and the feeding and grazing system practised. The farmers were grouped into two categories according to their experience with the STN breed; those who had no experience and those who had previous experience with the breed. The answers from the first group will reflect their expectations based on what they have heard about the breed, while the answers from the second group will be based on the farmers' real experience.

Both groups were asked to give their opinion as to the traits in which the breed differed from the predominant breed of the country, NRF, i.e. conformation traits, heat detection, health traits, milk composition, longevity, length of grazing season, pasture damage caused by hooves, net income, extensive grazing, herd behaviour and whether the breed had advantages in organic production systems or for tourist reasons.

The next section of the questionnaire listed possible motives for raising this breed. The options given were of a more idealistic character, i.e. cultural history, a rare breed, an interesting breeding policy, a "different" breed, an important genetic resource; the breeding strategy is challenging the importance of maintaining a dairy breed with smaller framed animals as an alternative to the NRF and other motives.

Finally the farmers were asked about how they procured their STN herd; whether they use natural mating or artificial insemination and what traits they find important when choosing a breeding bull.

Questionnaires were sent to 1 722 farmers, i.e. all the farmers who had inseminated with this breed as recorded in the National Milk Recording System during the last ten years. The intention was to ask those farmers who had used STN-semen during the last five years but by mistake, the selection included up to 10-year-old inseminations. The number of farmers who answered the questionnaire was 441, a response percentage of 26.6. This relatively low response can probably be explained by the long time period of inseminations (up to 10 years since the insemination occurred). Other explanations might be that some of the farmers had inseminated with STN semen without any real planning. Of the 441 answers, 237 of the farmers had no STN experience, while 162 had.

The data were tested for significant differences in opinions between the two groupings of farmers using chi-square tests at a level of one percent.

Results and Discussion

The typical herd in this survey

On average, there were 2.6 STN cows per herd in the survey. Out of an average herd size of 15 cows, the STN cows constituted an average of only 17.5 percent of the herd. The average herd size in Norway in 1997 was 12.9 (Agricultural Statistics, 1997). The group with previous STN experience had on average almost five STN cows while the group with no STN experience had on average 1.3 STN cows. The typical herd of this survey was therefore just above the national average herd size, with both STN and NRF represented.

The average milk yield of the farms with STN experience was 5 549 kg and of those without STN experience 6 061 kg, annually. The annual yield per cow in the country as a whole was 6 222 kg in 1997 (Agricultural Statistics, 1997). The annual milk yield in the experienced group was >10 percent, lower than the national average, while the inexperienced group had a milk yield not significantly different from the national average. This may be explained by two factors; either that the lower producing STN cows are responsible for the lower milk yield in the herds or by the fact that the experienced group had a more established extensive production system which does not

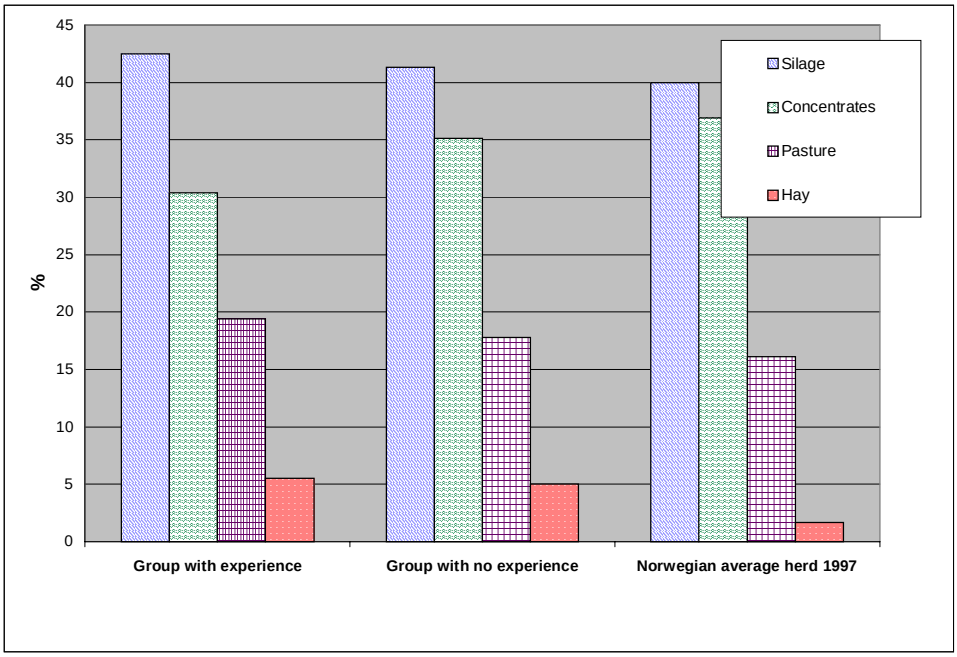

Figure 3. Feed consumption (energy) by type of feed in the survey in Norway 1997.

focus so much on a high milk yield. Most likely the explanation is a combination of these two factors. Both the experienced and the inexperienced group seem to be at a stage where the STN herd was being established. The low STN herd sizes, plus the fact that the experienced group found the culling age a bit lower than they expected, indicate this.

The fat and protein percentage did not differ between these groups of farms and the national average. The average fat and protein percentage in Norway in 1997 was 4.03 and 3.21, respectively (Agricultural Statistics, 1997).

Feed consumption (energy) by type of feed showed a different distribution for the farms in the survey compared to the national average (Agricultural Statistics, 1997). The concentrate percentage is a bit lower for the farms in the survey, while the pasture and silage percentages are higher (Figure 3). Even if there is a tendency in the direction of extensive production, only 13 percent of the farmers considered their production to be organic.

Differences in opinions on STN and NRF

Table 1 shows the results of the questionnaire regarding the different production and performance traits. STN is different from NRF in 13 out of 22 traits listed in the survey. Farmers ranked the STN breed as having lower liveweight, more polled animals and nicer colour patterns. They also ranked the breed as a lower milk producer, but with higher fat and protein content. Among the health traits, they thought the breed has easier heat detection and higher longevity. They also thought the breed fits better into ecological production systems than the NRF breed because, among other reasons, there is less damage to pasture caused by hooves, better grazing behaviour on extensive pasture and more qualities as better leading cows. They also considered the STN cow to be more favourable for tourist purposes.

It was expected that the STN cows would be associated both with extensive production systems and with organic farming. The answers from the survey do not support this

Table 1. Results of the farmers` opinion on traits in which the STN breed differs from the predominant NRF breed and in which direction they differ.

Trait	Does STN differ from NRF ?	How does STN differ?	Does experience influence the answer?
Liveweight	Yes	Lower liveweight	No
Polled / horned	Yes	More polled animals	Yes, experience favours the opinion that STN has more polled animals
Colour pattern	Yes	Nicer colour pattern	Yes, experience favours STN less
Milk production	Yes	Lower milk production	No
Protein content of milk	Yes	Higher protein content	No
Fat content of milk	Yes	Higher fat content	No
Somatic cell count	No	No	
Mastitis frequency	No	No	
Milk fever	No	No	
Ketosis	No	No	
Heat detection	Yes	Easier heat detection	No
Calving ease	No	No	
Culling age	Yes	Higher culling age	Yes, experience favours equality between breeds
Pasture damage caused by hooves	Yes	Less pasture damage	No
Grazing season, extensive pastures	No	No	
Grazing season, intensive pastures	No	No	
Net income	No	No	
Extensive pasture	Yes	Functioning better	No
Extensive production system	No	No	
Ecological production system	Yes	Functioning better	No
Leader cow	Yes	Better leader cows	No
Tourism	yes	better for tourism	No

assumption completely as the tendency is that the farmers with STN cows ran more extensive farming than the national average but only 13 percent said they farmed organically. Later in the questionnaire, the answers indicated another perspective; the STN cow was seen to be better in organic production systems than the NRF cow, but the two breeds are equal in more traditional extensive production systems.

The general opinion seems to be that the STN cow is a smaller, lower producing and more picturesque cow than the NRF and has higher fat and protein contents in the milk. Most of these statements might well be true but the results from the survey also reveal that the herds with STN cows do not have a higher fat and protein content in milk than the national herd average. Even when examining the twelve herds with only STN cows, the survey revealed estimates no different from the national average. It might seem that the general breeding goal of most cattle breeds, higher protein content, is strongly influencing the farmers breeding STN. The bull mother's protein content in milk is clearly the most sought-after trait (chosen by 45 percent of the farmers) when choosing a breeding bull. However, only 8 percent of the same farmers were concerned about the bull mothers' fat content of the milk.

A common argument for using the old native breeds instead of NRF has been that the old breeds have better health, fertility and longevity than the modern NRF, especially heat detection and udder health. According to the farmers in the survey this is not true. The only health traits that seem to favour STN are heat detection and culling age. The old-fashioned long teats of the STN breed, compared to the small and rather short teats of modern breeds, is expected to cause a higher somatic cell count and mastitis frequency in STN under machine milking conditions. This situation might explain why the survey reports the same udder health in STN and NRF. Some farmers have reported better udder health after having changed from standard milking equipment to special equipment adjusted for udders with long teats.

The STN cow seems to score higher on traits important for grazing and especially for grazing on extensive pastures. The lighter liveweight causes less damage by hooves to the grass and the leader cow trait is assumed to be important when utilizing large pastures in typical extensive grazing fields, as in the mountain areas.

Table 2. Use of specific ordered AI-bulls and degree of natural mating in STN.

	All answers in %	The groups' answers in %	
		Experienced group	Inexperienced group
Have ordered specific AI-bulls from the technician	49*	58	38
Natural mating is used with STN, because of;	11*	20	6
– Just as good breeding bulls as an AI-bull	7	10	4
– Minimizing the increasing of inbreeding in the population	3*	7	1
– Not accepting AI in principal	0	0.5	0
– It is cheap to use natural mating	6	9	4
– Other reasons	11*	18	6

*There was a significant difference between the two groups.

Difference in opinions between experienced and inexperienced

Only in three traits does experience significantly influence the answers on how STN differs from NRF. The experienced group favours STN more highly because they are polled, while they think the different colour pattern is of less importance than the experienced group. The inexperienced group has expectations of older culling age of the STN, while the experienced group is not sure that STN is different from NRF. It can be concluded that in most traits the two groups have similar opinions on STN versus NRF.

Breeding strategies in STN

Table 2 contains the answers on farmers' use of natural mating in contrast to AI. The results show that 49 percent of the farmers have ordered specific AI-bulls from the technicians and that the experienced group is significantly more concerned about which AI bull they want to use on their cows.

Table 2 shows that natural mating was practised in 11 percent of the farms in the survey. Among the experienced group 20 percent use natural mating, a result which is significantly higher than the 6 percent in the inexperienced group. "Other reasons" is the most chosen alternative for using natural mating instead of AI and is mainly explained by the statement "It's more trouble-free and safer than using AI." The other important reasons for using natural mating were that bulls for natural mating might have just as good breeding qualities as an AI bull and that natural mating was considered cheaper.

An increased number of males in the breeding programme is a rather important issue in reducing the risk of increased inbreeding in such a small population. Gjerstad (1999) showed that in small populations of old cattle breeds, avoiding inbreeding might be the best criterion for increased milk production. The National Genetic Resource Committee on Farm Animals has sent out several recommendations on using more natural mating in the small native populations.

The results from the survey showing that 20 percent of the experienced farmers and 6 percent of the inexperienced farmers use natural mating, indicate that breeders are quite aware of the importance of using natural mating. Still, within the experienced group there should be potential for using it even more than by the reported 20 percent. Within the inexperienced group it must be considered satisfactory that six percent is

Table 3. Traits of importance when choosing STN breeding bull.

	All answers in %	The groups' answers in %	
		Experienced group	Inexperienced group
The bull mother's protein content of milk	45*	57	36
The bull's relationship to the cow	41*	63	25
The bull mother's annual milk yield	38*	50	29
The bull mother's udder	23*	30	18
The bull's colour pattern	20	29	15
The bull's muscle score	13	14	12
The bull mother's liveweight	11	16	7
The bull's stance	8	9	5
The bull mother's fat content of milk	8	9.5	7.5
The bull mother's colour pattern	8*	12	5
The bull mother's stance	7	7	6

*There was a significant difference between the two groups.

making use of natural mating, bearing in mind that this group on average only had 1.6 STN cows in their herd.

Important traits when breeding STN

Table 3 shows that the three clearly most important traits to consider were protein yield, milk yield and awareness of inbreeding. The next two important traits are the bull mother's udder and the bull's colour pattern. Meat production concerned only 13 percent of the breeders and 11 percent were concerned about the cow's liveweight. The bull mother's colour pattern is significantly more important to the experienced group than to the group without experience, although it is one of the least important traits in the table, as only 8 percent said it was a trait of concern when choosing a breeding bull.

Since the lower liveweight seems to be both an important and a characteristic trait for the breed, it is remarkable that Table 3 shows that the bull mother's liveweight is of so little importance to the farmers when choosing a bull.

Finally, the survey seems to reveal that the STN farmers are aware of the correlation between udder health and udder conformation, since the bull mother's udder is the fourth most important trait the farmers were concerned about when choosing semen from STN.

Motives for breeding STN

The ranking of the more idealistic motives for breeding STN is shown in figure 4 and is based on the answers from all the farmers. "Conserving an alternative dairy breed" scored highest. Several other motives are linked to the genetic resources aspect. Within the category "other motives", the farmers were focused on "a nice, small cow with good temperament, easy to handle".

It was concluded that the farmers who have chosen the STN breed were aware of the breed's lower production, however, they chose this breed from both idealistic motives and from a belief in biological efficiency; i.e. other traits than milk production also influence the total economic situation of the farm.

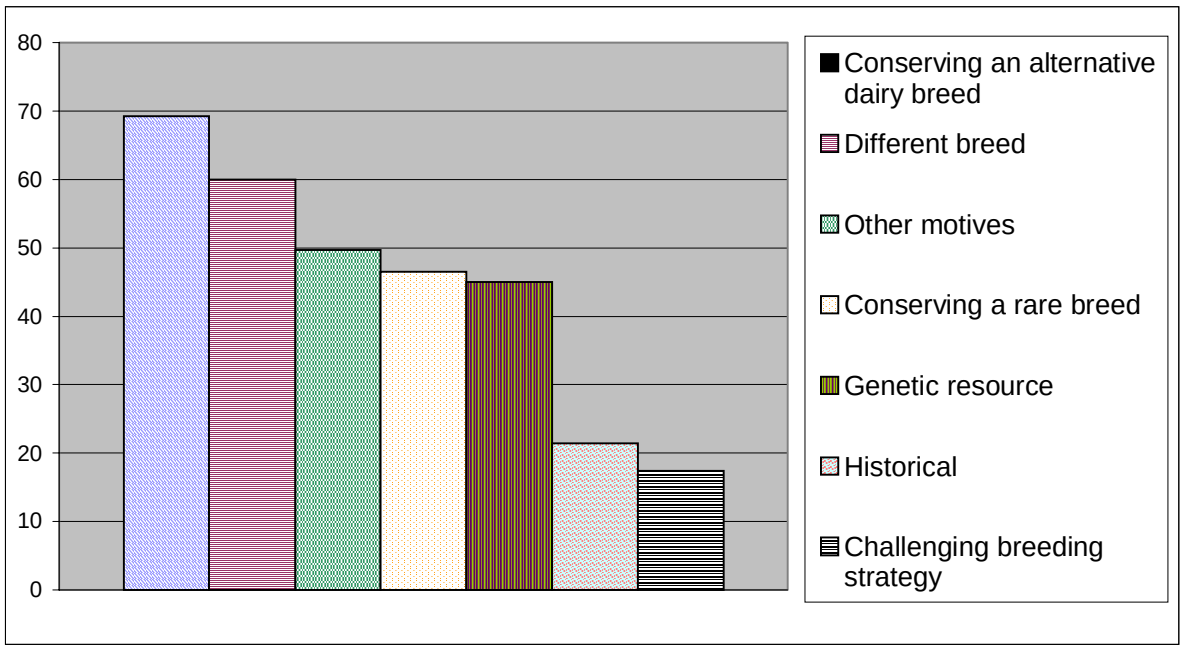

Figure 4. Motives for breeding STN.

Concluding Remarks

An investigation of the type presented in this study raises several questions. What is the value of "opinions" on a breed when it should be possible to produce more objective information on production and other traits? Firstly, the questionnaire gives indications to several of the motives farmers have for choosing a lower producing, smaller framed type of milking cow. It is obvious from the answers that a substantial proportion of farmers are aware of the need for maintaining domestic animal diversity. As stated by several authors (Vangen and Mukherjee, 1994; Olesen *et al*., 1998) there is a need for the development of alternative breeding goals and sustainable breeding programmes in several of the smaller populations of farm animals. In order to develop such breeding goals, it is necessary to know the opinions and interests of the breeders. Only with the interest of and enthusiasm by the breeders will these alternative breeds survive in the future. Secondly, several programmes have been developed in the Nordic countries to conserve domestic animal diversity (Vangen *et al*., 1994; Danell *et al*., 1998). The next step in the conservation programmes will be to stimulate the development of active breeding populations for some of these breeds. Objective information and scientific help with breeding objectives and breeding strategies are important factors in this next step.

The results of the questionnaire convey the message that farmers believe in traits not focused on in modern breeding programmes, even in other traits than the traditional secondary or functional traits. Especially in

Figure 5. A herd of Blacksided Trønder and Nordland Cattle (STN) grazing in the birch forest of the mountain areas of Southern Norway. The variety in colour patterns is quite characteristic for the breed (Photo by Halvard Blegen).

Figure 6. A herd of Blacksided Trønder and Nordland Cattle (STN) grazing outside the summer farm in the high mountain areas of Southern Norway (Photo by Kjell Wickstrøm).

extensive, less industrialized farming, these traits play an important role. Several farmers are of the opinion that these traits do not receive the attention they deserve in modern breeding programmes.

Finally, several of the farmers point to the positive aspects of smaller framed animals for biological efficiency reasons. They expect a net income on the same level as the intensive dairy breed when all traits are included in the economic evaluation. Obviously the answers given are influenced by production regulatory factors like milk quotas and subsidies per head of cattle. Under such production assumptions, a lower producing animal could have some advantages. However, the results of the questionnaire indicate an increasing interest in biological efficiency rather than in breeding only for production records.

The survey revealed an obvious need for more research and objective information about this old native breed. Therefore, a research programme was launched on the STN. Studies of biological efficiency in relation to specific production environments would be an important consideration.

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The Muturu: A rare sacred breed of cattle in Nigeria

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Summary

The Muturu, a trypanotolerant cattle breed is probably one of the least known breed of cattle in West Africa. Little has been published on its distribution, management, morphological characteristics or biological performance.

Early reports showed that the Muturu cattle were once widely distributed across the continent from Liberia, across the West African subregion, to Ethiopia. However, due to expansion of the Zebu population and rapid urbanization, the small bodied animal came under pressure and was found surviving in pockets of the savannahs and in the humid forest zones where it had the comparative advantage of trypanotolerance. The survival of the cattle in the humid and forest zones of Nigeria stems from the fact that the animal is still sacred in so many communities and its milk is widely used for medicinal purposes. In some states of Nigeria, the semi-feral Muturu are not tended but hunted when required for sacrifice.

From a population size of 0.4 million heads in 1960, Akinwunmi and Ikpi, (1985) reported a decline in the population of the breed to 50-80 thousand in the late 1980s in Nigeria although RIMS (1992), reported a population growth to 115 172 heads. With limited data bank information on their adaptation and productivity, possible identification of genes that confer resistance to or tolerance of environmental stress in these animals will be of global significance.

Resumen

La raza Muturu, raza bovina tripanotolerante, es probablemente una de las menos conocidas del Africa oriental. Se ha publicado muy poco sobre su distribución, gestión, características morfológicas o rendimientos biológicos.

Unos primeros informes mostraban que la raza Muturu antiguamente se hallaba a lo largo de todo el continente, desde Liberia, pasando por las regiones del Africa oriental, hasta Etiopia. Sin embargo, debido a la expansión de la población de Zebu y a la rápida urbanización, los animales de pequeño tamaño se encontraron bajo presión y hallaron la supervivencia sólo en pocas zonas de savana y en los bosques húmedos, donde se encontraba la ventaja comparativa de la tripanotolerancia. La supervivencia de bovinos en zonas húmedas y de bosques de Nigeria se debe a que este animal es considerado sagrado en muchas comunidades y su leche se utiliza mucho en prácticas medicinales. En algunos estados de Nigeria los animales Muturu sólo se cazan cuando se requiere un sacrificio.

Partiendo de una población de 0,4 millones de animales en 1960 (Akinwunmi y Ikpi, 1985), se ha llegado a una población de 50-80 mil animales en Nigeria a finales de los años 80, a pesar de que RIMS (1992) indicaba una población de 115 172 animales. Dada la limitada información sobre su adaptación y productividad, resultaría de gran importancia la identificación de los genes que confieren resistencia o tolerancia a las condiciones de estrés ambiental en estos animales.

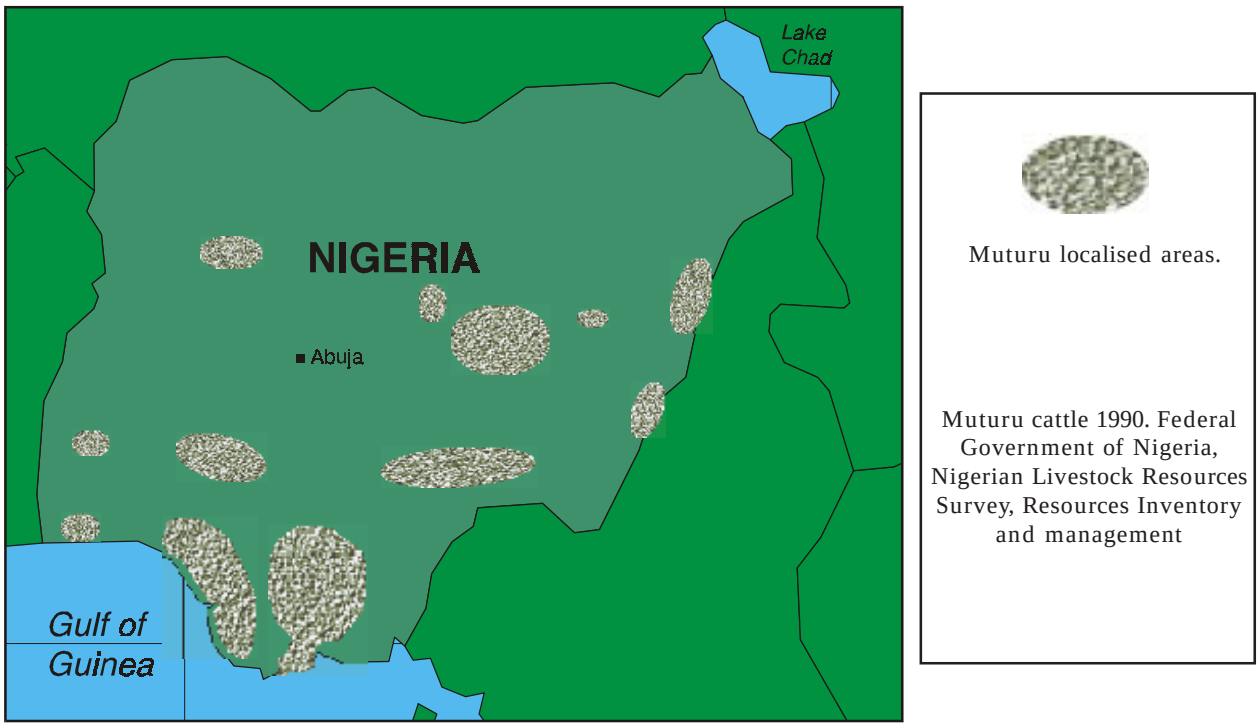

Figure 1. Nigeria's short horn cattle breed - the Muturu distribution (Rim, 1992)

Keywords: *Muturu, Origin and distribution, Trypanotolerant breeds, Characterisation. Productivity.*

Introduction

Nigeria's cattle population

The Federal Office of Statistics gave fluctuating cattle data of 3.45-7.49 million between 1960 and 1986, while FAO gave figures of 10.86-12.30 between 1963 and 1989 with a population growth of 0.6 percent per annum between 1975 and 1987. A recent livestock survey (RIM, 1992) gave a cattle population of 13.89 million out of which 115 172 were Muturu (Table 1) constituing 64 percent of the total trypanotolerant cattle population in the tsetse infested forest zone of Southern Nigeria (Table 2), compared to Akinwumi and Ikpi's 55.7 percent in 1985.

Table 1. 1990 National Cattle Population (Resource Inventory Management Ltd. 1992).

Species	Pastoral	Village	Urban	Total	% SE
All cattle	11 478 145	2 358 078	49 590	13 885 813	1.6
Muturu	-	114 241	931	115 172	19.5
Zebu and others	11 473 800	2 248 182	48 659	13 770 641	1.6

Origin and distribution of Muturu breed

Epstein (1971) reported that the most common type of cattle in Northern Nigeria until the Fulani invasion of 1820 was the West African Shorthorn (WAS). The original breeding area of the WAS stretches on an almost continuous belt from Liberia to Cameroon. They were found in all the coastal countries and also in the Southern part of Upper Volta (Burkina Faso). They derive from the shorthorn humpless (*Brachyceros*) cattle which appeared in ancient Egypt in the middle of the second millennium BC and were first recorded in West Africa during the second half of the first millennium.

Trypanotolerant cattle breeds

The trypanotolerant cattle breeds in Nigeria comprise the N'Dama, Muturu and the Keteku. The Keteku happens to be a cross between Zebu and the Muturu. These three breeds were reported to make up 21.93 percent of the total cattle population of the southern humid/forest zones of Nigeria. Out of this total, the Muturu comprise 55.7 percent, the N'Dama 36.9 percent and the Keteku 7.4 percent (Akinwunmi and Ikpi, 1985).

The Muturu population was 8.3 percent of the total cattle population of Nigeria (RIM, 1992). The total trypanotolerant cattle population which stood at only

Figure 2. Herded Muturu in villages.

Table 2. The Muturu as percent of Trypanotolerant cattle per state (Akinwunmi & Ikpi, 1985).

State	No of heads	% of total trypanotolerant / State
Ogun	536	8.1
Ondo	3 660	56.4
Oyo	8 447	35.1
Lagos	1 217	30.8
Bendel	1 547	75.8
Anambra	11 310	92.4
Imo	7 412	96.1
Rivers	329	84.7
Cross River	2 575	96.9

Figure 3. Mature Muturu compared to mature Bumahi (white).

200 000 declined almost by a third in the 1980s. However, the N'Dama population increased from 15 to 20 thousand heads as opposed to other breeds through a special programme implemented with N'Dama cattle breeds in the 1980s. Five thousand heads of N'Dama were imported from Liberia (Shaw and Hoste, 1987) with the result that six N'Dama cattle multiplication centres currently exist in Southern Nigeria to provide information on the N'Dama and Keteku at the expense of the indigenous Muturu (Table 3).

The Muturu Breed

The Muturu breed; a variety of the West African shorthorn is also known as the Nigerian Shorthorn, the Pagan cattle, the Savanna Muturu in the South-West and Forest Muturu in the Middle Belt and Eastern parts of the country (Figure 1).

Its relatives, the Liberian Dwarf found in Liberia and the Bakwiri found at the foot of Mount Cameroon in South West Cameroon, were classified as almost extinct (Mason, 1988). The Muturus are reared for sacrifice at major ceremonies such that ritual restrictions surround their management. As males are slaughtered for ceremonies there is an acute shortage of breeding males. This prevented the Muturus from realizing their breeding potential even under traditional management. One of the assumptions behind the importation of N'Dama is that Zebu cattle cannot sustain comparable productivity as the Muturu in similar conditions and the N'Damas are closer to Muturus than the Zebu breed.

During the Nigerian civil war, 1967-1970, it was recorded that many Muturu cattle were slaughtered to feed the starving human population. They were thus decimated both during and immediately after the civil war. Where some herds survived, owners were known to have preserved their animals by hiding them in caves. From these the Muturus were once again multiplied in Imo and Akwa Ibom States where the Zebu cattle were rejected as hazardous. Muturu populations compared to those of Keteku in some states are shown in Table 4 (Oloruntobi, 1994).

Table 3. Trypanotolerant cattle multiplication herds (after Shaw, 1985).

Name	Location	Responsible organisation	Size (ha)	Breeds	Number
Upper Ogun Ranch	Oyo State	Western Livestock Company	10 522	N'Dama	2 258
Fashola Stock Farm	Oyo State	Ministry of Agriculture	550	N'Dama and Keteku	620
Ogboro Cattle Ranch	Oyo State	Western Livestock Company	1 864	N'Dama	1 646
Akunnu Cattle Ranch	Ondo State	Western Livestock Company	8 094	N'Dama	1 652
Oke Ako Ranch	Ondo State	Western Livestock Company	10 025	N'Dama and Keteku	455
Imeko Ranch	Ogun State	Western Livestock Company	4 000	N'Dama	200

Table 5. N'Dama, Muturu and Zebu production traits.

Trait		Muturu	N'Dama x Zebu	Zebu
Age at 1st calving (days)		635	684	761
Calving interval (days)		350	363	403
Weight at birth.	Males (kg)	13.7	18.1	26.5
	Females (kg)	13.9	15.9	22.7
Weight at 3 months.	Males (kg)	38.9	54.6	78.0
	Females (kg)	37.5	54.3	77.5
Weight at 6 months.	Males (kg)	71.5	-	130.4
	Females (kg)	61.5	92.1	28.6
Weight at 9 months.	Males (kg)	98.1	119.3	178.2
	Female (kg)	82.1	112.4	165.0
Weight at 12 months.	Males (kg)	108.1	137.4	206.7
	Females (kg)	93.5	124.6	193.2
Cow weight 1-2 years (kg)		109	181	242
3-4 years (kg)		167	252	323
5-6 years (kg)		204	275	374

Table 6. Productivity index for Keteku and Muturu under various environments.

	Muturu		
	Village (tsetse)	Station (tsetse free)	Keteku
Cow viability %	95	95	97.8
Calving rate	57	92.4	65
Calf viability to 1 year	85	90	95.8
Calf weight (kg / year)	80	91.5	140
Productivity index per cow pear year (kg)	36.8	72.3	87.2
Cow weight (kg)	150	177	295
Productivity index per 100 kg cow maintained per year (kg)	24.5	40.8	29.6

The Muturus have an important place in traditional culture and this affects their management and marketing. There is a strong spiritual attachment to the animals. To harm a Muturu was considered sacrilegious and would pressage ill for the perpetrator. They must not be roasted whole or in large pieces despite their small carcass yield as this is believed to be a humiliating experience for the spirit of the sacred animal. A farmer who does this angers the gods and may lose all his cattle unless he appeases appropriate deities.

Muturus have special protection and can wander freely in the fields and destroy crops with impunity. Even Christians tend to observe these restrictions in that Muturus are regarded as untouchable animals.

Figure 4. Coloured variants among Muturu breed.

Productivity

The Muturu traits have been evaluated in a communal management system in some states (Table 4). This system has been largely responsible for the conservation of the Muturu (Robert and Cray, 1973). Under the system, cattle belonging to various owners in a village are herded together. The system was developed to minimize damage to crops by these cattle and prevent conflict between farmers and cattle owners. Whilst the calving rate in this village system is 57 percent, it was as high as 92 percent when tsetse was controlled in the station environment (Table 5). Compared to the Zebu or the Zebu cross, the Muturu calved earlier, 635 days compared to 761 and 684 days of Zebu and Zebu cross, had calving intervals of 350 days compared to 403 and 363 of the others, respectively, though the cows' weight was much lower at maturity (three-four years), 167 kg compared to 323 and 252 kg of the Zebu and the N'Dama x Zebu Cross.

Anatomical differences between male and female Muturu were similarly reported in various field station conditions (Olutogun, 1976, Akinwunmi and Ikpi, 1985). The Muturu cattle are reportedly very fertile with a capacity to produce one viable calf per annum (Oyenuga 1967; ILCA 1979a; Adeniji, 1985). They mature earlier than the Zebu in the region and the intervals between consecutive calvings were shorter. Under improved management it was reported to be between 10-15 months and 18-24 months under the traditional village system.

Table 7. Body measurements of Muturu 4 years old bulls.

	Muturu [a]	N'Dama[b]
Height at wither (cm)	86.43 – 112.63	93 – 120
Heart girth (cm)	103.79 – 118.73	109-162
Rear Flank girth (cm)	106.79 – 120.51	-
Circumference of pouch (cm)	125.55 – 135.62	-
Circumference of canon (cm)	10.53 – 10.85	-
Circumference of neck (cm)	51.91 – 53.90	51 – 54
Circumference of hind legs (cm)	38.05 – 45.55	35 – 43
Body length (cm)	111.76 - 161.56	128 – 172

Source: [a] Oloruntobi, 1994;
[b] Sokefun, 1994.

Milk Production

The Muturus are rarely milked because their milk production is hardly sufficient for their calves. Milking by the Koma people of Gongola State was done for medicinal purposes. However, lactation milk yields of 127-421 kg for lactation length of 120-216 days were reported (Olaloku, 1976; Fricke 1979).

Productivity Index

Productivity indices of the Muturu in different production environments characterized by light and zero tsetse challenge are shown in Table 6. The animals under a tsetse free environment were found to perform better than those in a tsetse infested environment even under improved management. The productivity index varied from 36.8-72.3 under the two systems.

Characterization

Morphometric characterization of the Muturu breed revealed colour shades of ebony black, fawn, black and white, black with white patches, white with brown or black spots of varying frequencies ranging from 39-90 percent, 62 percent of the population studied were predominantly black, which corresponds to ecological adaptation of the animal in the south of the country where it is highly distributed (Oloruntobi, 1994); the lighter shades occurring more among the Northern varieties.

Body measurements as reported by some authors are presented in Table 7. When compared to that of N'Dama, the height at wither ranged from 86-113 cm compared to 93-120 cm of the N'Dama whilst the body length varied from 112–161.6 cm compared to 128-172 cm of the N'Dama, hence, Sokefun (1994), Fall, *et. al*. (1992) showed Muturu as a small bodied compact animal with fine-boned limbs.

Conclusion

The Muturu cattle is the only native shorthorn cattle in Nigeria, the N'Dama having been imported to upgrade Nigerian Zebu for beef production and confirment of trypanotolerance on the trypanosusceptible breed.

Available reports have pointed to the fact that the Muturu is a highly endangered breed as a result of:

1. Civil strife in Nigeria.
2. Reduction in the habitat of tsetse fly through increase cropping hence they are being replaced by the bigger bodied Zebu even in areas where they are considered as sacred.
3. Extensive crossing with the Zebu in tsetse fly areas resulting in its genetic dilution.
4. Urbanization.

Hence survival has been restricted to pockets of savannah and the humid forest zone. With a decline in tradition and destruction of shrines as urbanization continues and the current spread of Christianity, many of the Muturu population will be further drastically reduced if nothing is urgently done about its conservation.

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Jamaica Hope: The dairy breed for the tropics

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Summary

Experimentation in breeding dairy cattle for the tropics began in Jamaica at Hope Farm in 1910 with local cattle, temperate dairy breeds and the infusion of the Sahiwal (Zebu) breed.

The research results, which also influenced farmers' operations, indicated the superiority of the grade Jersey for production and fertility, which was considered to be the result of adaptation. Thereafter, breeding inter se, a tropical dairy breed, the Jamaica Hope was established and was declared in 1952. The formation of the Jamaica Hope Cattle Breeders' Society immediately followed.

The breed has shown a high level of productivity under wide ranging husbandry conditions. The highest yields have been above 8 800 litres of milk in 305 days.

The MOET technique of reproduction will be employed in the expansion of the breed.

Resumen

La experimentación en mejora de bovinos de leche en la zona tropical comenzó en Jamaica en la Hope Farm en 1910 con una raza local, razas de leche de zonas templadas y con la raza Sahiwal (Zebu).

Los resultados de las investigaciones mostraron la superioridad de la raza Grade Jersey para la producción y la fertilidad; que se pensó era el resultado de una buena adaptación. Más adelante, con los cruzamientos *inter se*, se llegó a una raza lechera de zona tropical, la Jamaica Hope, que fue reconocida y declarada como tal en 1952.

A esto siguió el establecimiento de la Asociación de Ganaderos de la Raza Bovina Jamaica Hope.

La raza ha mostrado un alto nivel de productividad en condiciones intensivas. Los mayores rendimientos han sido de aproximadamente 8 000 litros de leche en 305 días.

La técnica MOET de reproducción será empleada para la expansión de esta raza.

Keywords*: Jamaica Hope, Tropical Dairy Breed, Production, Fertility, Adaptation.*

Origin

Cattle were introduced to Jamaica from the time of the Spanish occupation in 1494 to produce hides for leather manufacture with beef production being merely of secondary importance. This was followed by introductions by the British after 1655.

The growth of the sugar industry in the eighteenth century increased cattle rearing for the production of animals to work on the sugar estates. At the same time cattle from among the various breeds, both dairy and beef, which were then developed in the United Kingdom, were brought into Jamaica. The animals of Spanish and British origin were inter-bred in an attempt to increase productivity. The continued importations included Zebu or Indian cattle for their proven capacity as draft animals as well as their known resistance to tick borne diseases.

Dairying started on a limited scale and by the beginning of the twentieth century there was demand for supplies of fresh milk. This gave rise to a number of farms with animals from a mixture of breeds.

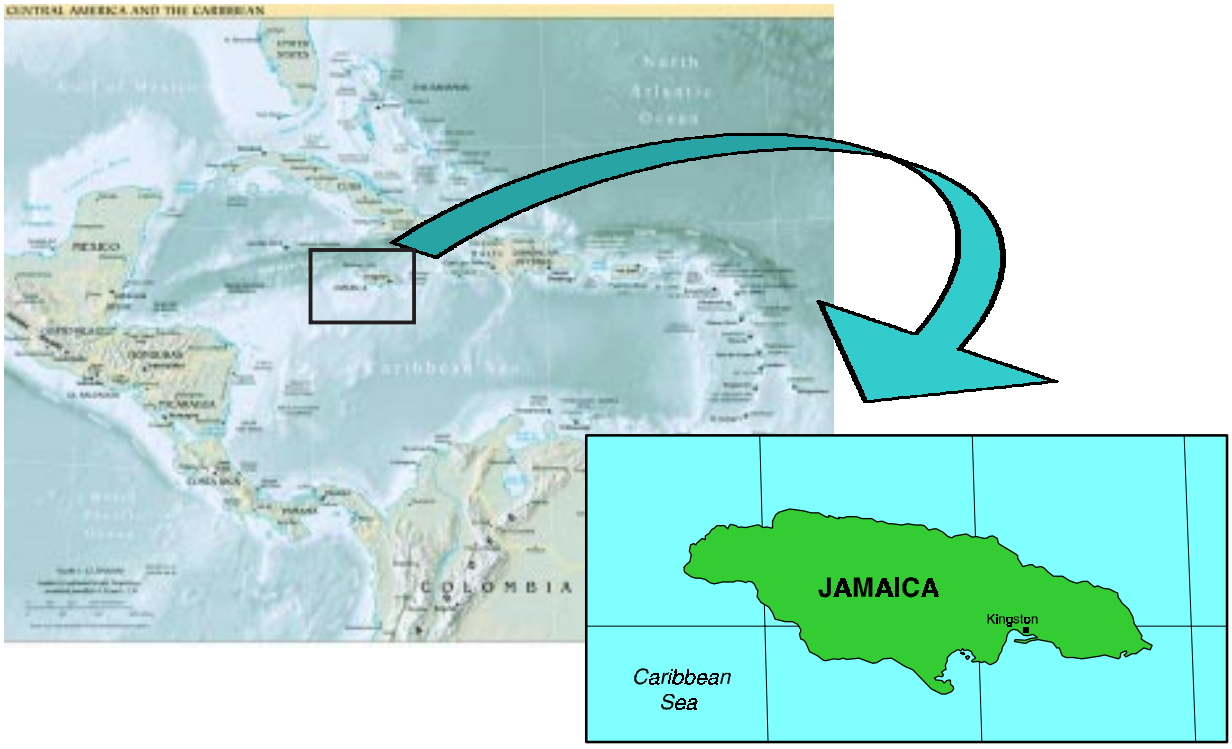

Figure 1. Jamaica in the geographic map.

Experimental work in the breeding of dairy cattle for the tropics began in Jamaica at the Government Hope Farm in 1910 when the need was recognized for a dairy breed capable of coping with the heat, humidity, diseases and low quality forages of the tropics.

A nucleus of local dairy cows purchased from farms and importations made up of dairy cattle from the Jersey, Guernsey, Ayrshire, Holstein, Brown Swiss and Red Poll breeds, as well as of two bulls of the Sahiwal breed from India, formed the basis for experimentation.

The Sahiwal has contributed hardiness, that is an ability to tolerate heat, low quality forage, parasite burdens, as well as strengthening feet and legs. The Jersey emerged the most heat tolerant of the Bos Taurus breeds and has enhanced fertility and udder characteristics, while at the same time ensuring a suitable body size for the tropics.

From the early experimental work Cousins (1933) indicated the possibility of developing a tropical dairy breed.

Jamaica, north of the equator in the Caribbean area, in the region of the 18th parallel, is in the tropics (Figure 1). Mountain ridges are mainly from east to west and grasslands are at different altitudes in hilly areas as well as on flat lands. Temperatures are moderated by the influences of day and night winds.

The average maximum temperature at Hope, the location of the start of dairy cattle research, was 24°C. Bodles, the new Research Station, slightly above sea level, to which the research herd was transferred in 1950–1951 to intensify development, has an average maximum temperature of 31.5°C.

Developmental Results

The experimental work, sustained within the Agricultural Station and influencing farmers island-wide, mainly by the provision of sires, resulted in the dominance of the grade Jersey as the most productive. On this observation

Table 1. Main characteristics of the Jamaica Hope.

Body size mature animals	630-730 kg for male and 385-455 kg for female
Appearance	Angular from fore to hindquarters showing a wedge-shaped form. Good width between forelegs; good barrel carrying through to hindquarters
Skin	Smooth appearance, not loose or coarse
Head in male	Masculine appearance, face, wide between eyes and moderately dished; medium-length, broad muzzle and wide nostrils
Head in female	Moderately dished, medium-length
Body in male	Neck, strong, with crest blending into shoulders, long body, with rump, slightly sloping, of good width and good length from hip to pins
Testicles	Evenly sized well-balanced and hanging at medium-length
Body in female	Neck, blending smoothly with withers, body firm and deep with well sprung ribs showing good barrel
Udder	Level floor, quarters evenly balanced and defined: teats well apart squarely placed; rear attachment high and with good width; fore attachment carried forward and well attached
Colour	Fawn, varying from light to dark fawn, solid colour predominates
Pigment	Dark (black) Nose – black Hooves – black Switch – dark
Other characteristics	• 12-months calving interval • Low maintenance requirements • High milk production • Tolerance to external parasites • Good milk let-down without calf • Easy calving • At foot • Strong feet and legs • High butter fat production • Calm dairy temperament • Good foraging ability

Lecky (1949) indicated and ceased further use of Jersey bulls on the grade Jersey as further use of the Jersey would lower adaptation.

A critical evaluation in 1950-51 of the data collected from the sustained research with the Hope herd revealed that to develop a new breed the greatest possibility was with the selection within the grade Jersey (Lecky, 1951).

The Jamaica Hope breed

The Jamaica Hope was declared a breed in 1952 with the Government's grade Jersey herd given pure-bred status. The genetic make-up is estimated to be 80 percent Jersey, 15 percent Sahiwal and five percent Holstein. The Jamaica Hope Cattle Breeders' Society was also founded in that year and involved farmers with grade Jersey Herds.

Breed Characteristics

Main characteristics of the breed are summarised in table 1.

Breed development

Breed development is controlled by the Jamaica Hope Cattle Breeders' Society. The Society operates an open Herd Book Policy whereby approved females are up-graded through three generations by the use of registered Jamaica Hope bulls.

Visual appraisals to ensure conformity with breed standards are carried out with females after calving and with bulls up to four years old. Strong emphasis is placed on udder characteristic, feet and legs.

Selection is against beef conformation and heavy fat deposition.

The Ministry of Agriculture continues research with the nucleus herd at Bodles Research Station, Old Harbour and operates the National Recording Programme enabling testing. Development programmes such as the Multiple Ovulation Embryo Transfer (MOET) are envisaged for the future.

The breed is productive, fertile, heat tolerant and has excellent dairy characteristics. This tropically adapted breed, resistant to tick borne diseases, Anaplasmosis and Piroplasmosis is fully established on several private- and Government-owned farms operating in the tropics.

Farmers' herds integrate the development of the breed thus enabling the use of bulls from their herds. **T**he second lactation pure-bred Jamaica Hope cow at Bodles, is sired by a bull introduced into the Bodles her (Figure 2).

Figure 2. Second lactation purebred jamaica Hope at Bodies Agricultural Research Station, Jamaica. First lactation production 3 700 litres in 305 days.

Figure 3. Jamaica Hope bull, named Bodles Brucome, age four (4) years, which is on national use through the Bodles Artificial Insemination Centre

Management of herds is through progressive husbandry from calf rearing onwards. Calf rearing is by different methods.

The Jamaica Hope development through the sire genealogy path across all sire lines, since declaration of the breed, ranges from seven to ten generations. Figure 3 is the Jamaica Hope bull, named Bodles Brucome, age four (4) years, which is on national use through the Bodles Artificial Insemination Centre.

Breed performance

Jamaica Hope cattle are used successfully over a wide spectrum of conditions ranging from subsistence farming to large commercial enterprises.

On low-input farming systems the Jamaica Hope is successful. Cows are milked once per day. Forage is often cut and carried with little supplementary feeding.

On the large dairy enterprises, cows are milked in the herds of several hundreds at stocking rates of five cows per hectare, to produce over 17 000 litres of milk per hectare with supplementary feed at 0.4 kg per litre of milk. Several herds have averages of over 4 800 litres per lactation while individual cows have produced over 8 800 litres of milk in 305 days, milking twice a day.

Longevity and reproductive performance are good even under intensive commercial systems. The average number of lactation is over five with calving intervals of less than 13 months.

Health status

Jamaica is free of rabies and foot-and-mouth disease. All herds are tested regularly for tuberculosis (TB) and brucellosis. The island's strict quarantine regulations ensure this status is maintained.

Population

The number of animals in the national herd is estimated at 20 000.

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Performance evaluation, conservation and improvement of Sahiwal cattle in India

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Summary

The Sahiwal cattle, one of the best dairy breeds of Zebu cattle in India and Pakistan, originate from the Montgomery district of Pakistan and is distributed on farmer herds in certain pockets of the bordering districts of Punjab and Rajsthan in India. The animals of this breed are also available in Kenya and are used for crossing with local East African Zebu types to improve milk production. Sahiwal cattle have deep body, loose skin, short legs, stumpy horns and a broad head with pale red to dark brown body colour. The average body weight in adult females and males is around 350 and 500 kg, respectively. The animals of this breed are maintained on various State and Central Government farms, privately owned farms, charitable trusts and a small proportion of animals are also available with the farmers. More than 1 200 breedable females are available at various farms in the country. The average lactation milk yield of Sahiwal cattle on organized farms ranges between 1 500 to 2 500 kg. However, in well-managed herds, the highest lactation milk production in certain cows is more than 4 500 kg. The overall weighted average milk yield, age at first calving, lactation length and calving interval based on the performance at various herds is around 1 900 kg, 36 months, 315 days and 420 days, respectively. The fat and Solid Non Fat (SNF) percent ranges from 4.6 to 5.2 percent and 8.9 to 9.3 percent, respectively. Quite a large proportion of pure-bred Sahiwal cattle maintained on organized breeding farms has been used for the production of cross-bred cattle. As a result, different cross-bred strains of dairy cattle *viz* Karan Swiss, Karan Fries and Frieswal have evolved at the National Dairy Research Institute, Karnal and Military Dairy Farms. The breed has also been utilized for the production of synthetic strains like Jamaica Hope (JH), Australian Milking Zebu (AMZ) and Australian Friesian Sahiwal (AFS) in other countries. Currently, efforts are being made to characterize, evaluate and conserve the breed in field conditions. More than 0.10 million doses of frozen semen of this breed are cryopreserved at various semen banks in the country. The frozen semen is being utilized for strengthening and genetically improving the existing herds of the breed through progeny testing programmes of sires associating various herds of Sahiwal in the country.

Resumen

La Sahiwal es una de las mejores razas zebú de leche en la India y Pakistan, originarias del distrito de Montgomery en Pakistan, se encuentran distribuidas por rebaños pequeños en algunas zonas limitadas de los distritos fronterizos de Punjab y Rajsthan en la India. Estos animales se encuentran también en Kenya y vienen utilizados para cruces con tipos locales de zebú del Africa del Este, con el fin de mejorar la producción de leche. La raza Sahiwal posee un cuerpo fuerte, poco pelo, patas cortas, cuernos cortos y una cabeza ancha y el color va del rojo claro al marrón oscuro. El peso medio corporal de las hembras y los machos adultos es de 350 y 500 kg, respectivamente. Los animales pertenecientes a esta raza se crian en centros

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estatales o regionales, en ganaderías privadas, centros de apoyo voluntario y también una pequeña cantidad de ellos se puede encontrar en pequeñas granjas privadas. Hay a disposición más de 1 200 hembras para cruces. La media del rendimiento por lactación de la raza Sahiwal en granjas organizadas es de 1 500 a 2 500 kg. Sin embargo, en rebaños muy bien conducidos, se alcanza con algunas hembras una producción lechera de más de 4 500 kg. Basándonos en los rendimientos de varios rebaños se puede decir que la media total de rendimiento por lactación es de 1 900 kg, la edad al primer parto de 36 meses, la duración de la lactación es de 315 días y el intervalo entre partos de 420 días. El porcentaje de grasa y SNF va de 4,6 a 5,2 y de 8,9 a 9,3, respectivamente. Una amplia proporción de pura raza Sahiwal conservada en granjas organizadas ha sido utilizada para producción de cruces. Como resultado de todo ello, distintas líneas de cruces especializadas en producción lechera, tales como Karan Swiss, Karan Fries y Frieswal, han sido mantenidas en el Instituto Nacional de Investigación Lechera, en Karnal y en Granjas Lecheras Militares. La raza ha sido también utilizada en otros países para la producción de líneas sintéticas tales como Jamaica Hope (JH), Austalian Milking Zebu (AMZ) y Australian Friesian Sahiwal (AFS). Recientemente, se han llevado a cabo esfuerzos para caracterizar, evaluar y conservar la raza en condiciones de campo. Más de 0,10 millones de dosis de semen congelado de esta raza han sido crioreservados en distintos bancos de semen en el país. El semen congelado se utilizará para reforzar y genéticamente mejorar los rebaños existentes a través de programas de test de progenie de machos de raza Sahiwal en distintos rebaños del país.

Key words*: Conservation, Sahiwal, Genetic gain, Breed improvement, Evaluation.*

Introduction

Sahiwal, one of the best dairy cattle breeds of India and Pakistan, originated from the Montgomery district of Pakistan. In India, the animals of the breed with good production potential are available at some of the organized farms in North, North-Western and Central India. In field conditions, animals of this breed are available in certain pockets of the bordering districts of Punjab and Rajasthan. The number of Sahiwal animals in Punjab has declined drastically due to cross-breeding of these animals with exotic breeds to enhance milk production. Though cross-breeding of Zebu cattle with exotic temperate dairy breeds has enhanced milk production, it is not presently feasible to introduce this system on a large scale due to several reasons like less heat tolerance capacity, more susceptibility to tropical diseases, low milk fat content, poor ability to use coarse fibres, deterioration of F_2 and further generations from intense mating and above all high cost of maintenance of cross-bred animals. On the contrary, Zebu cattle in particular have a remarkable power of endurance by adaptation to hot climate, resistance to tropical diseases, relatively higher percentages of milk fat and SNF and an ultimately low cost of maintenance compared to cross-breds. Due to these attributes, Sahiwal is one of the few indigenous breeds which has been imported by many tropical countries from India or Pakistan and has been used either for first crossing or later on for incorporating some Zebu genes, after the failure of the cross-breeding to make improvements by increasing the exotic inheritance for developing suitable dairy breeds (Nagarcenkar, 1982). The multi-faceted usage of this breed is clear from the fact that in Kenya, a National Sahiwal Stud has been established at Naivasha by importing Sahiwal cows from India and Pakistan. The animals of these breeds have also been utilized for the production of synthetic strains like Jamaica Hope (JH), Australian Milking Zebu (AMZ) and Australian Friesian Sahiwal (AFS) in other countries. In view of the multi purpose utility of this breed, it is of utmost importance to multiply, improve and conserve this valuable germplasm and to bring about

further improvement in the performance of this milk breed.

In India, more than 1 200 breedable females are maintained on various organized farms located in different areas of the country (Figure 1, 2 and 3). Breedwise, distribution of livestock population in the country is not available because the quinquiennium census on livestock are conducted species-wise. However, there are few farmers and breeders particularly belonging to tribal communities in the Pak bordering districts of Punjab and Rajasthan possessing a large number of Sahiwal cattle. The distribution of Sahiwal cattle in farmers' herds is scanty. At present there are 12 organized herds of this breed in India, namely:

1. Government Livestock Farm, Hisar (Haryana)
2. National Dairy Research Institute, Karnal (Haryana)
3. Cattle Breeding Farm, Beli Charana, Jammu Cantt (J & K)
4. Amritsar Pinjrapole Cow Stable (Regd.), Ghee Mandi, Amritsar (Punjab)
5. Cattle Breeding Farm, Nabha (Punjab)
6. Cattle Breeding Farm, Chak-Ganjaria, Lucknow (U.P.)
7. Cattle Breeding Farm, Bod, Amravati (Maharashtra)
8. Cattle Breeding Farm, Anjora, Distt. Durg (M.P.)
9. Military Dairy Farm, Meerut (U.P.)
10. Dairy Farm, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Distt. Nainital (U.P.)
11. Shri Satguru Hari Singh Animal Breeding and Agricultural Farm, Sirsa (Haryana)
12. Satguru Sewa Sangh, Bheni Sahib (Khanna), Distt. Ludhiana (Punjab).

Sahiwal cattle on most of the central and State Government organized farms are pedigreed and performance recorded animals, however, very few farms have infrastructural facilities of rearing breeding bulls (Figure 4 and 5), collection and cryopreservation of semen and artificial insemination. More than 0.10 million frozen semen doses of 40 breeding bulls in breed improvement programmes are available with Germplasm Centres of NDRI, Karnal for distribution to associating organized and farmers' herds.

The objective of the present paper was to evaluate the performance of Sahiwal cattle with respect to growth, milk production and reproduction parameters. The heritability

Figure 1. In situ *conservation of Sahiwal cattle by tribal communities.*

Figure 2. A tribal cattle owner looking at his prised Sahiwal cattle.

estimates of different economic traits, genetic gain in milk production through selection, breed improvement programmes of Sahiwal in farm and field conditions and the use of Sahiwal in evolving new dairy breeds of cattle, will also be discussed.

Performance Parameters

Birth weight and growth rates

The average birth weight of male and female calves was 22.35 and 20.67 kg, respectively. The highest birth weights of male and female calves were reported during 4th parity at NDRI Farm, while Sivarajasingam *et al.* (1986) reported highest birth weight during 3rd parity in Sahiwal cattle in Malaysia. Mwandotto (1986) reported average birth weight of 22.9 ± 0.09 kg of Kenyan Sahiwal cattle, whereas Singh and Bhat (1987) reported lowest birth weight (20.4 kg) in Indian Sahiwal calves. Different factors like sex, dam, year, month / season and herd parity were reported to have significant effects on birth weight.

The growth rate serves as a check on feeding systems and management efficiency for rearing calves and it influences the maturity age and lifetime productivity of cows. Mudgal and Ray (1965) reported that daily growth rate (309 and 293 g in male and female calves) was slow from birth to 2½ months and later it exhibited an increasing trend (476 and 407g from 2.5 to 6 months). The growth rate was lower from seven months to one year of age. Mwandotto (1986) reported absolute daily growth rates in Kenyan Sahiwal animals as 339.5±2.9, 409.7±3.3, 329.0± 9.6 and 37.9±7.0g from birth to 55 kg, 55 kg-125 kg, 125 kg-27 months of age and from birth to 27 months of age, respectively. The average weight at first conception and at calving in Indian Sahiwal cows was 288.74±31.07 and 380.16±31.00 kg, while in Kenyan Sahiwal cattle weight at first calving was 410.9±1.8 kg (Mwandotto, 1986).

Mwandotto (1986) reported heritability estimates as 0.17±0.06 for birth weight, 0.25±0.06 for absolute growth rate to 27 months of age, 0.03±0.04 for relative growth rate to 27 months and 0.33±0.07 for 27 months body weight of Kenyan Sahiwal

cattle. Low and non-significant genetic and phenotypic correlations of growth traits with milk yield were reported.

Age at first calving

The overall average age at first calving was 1 080 days ranging from 879 days in Indian Sahiwal maintained at Karnal (Bhatnagar and Sharma, 1976) to 1 487 days at Hisar (Reddy, 1983). The heritability estimates of the trait reported by different workers ranged from zero (Reddy and Nagarcenkar, 1989) to 0.75±0.21 (Singh, 1977).

First lactation total milk yield

The overall weighted average first lactation milk yield of Sahiwal cows was 1 902 kg with a range of 1 519 kg (Singh *et al.*, 1980) to 2 499 kg (Sundersan *et al.* 1965). Heritability estimates ranging from zero to 0.92±0.40 have been reported. Positive and significant genetic and phenotypic correlations of milk yield with first lactation length and first calving interval have been reported. Moderate to high estimates of repeatability of lactation milk yield were reported by different workers (Gandhi and Gurnani, 1988; Khan *et al.* 1988).

First lactation length

The weighted average of first lactation length was 315 days. It ranged from 214±9 days (Kavitkar *et al.* 1968) to 345±4 days (Gandhi and Gurnani, 1988). Low to high estimates of heritability were reported by different workers ranging from close to zero (Reddy and Nagarcenkar, 1989) to 0.67±0.26 (Chopra *et al.*, 1973) in Sahiwal cattle. The genetic and phenotypic correlations of this trait with first calving interval were positive and significant (Rao, 1985). The repeatability estimates of lactation length were high (Khan *et al.*, 1988; Sharma and Khan, 1989; Reddy, 1983).

First calving interval

The average first calving interval reported by different workers was 440 days in Sahiwal cows and it ranged from 413 days (Reddy, 1983) to 498±124 days (Kushwaha and Misra, 1969). Most of the estimates of heritability reported in the literature were not significantly different from zero.

Life-time milk production

Life-time milk production ranged between 5 244 kg (Reddy, 1983) and 6 405 kg (Bhatia, 1980) up to three lactations and between 8 928 kg (Reddy, 1983) to 17 652 kg (Gopal and Bhatnagar, 1972) up to five lactations. Life-time milk production up to ten years of age was between 10 794 (Gandhi, 1986) and 24 406 kg (Gopal and Bhatnagar, 1972). The heritability of lifetime production up to ten years from adjusted and unadjusted data was not significantly different from zero as reported by Rao (1985) while Gandhi (1986) reported the heritability for the same trait as 0.43±0.06.

Breeding efficiency

The breeding efficiency is a function of the total number of parturitions, number of days from first to last calving and an ideal calving interval of 365 days and has been calculated after Wilcox *et al.* (1957). The average breeding efficiency in Sahiwal cattle ranged between 80.6 percent (Gandhi and Gurnani, 1990) and 89.2 percent (Singh *et al.*, 1980). Genetic correlations between breeding efficiency and weight and age at first calving, first lactation milk yield and milk yield per day of first calving interval were positive and significant. The phenotypic correlation of breeding efficiency with age at first calving and first lactation milk yield were, however, negative and significant (Singh *et al.*, 1980). Heritability estimates of breeding efficiency were 0.18±0.05 and 0.19±0.08 based on paternal halfsib and intrasire regression of offspring on dam methods, respectively (Singh *et al.*, 1980).

Figure 3. A thatched shed for housing Sahiwal cattle.

Figure 4. Sahiwal herd under field conditions.

Genetic gains in milk production through selection

Singh (1981) estimated the expected genetic progress in milk production through direct selection from the selection of dams of bulls, dams of cows, sires of bulls and sires of cows at Karnal and Chak-Ganjaria (Lucknow) herds in India. The overall genetic change per annum was 1.11 percent of herd average of 2 108 kg at Karnal herd and 0.20 percent of herd average of 1 614 kg at Chak Ganjaria farm. The average generation interval was 77.53 months at Karnal and 76.52 months at Chak-Ganjaria farm. The largest contribution of 69.6 percent in genetic change was found to be derived from dam to bull path followed by sire to bull (28.9 percent), dam to daughter (3 percent) and sire to daughter (-1.6 percent) paths in Karnal herd.

Sahiwal breed improvement programme

The main breeding policy has been the selective breeding for genetic improvement of this breed. To have an adequate number of superior breeding bulls for producing sufficient frozen semen doses in order to breed pure-bred Sahiwal cattle population in field and farm conditions, a progeny testing programme entitled "Associated herd progeny testing in Sahiwal" was started in 1979 associating five herds of Sahiwal maintained at Government Livestock Farms, Hisar, Lucknow, Durg; Cattle Breeding Farms, Nabha and NDRI, Karnal, to have the requisite number of progeny/sire and to evaluate sires more accurately. The NDRI herd of Sahiwal having fully established infrastructural facilities for bull rearing, semen collection, processing and cryopreservation was the coordinating centre and later on more Sahiwal herds were associated with the project. The association of different herds envisaged the effective testing and evaluation of a large number of bulls over a large population. Together these farms contributed about 700 breedable populations of Sahiwal cattle. Out of the first set of progeny testing six bulls, the highest predicted breeding value of 1 679 kg (+9.5 percent above herd average) based on 19 daughters in five herds was obtained. This bull was used for nominated matings with 20 percent elite females. Out of the second set of eight bulls, the highest breeding value of 1 824 kg (+12.9 percent above herd average) on 32 daughters followed by 1 743 kg (+7.9 percent above herd average) based on 14 daughters of second bulls was obtained. These bulls were also used for elite mating. For production of bull calves the performance of daughters of bulls of the third and fourth sets is being evaluated. Presently, the fifth set of six bulls with dam's best yield ranging from 3 031 to 3 559 kg (average superiority 3.6 to 12.3 percent) are being used in three herds (Figure 6).

The organized herds of Sahiwal cattle besides bringing out genetic improvement in the breed are also engaged in multiplication of germplasm in the form of breeding bulls and semen and their dissemination to the selected pockets of farmer herds, few cow stables and private breeders. The germplasm is also being used for up-grading of non-descript cattle.

The germplasm of Sahiwal has been used extensively for developing country's well known synthetic strains of the cross-bred cattle in organized herds. This has drastically reduced the number of Sahiwal cows on organized farms. No doubt, due to cross-breeding the milk production has increased significantly in field conditions. Research conducted under organized herds has shown that performance of cross-breds with 50-62.5 percent exotic inheritance is better than that of the indigenous cattle breeds. Sahiwal germplasm has been used to develop two cross-bred cattle strains *viz* Karan Swiss and Karan Fries at NDRI, Karnal by crossing Sahiwal/Tharparkar females with imported semen of Brown Swiss and Holstein Friesian bulls.

Frieswal is another cross-bred cattle strain being developed on military dairy farms by crossing Sahiwal females with Holstein Friesian males. The Sahiwal bulls are also

being used to backcross cross-bred progeny to maintain exotic inheritance at a level of 50-62.5 percent.

Furthermore, the Sahiwal breed has also been used for cross-breeding in different countries like Bangladesh, Australia, Tanzania and the West Indies and cross-bred cattle strains like Australian Friesian Sahiwal, Australian Milking Zebu, Jamaica Hope, Mpwapwa and Pabna crosses have evolved.

In India, the emphasis is currently being given to pure-breeding of Zebu milk breeds to strengthen their herd on organized farms to multiply, conserve and propagate superior germplasm of native breeds including Sahiwal. There is an urgent need to formulate breeding programmes and strategies to bring about genetic improvement in milk yield of Sahiwal cattle, which is one of the best indigenous cattle milk breeds.

Present status of Sahiwal cattle in field conditions

The fast changing socio-economic levels of farmers and cattle breeders, ecological profile and agricultural scenario and various factors such as shrinking pasture lands, over-emphasis on cross-breeding with exotic cattle inheritance as well as the increased emergence of buffalo as commercial dairy animals, have resulted in the further decline in the population of Sahiwal cattle which were sparsely distributed in the Pak-bordering districts of Punjab and Rajasthan. Now, very few pure-bred cattle of Sahiwal herds are maintained at selected cow stables, religious charitable trusts, State cattle breeding farms and the research and development organizations besides tribal cattle breeders who are still committed to rearing Sahiwal cattle on their own. These tribal families are now temporarily settled near the vicinity of various towns in the districts of Punjab and Rajasthan. The tribal cattle breeders in Rajasthan also introduced the inheritance of Sahiwal cattle in the indigenous cattle breeds and developed another milk breed of cattle named Rathi which carries the major proportion of Sahiwal cattle inheritance. These tribal cattle breeders possess large herds of Sahiwal cattle ranging from a few hundred to a thousand animals that can be seen camped at one place. To determine the socio-economic levels of Sahiwal cattle breeders / farmers, demographic and geographic distribution, morphological characteristics, performance traits as well as genetic characterization of the Sahiwal cattle breed, there is a need to conduct a breed survey in this area which could generate useful information for developing a breeding plan for conservation and further improvement.

Future Strategies for Improvement

The population of Sahiwal pure-bred herds on organized farms has declined drastically due to their extensive use for cross-breeding during the last two decades. No doubt, India has achieved a breakthrough to enhance milk production by cross-breeding native stock with exotic breeds to such an extent that it has emerged as the top producer of milk after surpassing the USA. In the process of over-emphasising the cross-breeding programme and its indiscriminate use, some of the well known Indian Zebu cattle breeds like Gir, Red Sindhi, Tharparkar and Sahiwal were subjected to genetic dilution and population decline. Realizing this, emphasis is given to further strengthen the already established pure-bred herds to increase the size of herds of our native milk and dual-purpose breeds on organized farms as well as in their respective breeding tracts. Hence, undertaking programmes on identification, selection and propagation of superior germplasm as well as re-establishing the herds of Sahiwal cattle, being one of the most important indigenous milk breeds, is of utmost importance. The comparable performance of Sahiwal with cross-bred cows in terms of per day milk yield (milking average of 8.8 kg in Sahiwal versus 12.5 kg in Karan Fries) at NDRI Farm, revealed that Sahiwal cows have the genetic potential to increase productivity and can withstand

Figure 5. Young Sahiwal calves under village conditions.

Figure 6. A progeny-tested Sahiwal bull.

tropical climatic stress and subsist on a crop residue based feed system. Thus, the cost of rearing and maintaining of Sahiwal cattle is comparatively lower in comparison to cross-breds.

A large scale progeny testing programme for evaluating the adequate number of Sahiwal bulls associating sizeable breeding herds of Sahiwal maintained at a number of Central / State Government livestock breeding farms and other organized herds possessed by the Charitable Trust, cow stables and even private farms, needs to be undertaken. This would also lead to the establishment of Sahiwal bull mother farms and germplasm collection centres which will further disseminate the superior germplasm in the form of semen and breeding bulls to Sahiwal herds on organized farms and farmer / breeder herds.

Multiple ovulation and embryo transfer (MOET), a new emerging tool of biotechnology may be used to enhance multiplication of superior germplasm from the nucleus herd of Sahiwal cows to produce a larger number of elite progeny from nominated matings per unit of time. It has been reported that by using this technology in the near future, 6-12 progenies from a donor can be produced in a year or 30-60 offsprings in her lifetime (Kurup, 1992). A conceptual model for production and evaluation of Sahiwal bulls in associated herd system integrating MOET with the conventional AI programme has been discussed by Gandhi and Singh (1997), using a nucleus herd of 500 breedable females. The expected genetic gain from the adult MOET scheme was 2.95 percent of the herd mean (1 788 kg), which was about two-fold expected from the progeny testing scheme in Indian conditions. It was concluded that wherever infrastructural facilities for cryopreservation of semen / embryos and transfer of embryos are available, MOET technology should be adopted on organized farms to raise progeny from elite mating for conservation, propagation and for bringing about faster genetic improvement in milk yield of Sahiwal cattle.

Furthermore, there is a need for inter-country collaboration among the countries maintaining the Sahiwal breed through the exchange of superior germplasm in order to broaden the genetic base and to make selection more effective. If possible, an associated herd progeny testing programme may be undertaken throughout these countries in order to improve the accuracy and intensity of selection of sire evaluation.

To summarize, the multiplication, evaluation, conservation and future propagation of the Sahiwal breed is of paramount importance in the prevailing situation in our country, where the number of animals of this breed has declined considerably due to their extensive use in cross-breeding with exotic breeds of temperate origin on organized farms as well as in field conditions. For conservation and improvement of this breed, concerted efforts have to be made to strengthen the breed improvement and development programmes by associating more farmers and organized herds in associated herd progeny testing programmes, producing superior germplasm on organized farms, establishing bull mother farms, producing a larger number of elite progeny by adoption of embryo transfer and ultimately creating awareness among farmers through the formation of the Sahiwal Cattle Breeders' Society and Breed Development Boards to the par excellence performance of this breed with cross-breds in terms of cost benefit ratio and feed conversion efficiency.

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Garole: The prolific sheep of India

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Summary

A survey on Garole sheep was carried out in the breeding tract for breed characterization. Garole sheep are distributed in the Sundarban region of West Bengal in India. It is a small-sized breed known for its prolificacy and adaptation to the saline marshy land of the Sundarban region. It is believed that these sheep contributed to the prolificacy gene in Booroola Merino sheep of Australia. The breeding tract of Garole sheep falls under the Coastal Saline Zone of West Bengal and the climate of this region is hot and humid. The population of Garole sheep was 206 720 in 1994-1995. This breed is maintained by marginal farmers and landless labourers. Flocks are stationary and average flock size ranges from three to five. They graze on rice fallow land and natural grass cover on the roadsides and water channels. Garole sheep have the ability to graze in knee deep conditions in marshy land. Their colour is generally white. Some animals of black or brown colour are also seen. The male is generally horned and females are polled. They have three distinct types of ears; small, medium and long. Average adult weights in male and females are 15 and 12 kg, respectively. Twin and triplet births are common. The Garole sheep are reared for mutton production. Farmers generally do not shear wool. Fleece is of a coarse quality and is used as bedding material.

Résumé

Une enquête sur la race ovine Garole a été réalisée sur place pour une étude de caractérisation de la race. La race Garole se trouve principalement dans la région de Sundarban dans l'Ouest Bengal aux Indes. Il s'agit d'une race de petite taille bien connue pour sa prolificité y grande adaptation aux terrains marécageux salins de la région de Sundarban. On pense que cette race a contribué a apporter le gène de la prolificacité dans la race Booroola Merino de l'Australie. Le milieu naturel de la race Garole se trouve sous la zone de la côte saline de l'Ouest Bengal et le climat de cette région est particulièrement chaud et humide. En 1994-1995 la population de race Garole était de 206 720 animaux. Cette race est élevée surtout par des petits fermiers et des paysans sans terre. Les troupeaux sont sédentaires et la taille moyenne de chacun est de trois à cinq animaux. Les animaux pâturent dans les jachères des risières et sur pâturages naturles des bords des chemins et des cours d'eau. Cette race possède l'habilité de pâturer même couverte jusqu'aux genoux dans les terrains marécageux. La couleur du manteau est généralement blanche, mais on voit aussi des animaux de couleur noir ou brun. En général les mâles possèdent des cornes et les femelles non. Il existe trois types différents d'oreilles: petites, moyennes, et longues. Le poids moyen à l'âge adulte chez le mâle et la femelle est de 15 et 12 kg, respectivement. Les naissances doubles et triples sont assez communes. La race Garole est élevée surtout pour la production de mouton. Les éleveurs en général n'utilisent pas la laine. La toison n'est pas de bonne qualité et n'est donc utilisée que comme matériel de litière.

Key words*: Garole sheep, Sheep genetic resources of India, Production system, Characteristics, Management.*

Introduction

Garole is a small sized sheep breed found in the Sundarban region of West Bengal. The Garole sheep are known for their survivability in marshy saline conditions and their prolificacy. Ghalsasi and Nimbkar (1993) reported that Garole sheep might be resistant to footroot. Garole sheep were imported into Australia from Bengal in 1792 and is assumed to have contributed prolificacy gene to the Booroola Merino sheep (Turner, 1982). There is much similarity in body and fleece characteristics of Garole sheep of the Sundarban region and that reported for early Bengal sheep of Australia (Singh and Bohra, 1996).

Garole sheep have not been characterized properly in their natural breeding tract. No mention of this unique sheep genetic resource is found in sheep and goat breeds of India (Acharya, 1982). Sharma *et al.* (1999) described the characteristics of Garole sheep maintained in farm conditions altogether different from its natural habitat. Information about this sheep from the breeding tract is meagre. This study was undertaken to document the Garole sheep by collecting information through a field survey in their home tract and documentation of the breed.

Materials and Methods

A pilot survey was undertaken in the Sundarban region of South 24-Paraganas of West Bengal to record information on Garole sheep. The physical characteristics were measured from 139 sheep of different age groups and reproductive performances were collected through interviews with the farmers.

Figure 1. Breeding tract of Garole sheep.

Table 1. The livestock population of the South 24-Paragans district of West Bengal.

Species	Male	Female	Total
Non-descript cattle	560 036	567 083	1 127 119
Cross-bred cattle	3 138	18 468	21 606
Buffalo	12 775	12 148	24 923
Sheep (Garole)	85 463	121 257	206 720
Sheep (cross-bred)	650	996	1 646
Goat	396 237	621 547	1 017 784
Pig (indigenous)	18 883	24 840	43 723
Pig (cross-bred)	1 907	1 895	3 802
Duck			1 333 534
Fowls			2 862 421

Results and Discussion

Distribution and breeding tract

The Garole sheep are found in the Sundarban region of South 24-Paragans district in West Bengal. Some animals are also found in parts of the North 24-Paraganas and Midnapore district adjoining the South 24-Paraganas district (Figure 1). The population of this breed is high in Joynagar-I, Joynagar-II, Kuttali, Mathurapur-I, Mathurapur-II, Mandir Bazar, Patharpratima, Namkhana and Kakdwip blocks of the 24-Parganas district.

The Sundarban region comes under the coastal Saline Zone of West Bengal. This zone is mostly comprised of the southern part of the state embracing the Alipore Sadar and Diamond Harbour sub-division of the South 24-Parganas district. The Sundarban is spread over an area of approximately 4 226 km² within 21-23º N latitude and 87-89º E longitudes. The human population of this region is about three million where 90 percent of the inhabitants are below the poverty line (Saha, 1996). Ninety five percent of the people depend only on agriculture of which 85 percent belong to small and marginal farmer families (Gangopadhyay, 1991).

Soil and climate

The breeding tract of Garole sheep is part of the Indo-Gangetic delta and traversed by numerous tidal rivers, cheeks and channels. The island areas are subjected to occasional inundation by the saline waters. Soils are of tidal origin and silty clay in nature. Soil pH ranges between 6.4 and 7.6 (Gangopadhyay, 1991). The mean annual rainfall of this region is 1 763 mm and ranges between 1 450 and 1 925 mm. Average minimum and maximum temperature range between 15.5 and 32.5°C. Relative humidity remains high, over 80 percent from June to September and minimum 65 percent in December.

Crops and cropping systems

Rice is cultivated in more than 80 percent of cultivable lands. Cropping intensity is 110 percent with the majority of lands remaining fallow for six to seven months due to non-availability of irrigation facilities, poor

Figure 2. Animals tied in the field during grazing.

Figure 3. Garole sheep grazing in the field.

drainage and saline soil. The main winter crops are wheat, barley, sunflower, cotton and chili.

Livestock population

The livestock population of the South 24-Paragans district of West Bengal as reported in the 15th Quinquennial Livestock Census Report in 1994-95 (Anonymous, 1996) is shown in the table 1.

It is evident from the Livestock Census figures that the population of cross-bred sheep was less than one percent of the total sheep population in that area. The same is true for cross-bred cattle also. The local agro-climatic condition like hot humid climate, lack of grazing land, saline soil and waterlogging during the rainy season may be a disadvantage to the cross-bred woolly sheep. The local livestock is well adapted to these conditions of the coastal area. The goat population of the 24-Paraganas district was 4.9 times the sheep population. The buffalo population was also very low in comparison to other livestock.

Management practices

Marginal farmers and landless labourers mostly from socially and economically less priviledged classes maintain Garole sheep. The flock size of Garole sheep ranges between two to 27 in the household surveyed. However, most of the farmers had small flocks ranging between three and five. No organized grazing land is available. The sheep are reared only on grazing on rice fallow land, bands and natural grass cover on the roadsides and water channels (Figures 2 and 3). The animals are tied with a small rope and allowed to graze the surrounding area. Mostly females and children are involved in the sheep rearing practices. In the rainy season, most of the fields become water-logged. Garole sheep have the ability to swim and graze in knee deep conditions in marshy land. During the monsoon, in addition to grazing, animals are fed treetops and chaffed paddy straw. Generally the sheep are not provided separate houses and are kept along with cattle. Some farmers believe that sheep and goats do not survive well together. Therefore, either they keep cattle and sheep or cattle and goats. However, some farmers

Table 1. Average body weights and body measurements and their standard errors in Garole sheep.

Traits												
Age (mo.)	Body weight (kg)		Body length (cm)		Height at wither (cm)		Height at ramp (cm)		Heart girth (cm)		Paunch girth (cm)	
	M	F	M	F	M	F	M	F	M	F	M	F
3	4.90±	5.80±	30.00±	36.30±	32.00±	35.20±	33.20±	36.00±	34.60±	41.90±	34.40±	44.5±
	0.86(5)	0.77(10)	2.12(5)	1.98(10)	2.17(5)	1.41(10)	2.48(5)	1.39(10)	3.01(5)	2.42(10)	3.61(5)	2.98(10)
6	8.55±	8.65±	40.81±	40.70±	39.64±	38.80±	41.36±	40.10±	49.00±	48.00±	53.09±	51.20±
	0.64(11)	0.56(10)	0.95(11)	1.09(10)	0.73(11)	0.87(10)	0.74(11)	0.97(10)	2.08(11)	1.02(10)	2.06(11)	1.91(10)
12	12.50±	11.89±	45.78±	45.62±	44.00±	43.69±	44.44±	44.69±	55.67±	55.69±	59.56±	59.23±
	0.83(9)	0.56(26)	0.70(9)	0.91(26)	0.75(9)	0.59(26)	0.80(9)	0.82(26)	1.05(9)	1.20(26)	2.39(9)	1.09(26)
18	15.08±	11.72±	50.00±	45.00±	50.00±	43.68±	50.67±	43.29±	59.67±	55.91±	66.17±	60.41±
	1.36(6)	0.78(22)	2.77(6)	0.82(22)	1.84(6)	0.76(22)	1.78(6)	2.06(22)	1.52(6)	1.19(22)	1.64(6)	1.11(22)
24	14.00±	14.33±	45.33±	47.50±	49.00±	46.75±	48.33±	48.17±	55.33±	59.63±	54.33±	64.79±
	0.58(3)	0.48(24)	0.33(3)	1.06(24)	0.58(3)	1.05(24)	0.33(3)	1.31(24)	1.33(3)	1.03(24)	2.33(3)	1.38(24)
>24	23.00±	15.82±	58.00±	48.64±	61.50±	47.09±	59.00±	47.27±	71.00±	61.64±	66.00±	65.91±
	1.00(2)	0.85(11)	0.0(2)	0.93(11)	0.50(2)	0.78(11)	0.0(2)	0.93(11)	1.00(2)	2.74(11)	1.00(2)	2.93(11)

M: Male, F: Female, Values in the parenthesis are number of observations.
Figures in the table are based on the sample surveyed. Age of lambs was taken as ' a word of mouth' from surveyed farmers, that of older sheep by dentition.

Table 2. Average body measurements and their standard errors in Garole sheep.

Traits / Age (mo.)	Ear length (cm)		Pole to pole length (cm)		Eye to eye length (cm)		Face length (cm)		Tail length (cm)	
	M	F	M	F	M	F	M	F	M	F
3	5.75± 0.48(4)	6.25± 0.84(8)	4.75± 0.25(4)	5.13± 0.61(8)	7.25± 0.85(4)	6.63± 0.42(8)	9.63± 0.75(4)	10.00± 0.66(8)	6.25± 0.25(4)	8.00± 0.27(8)
6	8.00± 0.66(8)	7.75± 0.84(8)	5.69± 0.37(8)	6.13± 0.35(8)	8.38± 0.38(8)	7.88± 0.35(8)	11.75± 0.16(8)	11.00± 0.27(8)	9.13± 0.44(8)	8.50± 0.27(8)
12	4.75± 1.44(4)	6.86± 0.51(14)	6.25± 01.32(4)	6.93± 0.37(14)	7.75± 1.60(4)	8.79± 0.21(14)	13.75± 0.48(4)	13.79± 0.32(14)	8.50± 0.50(4)	9.00± 1.18(14)
18	4.67± 1.66(3)	7.50± 1.15(8)	7.33± 0.33(3)	7.00± 1.15(8)	10.00± 0.0(3)	8.63± 0.49(8)	13.67± 0.88(3)	13.63± 0.46(8)	10.00± 1.00(3)	10.75± 0.53(8)
24	9.00± 1.00(3)	8.22± 0.57(9)	6.67± 0.33(3)	7.00± 0.33(9)	9.33± 0.67(3)	10.00± 0.24(9)	15.00± 0.58(3)	14.00± 0.33(9)	10.00± 1.00(3)	8.78± 0.36(9)
>24	9.00± 0.0(2)	6.63± 1.13(8)	8.00± 0.0(2)	7.50± 0.57(8)	12.00± 0.00(2)	10.00± 0.19(8)	17.00± 0.0(2)	14.88± 0.52(8)	10.00± 0.0(2)	9.75± 0.37(8)

M: Male, F: Female, Values in the parenthesis are number of observation.

Figures in the table are based on the sample surveyed. Age of lambs was taken as ' a word of mouth' from surveyed farmers, that of older sheep by dentition.

Figure 4. Housing of Garole sheep.

maintain both sheep and goats. Sheep are pegged in front of the house or on the roadside during daytime (Figure 4). The flocks are stationary.

Physical characteristics

Garole is a small sized sheep. More than 90 percent of sheep are white in colour and the remaining 10 percent are brownish black. Males are usually horned and females are polled. Garole sheep have rudimentary (1-3 cm), medium-sized (4-8 cm) or long (more than 8 cm) ears. Respective percentages reported by Bose (1996) was 12.7, 50.82 and 36.48 percent.

Birth weight of Garole sheep in the survey was about 1 kg. Similar birth weight (0.6-0.9 kg) was reported by Ghalsasi and Nimbkar (1993). Bose (1996) observed that the birth weight of Garole sheep was 1.116±0.021 kg. The body weights and body measurements of males and females at different ages are given in tables 2 and 3.

Reproductive performance

The Garole ewes breed round the year with two lambing peaks between December to February and August to September (Bose and Moitra, 1995). They lamb twice in 15-18 months and age at first lambing is 14-18 months. The lambing interval of 205±2.23 days was reported by Bose (1996). Multiple birth is common, mostly twins and triplets (Figure 5). Ewes also give birth to quadruplets. The percentages of single, twin, triplet and quadruplet births were 41.63, 43.35, 14.81 and 0.21, respectively (Bose 1996). He also reported the overall lambing rate as 173.6 per 100 ewes lambing. Singh and Bhora (1996) reported that twining was most common. They observed 25-30 percent single, 55-60 percent twins, 15-20 percent triplets and one-two percent quadruplets. They also reported 10-12 lambings in the lifetime of a ewe with longevity of seven-eight years.

Figure 5. Garole ewe and two lambs.

Disease prevalence

Parasitic infection and diarrhoea in the rainy season are the main health problems of Garole sheep. Singh and Bohra (1996) reported about 30 percent mortality in farmers' flocks due to various reasons. They also observed that mortality in lambs is higher during the winter season and in adults during the rainy season. Diarrhoea was mostly due to amphistomiosis infection. Bose (1996) observed that overall lamb and adult mortality was 33.2 and 12.2 percent, respectively and reported that death of lambs was highest in the rainy season (42 percent), followed by winter (39 percent) and summer (19 percent), whereas in adults it was highest in summer (40.3 percent) followed by winter (44.8 percent) and the rainy season (14.9 percent). He also reported that the mortality of lambs born as single, twin, triplet and quadruplet were 15.5, 36.1, 44 and 50 percent, respectively.

Utility of the breed

The Garole sheep are maintained only for meat production and the animals are not generally sheared. Surplus sheep and lambs are sold for slaughter prior to the rainy season to avoid risk of mortality. Some farmers do not sell ewes for slaughter. However, in some places, ewes are sold after six-seven lambings. The dressing percentage on a pre-slaughter liveweight basis of male animals slaughtered at the age of nine months was reported to be 48.26±0.31 (Bose, 1996).

In some cases wool is used as bedding material. Singh and Bohra (1996) reported that average annual wool production was about 150 g and the quality: staple length, 5.09 cm; fibre diameter, 67.82 µm and medullation percentage 75.17. Bose (1996) reported that the average annual greasy fleece yield of Garole sheep was 152±2.43 g.

The Garole sheep are self-sustainable in their breeding track due to their adaptability to the agro-climatic conditions, their survivability under low input system and their utility as meat animals. No organized cross-breeding is ongoing in the area because cross-bred may be less adaptable in that area. With a population of over 0.2 million Garole sheep and no organized sheep cross-breeding in this region, there is no immediate threat of decline in the breed's population. There is a need for a genetic improvement programme in Garole sheep in farmers' flocks in order to

make sheep rearing more profitable and for conservation of this unique sheep genetic resource of India.

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Beetal goats in their native tract

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Summary

Beetal is one of the largest Indian breeds of goats bred mainly for milk but equally important for meat as well. This breed is found in Punjab along the Indo-Pakistani border. The status of the Beetal breed in its native tract was studied through a detailed survey in the Gurdaspur and Amritsar districts of Punjab. In this part of the country, goats are mainly reared by '*Sansi*' tribals who are landless. Goat flocks are mainly stationery and browsing is the main source of feed and fodder for these goats. Long drooping ears and roman nose are the typical characteristics of this breed. The total population of this breed in its native tract in 1997 was found to be 20 772 and the average flock size was 5.27. Average test day milk yield and lactation length were 1.8±0.79 kg and 161 days, respectively. Average ages at first kidding and kidding interval were 17.2 and 11.14 months, respectively. Prolificacy was fairly high with an average of 1.76 kids per kidding.

Beetal goats are the mainstay for the landless poor families of this region and the breed needs to be conserved in its breeding tract. There is a need to popularize this breed through demonstration units to convince the farmers that this breed is sustainable under low input conditions. This will help in *in-situ* conservation of the Beetal breed.

Resumen

La raza caprina Beetal es una de las más importantes no sólo por su producción lechera sino también por la producción de carne. Esta raza se encuentra mayormente en Punjab, a lo largo de la frontera entre India y Pakistán. Se ha realizado un estudio de la raza Beetal en su entorno natural a través de una encuesta detallada llevada a cabo en los distritos de Gurdaspur y Amritsar pertenecientes a la región de Punjab. En este lugar del país las cabras pertenecen principalmente a los grupos tribales "Sansi" que no poseen tierras. Los rebaños de cabras son estacionarios y el pastoreo es la mayor fuente de alimentación disponible. Las características típicas de la raza son orejas largas y caídas y un perfil pronunciado. El total de esta población en su ambiente natural en 1997 era de 20 772 y la media del tamaño de los rebaños de 5,27. La media de producción de leche diaria comprobada en el campo y la duración de la lactación eran de 1,8±0,79 kg y 161 days, respectivamente. La media de la edad al primer parto y el intervalo entre partos eran de 17,2 y 11,14 meses, respectivamente. La prolificidad era relativamente alta con una media de 1,76 crías por parto. Las cabras Beetal representan una base sustancial para las familias sin tierras de esta región y por lo tanto se deberían conservar en su ambiente natural. Se debería también dar a conocer mejor esta raza a través de unidad de demonstraciones, con el objeto de convencer a los agricultores de la capacidad de esta raza de mantenerse en condiciones difíciles y con un aporte muy bajo. Todo esto ayudaría a la conservación *in situ* de la raza Beetal.

Key words: *Goat, Beetal, Population, Punjab, Gurdaspur, Amritsar, Characteristics.*

Introduction

Goats are considered the poor man's cow as they provide some milk with very little input. Goat rearing is an important occupation for

Figure 1. Breeding tract of Beetal.

the rural poor especially socially less privileged communities and it is a profitable venture for resource poor entrepreneurs as goats are able to sustain themselves on sparse vegetation, unsuitable for feeding to other livestock.

Beetal is one of the heaviest dairy type goat breeds of Northern India. The animals are characterized by a large size, long drooping ears and roman nose. The breed is found in the Gurdaspur and Amritsar districts of Punjab. It seems that the breed has been named after its place of origin i.e. Batala, a tehsil (sub-division) of the Gurdaspur district of Punjab. Pure animals are still found in and around Batala (Figure 1).

The breeding tract is characterized by extreme climatic conditions. Temperatures range from as low as 2ºC in winter to about 42ºC in summer. Annual rainfall is around 70 cm. Relative humidity ranges from 22 to 83 percent. Beetal goats are mainly reared for milk. The males are disposed of for meat at any age between three and 12 months whereas females are maintained for up to four to six lactations.

The Beetal breed has been used for cross-breeding with Saanen and Alpine breeds in the All India Coordinated Research Project on goats, both for milk and meat components. For the meat component, this breed was recommended to substitute Anglo-Nubian because the performance of both the breeds and their crosses is comparable (Rana *et al.*, 1981). However, the population of goats in Punjab is decreasing continuously and declined by about 23 percent during 1990 to 1997. Beetal being native to this area has suffered considerably. There is no information on its present status in its home tract. This study was therefore undertaken to evaluate Beetal breed in its native tract with respect to its population, characteristics, management practices and socio-economic status of the farmers raising this breed so that a proper strategy could be formulated for the improvement and conservation of this important breed.

Materials and Methods

A detailed study was carried out in 1997 covering the entire Gurdaspur district and Ajnala and Atari tehsils of the Amritsar district of Punjab to enumerate Beetal population in the breeding tract. All the villages of this area were surveyed and each household was contacted for this study. Enumeration was done separately for kids (zero-six months), yearlings, does in milk and dry and bucks.

After enumeration of the Beetal population, information on the socio-economic status of goat keepers, management practices, morphological, production and reproduction characteristics of Beetal goats was collected through a sample survey using a two way stratified sampling procedure. Questionnaires developed at the National Bureau of Animal Genetic Resources, Karnal for generating information through field surveys were translated into the local language (Punjabi) for easy communication with farmers.

Ten strata covering 76 villages were identified along the Indo-Pakistani border in Gurdaspur and Amritsar districts. Survey work was monitored through regular field visits and the data was cross-checked for ensuring accuracy. One enumerator was appointed in each stratum for conducting the survey. All enumerators were trained in the field for recording information on various parameters. A total of 8 932 households were contacted for this study.

Physical characteristics, body measurements and body weights were recorded on 1 029 goats. In addition to this, 1 190 females were recorded for daily milk yield at fortnightly intervals for complete lactation starting from the first week of kidding. Reproductive characters like age at first kidding, kidding interval and open period were noted by interviewing the farmers and the number of kids for each kidding was recorded for the lactating females. Frequency and average of various parameters were estimated.

Table 1. General statistics of the survey area in relation to goat rearing.

District	Villages	Houses	Goat keepers	Goats / village	Flock size
Gurdaspur	469	73 053	2 757	25.3	4.31
Amritsar	213	67 161	1 185	41.7	7.50
Overall	682	140 214	3 942	30.5	5.27

Table 2. Population of Beetal goats.

	Kids	Yearlings	Doe			
District	(0-6 months)	(6-12 months)	In milk	Dry	Buck	Total
Gurdaspur	3 927	2 545	3 029	2 417	975	11 883
Amritsar	1 676	1 833	3 002	1 746	632	8 889
Total	4 593	4 378	6 031	4 163	1 607	20 772

Figure 2. Beetal flock in the courtyard of farmer's house.

Results and discussion

Population

Goats are reared mainly by Sansi tribals who are landless. Goat keeping is considered a lower grade entrepreneurship and there is a social taboo among landlords in this area for keeping goats. A survey in the breeding tract revealed that there were a total of 3 942 families keeping goats in 682 villages. On average there were 156 and 315 households per village in Gurdaspur and Amritsar district, respectively. Only 2.8 percent of the households kept goats

Table 3. Frequency of farmers in various categories (%).

Districts	Total farmers contacted	Landless	Marginal 0-1 ha	Small 1-2 ha	Medium		Large>20 ha
					Lower 2-4 ha	Upper 4-8 ha	
Gurdaspur	3 372	48.2	20.3	19.2	8.6	3.0	0.7
Amritsar	5 560	34.7	14.1	26.0	18.3	5.9	0.9
Total	8 932	39.8	16.4	23.4	14.6	4.8	0.8
Goat Keepers							
Gurdaspur	205	71.2	10.2	13.7	3.9	0.5	0.5
Amritsar	148	70.9	8.1	12.0	6.8	0.7	0.7
Total	353	71.1	9.3	13.1	5.1	0.6	0.6

Table 4. Average family status in the survey area.

District	Family members	Literate members	Involved in animal rearing		Land holding (acres)
			Male	Female	
Gurdaspur	6.32	2.24	0.56	0.12	2.34
Amritsar	5.39	1.01	0.62	0.30	3.59

(Figure 2 and 3). Five percent of the villages had more than 100; 46 percent had 11 to 50; 12 percent had 51-100; and 37 percent had less than 10 Beetal goats. There were about 25.3 and 41.8 Beetal goats per village and the average flock size was 4.3 and 7.5 in the Gurdaspur and Amritsar districts, respectively, with an overall average of 5.27 (Table 1). Acharya (1982) reported a flock size of 21.06±1.92. This shows that there has been a marked decline in the flock size over the years. This is mainly due to reduction in the natural vegetation for browsing.

There were a total of 20 772 Beetal goats in the breeding tract (Table 2). The Gurdaspur district had 57 percent while the Amritsar district had 43 percent of these goats. Kids, yearlings and adult stock constituted 22, 21 and 56 percent, respectively. The adult male to female ratio was 1:6.3 which was lower than that reported by Acharya, 1982 (1:7.8). Among the adult females, 59 percent of does were in milk.

Socio-economic status

Analysis of landholding revealed that 48.2 and 34.7 percent of the respondents were landless; 20.3 and 14.1 percent marginal; 19.2 and 26 percent small; 8.6 and 18.3 percent lower medium; 3 and 5.9 percent upper medium; and only 0.7 and 0.9 percent were large farmers in the Gurdaspur and Amritsar districts, respectively (Table 3).

Most of the farmers kept both buffalo and cattle whereas very few had goats. Among the goat keepers, the majority of farmers (71 percent) were landless and only 0.6 percent were large farmers. Among the farmers contacted, 54 percent had cattle, 84 percent had buffaloes and only 4 percent had goats (Table 3).

The average family size was 6.32 and 5.39 in Gurdaspur and Amritsar districts, respectively. More male members of the family were engaged in animal rearing than female members (Table 4).

Figure 3. Housing for goat and sheep.

Table 5. Composition of livestock in survey area.

			Goat	
District	Cattle	Buffalo	Total	Beetal (%)
Gurdaspur	3 500	8 221	1 389	81.5
Amritsar	8 097	26 806	1 410	44.3
Total	11 597	35 027	2 799	62.8

Figure 4. Breeding buck.

Table 6. Characteristics of Beetal goat (frequency %).

Parameters		Kids		Young		Adult	
		Male	Female	Male	Female	Male	Female
Animals recorded		34	38	44	92	96	725
Hair	Long	38	23	5	12	52	37
	Medium	62	77	95	88	48	63
	Smooth	47	45	79	7	68	36
	Ugly	53	55	21	93	32	64
	Straight	100	100	90	97	86	99
	Curly	-	-	10	3	14	1
Colour	Body - Black	76	82	82	85	94	75
	Skin - Grey	72	79	67	78	76	86
	Lips - Black	92	83	63	94	93	82
	Eyes - Black	88	88	82	89	94	88
	Hooves –Black	88	91	95	93	95	86
	Tail Switch – Black	76	68	86	91	89	75
Horns	Present					85	93
	Colour –					35	44
	Brown					44	41
	- Grey						
	Shape –					49	42
	Straight					51	58
	Twisted						
	Orientation						
	- Backward					65	85
	- Inward					25	10
	- Upward					10	5
Ear	Length (cm)	14	15	17	26	23	19 (pruned)

Figure 5. Milking doe.

Figure 6. Beetal kid.

Livestock composition

In the area surveyed, buffaloes constituted about 71 percent, cattle 23.4 percent while goats constituted only 5.6 percent of the total livestock. Of the total goats enumerated, 81.5 and 44.3 percent were identified as Beetal goats in Gurdaspur and Amritsar districts, respectively (Table 5).

Management practices

Information on management practices for goat rearing was generated by interviewing 353 goat keepers in the breeding tract. Only one percent of the flocks were migratory and the rest were stationery. The goats were taken out for browsing by the owners themselves (96 percent). As there are no forest areas left, the goats were taken to roadside and canal embankments. The mortality was high due to worm infestations, as de-worming practices were not followed. The long ears were pruned to avoid injury. About 51 percent of breeders kept their own buck for service while others did it on a payment basis.

Almost all the Beetal females were reared on browsing whereas only 43 percent of adult males were taken out for browsing. Goats were fed mostly in groups and only 38 percent of adult males were fed alone. Fodder was generally purchased. Water was

sufficient and supplied through hand pumps. Eighty-nine percent of the respondents bathed their animals.

Morphological characteristics

Morphological characteristics and body measurements of Beetal goats are presented in table 6. Figures 4 to 6 show a breeding buck, a milking doe and a Beetal kid, respectively. The hair was of medium length and straight. The body colour was generally black but some animals with white spots were also available. Very few animals were brown in colour. The skin colour was predominantly grey. Lips, eyes, hooves and tail switch were black. Eighty-five percent adult males and 93 percent adult females were horned. The horns were either brown or grey in colour. The horns were twisted in 51 and 58 percent adult males and females, respectively. Sixty-five percent adult males and 85 percent adult females had horns turning backwards. The ears were long and hanging. The forehead was convex with a typical Roman nose. Wattles were present in only 15 percent males. Teats were either funnel (50 percent) or tube (44 percent) shaped. The teat tips were

Table 7. Average test day milk yield ± SE (kg) of Beetal does[a].

	Lactation number				
Test day	1	2	3	> =4	Pooled
1	1.7 ± 0.83 (232)	1.8 ± 0.84 (324)	1.9 ± 0.86 (221)	2.0 ± 0.95 (142)	1.9 ± 0.87 (919)
2	1.7 ± 0.75 (294)	1.8 ± 0.75 (394)	1.8 ± 0.79 (285)	2.0 ± 0.86 (164)	1.8 ± 0.78 (1137)
3	2.1 ± 0.73 (291)	2.2 ± 0.78 (388)	2.1 ± 0.74 (290)	2.2 ± 0.77 (169)	2.1 ± 0.76 (1138)
4	2.0 ± 0.63 (286)	2.1 ± 0.59 (386)	2.1 ± 0.57 (288)	2.1 ± 0.54 (162)	2.1 ± 0.59 (1122)
5	2.0 ± 0.63 (272)	2.1 ± 0.63 (380)	2.1 ± 0.61 (286)	2.0 ± 0.61 (158)	2.0 ± 0.63 (1096)
6	1.9 ± 0.76 (257)	2.1 ± 0.73 (354)	2.0 ± 0.80 (274)	1.8 ± 0.84 (148)	2.0 ± 0.78 (1033)
7	1.8 ± 0.83 (226)	1.9 ± 0.79 (332)	1.9 ± 0.81 (246)	1.8 ± 0.80 (125)	1.9 ± 0.81 (929)
8	1.6 ± 0.79 (202)	1.7 ± 0.74 (302)	1.6 ± 0.77 (216)	1.6 ± 0.78 (108)	1.6 ± 0.77 (828)
9	1.5 ± 0.71 (180)	1.5 ± 0.70 (275)	1.5 ± 0.68 (192)	1.3 ± 0.74 (97)	1.5 ± 0.71 (744)
10	1.3 ± 0.62 (155)	1.3 ± 0.67 (251)	1.3 ± 0.65 (172)	1.3 ± 0.75 (84)	1.3 ± 0.66 (662)
11	1.2 ± 0.54 (110)	1.2 ± 0.52 (199)	1.1 ± 0.52 (141)	1.1 ± 0.53 (59)	1.2 ± 0.53 (509)
12	0.9 ± 0.34 (63)	0.9 ± 0.38 (128)	0.9 ± 0.32 (97)	1.0 ± 0.29 (37)	0.9 ± 0.35 (325)
Average	1.8 ± 0.77 (2568)	1.8 ± 0.78 (3713)	1.8 ± 0.79 (2708)	1.8 ± 0.82 (1453)	1.8 ± 0.79 (10442)

[a]Numbers of record are in brackets

Table 8. Production characters of Beetal does.

Lactation no.	N	Lactation length±SE	Estimated milk yield
1	196	150.6 ± 52.56	264
2	282	168.2 ± 50.91	303
3	220	164.2 ± 51.09	294
>=4	133	154.6 ± 50.74	283
Pooled	831	160.8 ± 51.83	288

mostly pointed (72 percent) or rounded (26 percent). The milk vein was of medium size in 68 percent and small in 21 percent of the females. Most of the Beetal animals were docile.

The average body length, height and girth were 90, 81 and 83 cm, respectively in males and 64, 70 and 69 cm, respectively in females. Mishra (1979) reported body length, height and girth as 61.3, 63.9 and 59.8 cm, respectively, in females.

Production parameters

The average test-day milk yield was 1.8±0.79 kg (Table 7). Average daily milk yield recorded in this study in field conditions was much higher than 650–810 g reported by Gupta and Gill (1983) and 770 g by Rana and Dalal (1998) in farm conditions. This indicated that Beetal goats available in the breeding tract are superior. The average lactation length varied between 151 and 168 days with an overall average of 161 days (Table 8). Estimated milk yield per lactation was about 288 kg. Bhatnagar and Chawla (1984) reported a lactation milk yield and lactation length of 157 kg and 186 days, respectively in Beetal goats maintained at the National Dairy Research Institute, Karnal.

Reproduction parameters

The average age at first service and age at first kidding was 11.11 and 17.2±3.20 months, respectively. Mishra *et al*., (1979) also reported age at first kidding of 17.3 months while Singh and Acharya (1983), Kanaujia *et al*., (1987) and Rana and Dalal (1998) reported longer age at first kidding in Beetal goats (ranging from 21 to 25 months). Beetal goats kidded for the fifth time at about 5¼ years of age. Average service period was 5.2 months and average number of services per conception was 2.4±0.78. Average kidding interval, gestation period and number of kids per kidding were 11.1, 5.21 and 1.76 months, respectively. Mishra *et al*., (1979), Bhatnagar and Chawla (1984) Kanaujia *et al*. (1987) and Singh and Acharya, (1983) reported kidding interval in the range of 10.3 to 12.6 months. Rana *et al*. (1981) and Kanaujia *et al* (1987) recorded a slightly lower gestation period in Beetal goats (4.8-4.9 months). Similar litter size (1.7) was reported by Mishra *et al*. (1979) whereas Gupta and Gill (1983), reported lower kidding rate of 145 percent in Beetal goats as compared to that of this study.

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A review of conservation and management of the Pantaneiro horse in the Brazilian Pantanal

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Summary

The Pantaneiro horse is an important social and economic part of the infrastructure of cattle farms in the Brazilian Pantanal. It is of Iberian origin and closely related to other Brazilian breeds, specifically Mangalarga, Mangalarga Machador and Campolina. Physiological studies have shown this horse to be tolerant to long treks and capable of being maintained on natural pastures. The Brazilian Pantaneiro Horse Breeders' Association has registered, to date, approximately 1 600 mares and 300 stallions, the bulk of which are in the Poconé subregion. The horse is considered small and fast. Linear measurements taken at registration are shown to be, in general, highly heritable. The population has a vulnerable status. Characterization studies showed that a combination of genetic and physical characteristics of the Pantaneiro makes it a unique population that must be conserved. Recent trends in selection may threaten the rusticity and adaptability of this valuable genetic resource. In this paper, several research studies are reviewed and areas where research and technical training are needed are highlighted.

***Key words**: History, Characterization, Genetics, Physiology, Growth, Phenotype.*

Resumen

El caballo Pantaneiro es muy importante para la ganadería del Pantanal brasileño bajo el punto de vista social y económico. Estos animales son oriundos de la Peninsula Ibérica y están muy relacionados con otras razas caballares brasileñas, concretamente Mangalarga, Mangalarga Machador y Campolina. Estudios fisiológicos han mostrado que estos animales son resistentes a largas cabalgatas y capaces de mantenerse en pastizales naturales. La Asociación Brasileña de Ganaderos del Caballo Pantaneiro, ubicada en la subregión de Poconé, MT, posee hoy por hoy, cerca de 1600 yeguas y 300 sementales registrados. Estos caballos son considerados pequeños, veloces y con medidas morfométricas lineares de alta heredabilidad. La población se encuentra vulnerable y los estudios han mostrado que la combinación de genética y características físicas del caballo Pantaneiro apuntan para una población única y que debe ser conservada. Recientes tendencias en la selección apuntan amenazas en la rusticidad y adaptabilidad de este precioso recurso genético pantaneiro. En este artículo, varias investigaciones llevadas a cabo son revisadas y se apunta nuevas tendencias o inquietudes de investigaciones futuras.

Introduction

The Pantanal is a vast floodplain, situated in the central-west region of Brazil, characterized by distinct rainy and dry seasons (Figure 1 and 3). The intensity of flooding depends on rainfall, which presents multi-year cycles of greater or lesser intensity. In this region, beef cattle are the main economic source of income. The Pantaneiro horse is adapted to the bioclimatic conditions of this region, constituting an important economic and social factor, a must for the cattle industry and for regional transportation (Santos *et al*., 1992).

Historical and Actual Situation of the Pantaneiro Horse

The Pantaneiro horse has its probable origin from Iberian horses introduced by Spanish settlers, especially in the 16th and 17th centuries. Only in the 18th century, with the opening of a route from São Paulo to Cuiabá, through Goiás, were the horses introduced in the Pantanal. These came from the Brazilian coast, the main region of Portuguese colonization (Santos *et al*., 1992). The Guaicuru Indians were also important in the dissemination of horses in the Pantanal. As a consequence of natural selection for more than two centuries, with little or no human interference, an animal well adapted to the environment appeared.

At the end of the 19th century, the population of the breed was severely reduced mainly due to *Peste das cadeiras* (Trypanossomiasis). Later, other menaces to survival appeared, mainly indiscriminate cross-breeding and more recently Infectious Equine Anemia (AIE). Only in 1972, with the creation of the Brazilian Pantaneiro Horse Breeders' Association (ABCCP), was the breed standardized by uniting the different phenotypes. The ABCCP still has an open book for the registration of horses. In the Pantanal, there is an estimated population of 119 000 horses, mainly cross-bred. Of these,

Figure 1. Typical view of the Pantanal in the dry season (Source: Sandra Aparecida Santos).

there are about 1 600 mares and 300 stallions (Figure 4) registered in the ABCCP and the bulk of them are in the Poconé subregion, whose breeders collaborated in the creation of the ABCCP. Since the endangered status of animal breeds is determined by the size of breeding stock (Bodó, 1990), the Pantaneiro horse is classified as vulnerable and measures must be taken to prevent a further decrease in the population.

Genetic Characterization

Efforts to conserve rare breeds of domestic animals must take into account, conservation of genetic variability. Cothran *et al*. (1998) studied the genetics of the Pantaneiro horse. Individual genetic variation within the Pantaneiro (Ho) was slightly greater than mean Ho for 102 domestic horse populations (0.387 and 0.375, respectively). Thus, from a genetic conservation standpoint, there is no immediate concern about reduced genetic variation within the breed. Similarly, the population variation measures of the Pantaneiro were slightly greater than the means for domestic breeds with values of Hardy-Weinberg expected heterozygosity (He) at 0.369 compared to 0.365, effective number of alleles (Ae) of 2.68 compared to 2.397 and total number of variants found in each population (Na) of 72 compared to 64.99. Both individual and population estimates of genetic variation of the Pantaneiro indicate that variation levels are normal for horses and that there is no indication of inbreeding. There should be little concern for maintaining genetic variation within the breed as long as population size is maintained and there is no drastic change in breeding practices. For example, concentrated use of particular stallions would likely result in a loss of variation, especially if such a practice was continued for many years. The data show that the Pantaneiro horse has Iberian origin, as indicated by their known history and it was most closely related to other Brazilian breeds, specifically Mangalarga, Mangalarga Machador and Campolina.

Phenotypic Characterization

Conformation

Although concepts of perfect conformation vary among breeds, all breed registries agree that the overall quality and balance of a horse's build should be symmetrical and proportional to its size (Martin *et al*., 1978).

Fontes *et al*. (1987) established the norms for the Pantaneiro horse. For registration, the males must have a minimum shoulder height of 140 cm and females 135 cm. Morphologic aspects were analysed through genealogical registry charts, in collaboration with ABCCP (Santos *et al*., 1995, Miserani *et al*., submitted for publication). Pantaneiro horses usually stand between 134.7 and 143.4 cm high. Colours vary widely and include dapple-grey (35 percent), chestnut (27 percent), bay (21.8 percent), sorrel (6.4 percent), roan (4.2 percent) and grey (3.7 percent). According to Miserani *et al*. (submitted) the registered animals of the ABCCP from the Corumbá region were generally larger than animals from the other regions. Body index analysis indicates that these animals are considered as small and fast (McManus *et al*., 2001). Heritabilities for linear body measurements were medium to high (Miserani, 2001) and genetic correlations between most traits close to 1.00.

Today, the breeders are interested in selecting the Pantaneiro horse for expositions and auctions. Therefore, they place emphasis on desired conformation and have changed the natural environment, especially the diet, sometimes, without adequate criteria. The evaluation of genetic merit of the Pantaneiro horse population should include adaptability to the local environment, resistance against diseases and other traits balanced according to the intended use.

Growth curve

Growth curves reflect the lifetime interrelationships between an individual's inherent impulse to grow with the environment in which these impulses are

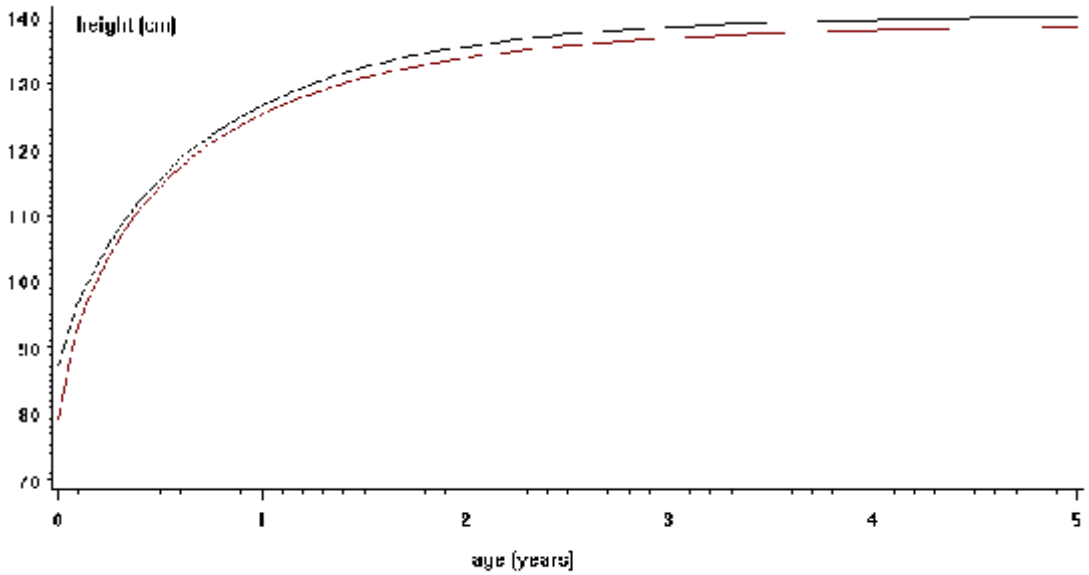

Figure 2. Height model functions for males (uppercurve): E(h) = 140.225 - 52.931 exp $(-1.360t^{.835})$ *and females:E(h) = 139.016 - 58.913 exp* $(-1.472t^{.732})$ *based on average values of parameters.*

expressed. The majority of the studies on the horse are based on weight, height, chest girth and cannon bone circumference (Santos, 1989). Of these measurements, height has more practical interest because it is required for the purpose of description and classification of horses, while weight is more a measure of the physical condition of the animal (Reed and Dunn, 1977).

Santos *et al*. (1999) used non-linear models to describe height growth curves in Pantaneiro horses from birth to 36 months age of 26 Pantaneiro horses raised on the Nhumirim farm. The animals were maintained in native pastures without supplementation. The Weibull model was chosen (Figure 2). Results showed that the mature height for males (140.2 cm) was below the mean for Pantaneiro males registered in the Association (ABCCP, C = 142 cm). For females the opposite was observed (study, X=139 cm and ABCCP, X=137 cm). There are two explanations for this. Firstly the males registered in the Association were selected animals and secondly the males in this study may not have reached maturity. Miserani *et al*. (submitted) note that the two and three year old horses were significantly smaller at registration than the other horses and if these data are used for selection, registration should be delayed until the horses have reached their mature size. Reed and Dunn (1977) studying Arabian horses observed that the mature height at withers for females was achieved by 48 months of age whereas males grew another 1 cm from 48-60 months of age.

Functional performance

In the Pantanal, the large distances between farms means that the horses have to walk for long distances in high environmental temperatures, over swampy and sandy terrain. Therefore, it is important to study the exercise physiology of the Pantaneiro horse as an adaptability criterion. Work endurance is one of the most important objectives for conservation. Athletic ability is determined by three main factors: genetics, environment and training. Studies of groups of identical twins has shown a strong genetic component for

Figure 3. Pantaneiro horse grazing in flooded field (Source: Revista Manchete Rural).

athletic performance, estimated to be between 40 and 60 percent for maximal oxygen consumption and endurance capacity, respectively (Derman and Noakes, 1994).

Training or conditioning implies creating progressively adaptive changes in response to correctly applied physical and mental stresses. Ability to withstand metabolic stress requires an increase in maximal oxygen intake, increase and enhancement of the oxidative capacity of muscle, increase in the efficiency of carbohydrate, fat and protein utilization and enhancement of the horse's thermoregulation abilities. Horses raised in a natural environment undergo early physical stress that helps to maximize genetic potential by tissue adaptation at an early age. This makes the conditioning progress more rapid while incurring less risk of injury (Ridgway, 1994).

Evaluation of performance potential requires an understanding of the physiological mechanisms involved in the energetics of exercise. As successful athletic performance is multifactorial, no single measurement will accurately predict exercise capacity. The most common measurements are: estimation of heart size and heart rate; hematology and plasma or serum biochemistry; muscle biopsy; conformation and score condition and treadmill testing.

Heart rate

Of all the measurements available to assess fitness and ability to continue an endurance ride, the heart rate is important because all other measurements used are reflected in the heart rate. Santos *et al*. (submitted) evaluated the heart rate of Pantaneiro horses during a 76 km ride in the Pantanal. The horses were divided into two groups (with and without work and supplementation) for one month before the ride: 1) four horses maintained on natural pastures, without work and supplementation for one month before the ride; and 2) four horses maintained on natural pastures with supplementation and working

for one month before the ride. The horses in groups one and two showed mean values of 60 and 56 beats per minute after 30 minutes of rest, respectively, indicating a good recovery response. Group 2 showed better adaptation to the level of exercise (applied stress) because they were working. Recovery heart rates can be used for determining the level of fitness and the ability to continue during exercise. Horses should be rested until the HR drops to 64 beats / minute or less. The 'true resting heart rate', when the animal is resting quietly in a pasture would fall between 24 and 36 beats / minute (Ridgway, 1994). In relaxed horses, resting heart rate is usually 25-40 beats / minute (Evans, 1994) and when saddled and ready to work 36 and 48 beats / minute, similar to mean values found with Pantaneiro horse (46 and 47 beats / minute, for groups 2 and 1, respectively).

Hematology and plasma or serum biochemistry

This provides access to the function of a range of body systems, which are crucial in the assessment of the athletic horse. During exercise, substantial sweat loss of electrolytes and the extent of fluid loss depends on the ambient temperature and humidity. The most extreme sweat losses are found during hot and humid conditions. Alterations in electrolyte concentrations could seriously affect work or athletic performance (Evans *et al*., 1995). The adaptive mechanisms to hypothermia and possible effects of acclimatization have not been studied intensively in horses, especially in the native (local) breeds that suffered adaptation due to environmental conditions such as the Pantaneiro horse.

Santos *et al* (1997; submitted) also evaluated biochemical parameters in the two groups of Pantaneiro horses submitted to an endurance ride of 76 km (described above). Serum concentration of total protein, albumin, sodium, potassium, chloride, calcium and phosphorus (Table 1), glucose and free fatty acids (FFA) were measured. Samples were taken before the ride (preride), during the mid point (midride), at the end of the ride (postride) and after a 30 minute recovery period (rest). In both groups, there was a significant decrease in calcium and potassium and an increase in sodium and phosphorus during the ride.

Table 1. Serum total protein (TP) and electrolyte means values (± SE) in two groups of Pantaneiro horses during a 76 km endurance ride.

	TP (g/l)	ALB. (g/l)	Na (mmol/l)	K (mmol/l)	Cl (mmol/l)	Ca (mmol/l)	P (mmol/l)
GROUP I							
Preride	57.2±7.1	27.2±1.9	119.2±6.3	6.3 ±2.3	83.3±15.5	3.3±0.3	0.81±0.2
Midride	63.0±1.5	31.8±3.2*	130.3±2.3*	4.6±1.0	74.5±3.8	2.1±0.4*	1.97±0.4 *+
Postride	62.0±6.1	29.6±2.1	134.3±8.6*	3.9±0.6*	74.7±12.8	1.6±0.3*	2.12±0.5*+
Rest	64.5±2.4	31.8±3.0	129.3±7.1*+	3.3±0.4*	68.6±4.8	1.8±0.4*	2.00±0.1*+
GROUP II							
Preride	66.0±4.6	24.8±1.0	115.6±4.5	4.8±0.2	71.1±4.6	3.5±0.6	0.68±0.2
Midride	64.7±2.9	28.2±0.6	128.3±4.4*	4.2±0.5	71.0±7.7	2.3±0.4*	2.64±0.4*+
Postride	64.6±2.2	28.1±4.5	133.0±8.5*	3.6±0.3	66.8±5.1	1.9±0.5*	3.06±0.3*+
Rest	67.5±2.1	29.5±4.6	139.5±3.5*+	4.4±2.3	67.5±4.2	2.2±0.5*	3.29±1.1*+

*Significantly different ($P<0.05$) from preride value.
+Significantly different ($P<0.05$) between groups.

With relation to glucose and FFA, the values increased during the exercise in the two groups. However, the values of serum glucose and FFA were significantly different between the groups, indicating that mobilization of the substrates depends probably on the physical condition, training and feed supplementation.

Blood or plasma lactate concentration is valuable information for evaluating exercise intensity and/or metabolic capacity of horses. Elevations in the rate of lactate production reflect an increased contribution of the anaerobic pathways to energy production. According to Evans *et al.* (1995) resting blood lactate concentrations in the horse is approximately 1-1.5 mmol/l, while Hodgson (1996) considers values normally bellow 1 mmol/l. Santos et al. (1996) determined changes in lactate (Table 2) during the course of a ride through the Pantanal.

Several major adaptations occur following physical training that influence lactate metabolism including improved circulatory function and metabolic efficiency of skeletal muscle (Hodgson, 1996). Trained horses show lower blood lactate concentrations at the same work speed (Evans *et al*., 1995), thus, Pantaneiro horses appeared to be better trained than other breeds during the ride. In general, a slight increase in lactate showed that anaerobic glycolysis was not an important factor and that the animals were working within their capacity for aerobic exercise.

Muscle biopsy

Hystochemical methods have shown that most mammalian muscles consist of a mosaic of muscle fibre types with varying metabolic and contractile properties. On the basis of myosin-ATPase activity at pH 9.4, two distinct fibre types exist. Those with low activity have been named type I fibres, and those with high activity are called type II fibres. The type II can be divided into the subtypes IIA, IIB and IIC.

Rosa (1997) determined the types of fibres of sixteen Pantaneiro horses. They were divided into four groups: mare, foal, castrated male and stallions. To classify the different types of muscle fibres, a biopsy was carried out with a Bergstrom needle (4.5 mm), to obtain samples from middle gluteal muscle. The results showed that Pantaneiro horses had greater proportion of the type I fibres (Table 3), so it can obtain better results over long distances or endurance events. In relation to the transversal section, the type I fibres were smaller (1 334 μm^2), followed by the type IIa (2 283 μm^2) and type IIb (3 743 μm^2). This pattern occurred in all groups.

Management and conservation

Seeking the conservation and encouragement of Pantaneiro horse-breeding, the EMBRAPA Pantanal Agricultural Research Center and Genetic Resources Research Center (CPAP

Table 2. Lactate concentration means (mmol/l) before (pre) and after (post) riding (340 km) in Pantaneiro, Criollo, cross-breed Criollo and mules.

	Pre	Post*
Pantaneiro	0.63±0.1	0.71±0.1
Crioulo	1.28±0.78	1.38±0.9
Cross-breed Crioulo	1.22±0.47	1.50±0.6
Mules	1.29±0.3	1.50±0.2

*Post riding blood samples were taken 30 minutes after the horses travelled the 340 km in 12 days.

and CENARGEN – EMBRAPA) established a conservation nucleus, *in situ*, at the Nhumirim Ranch, subregion of Nhecolândia, Pantanal. The base herd consisted of 30 mares and three stallions. The stallions were selected in accordance with the ABCCP norms and were substituted every three years. Sereno *et al*. (1997) established a breeding season from October to February. This allowed foaling to be concentrated, thus facilitating management. The percentage of pregnancy and parturition observed in 1990/1991 and 1991/1992 for the male:female proportions of 1:17 and 1:15 were 82.3, 100, 86.7 and 100 percent, respectively.

Horses in the nucleus share natural rangeland with cattle and wild herbivores. According to Bodó (1990), the maintenance of a local feeding system is obligatory because it is an important element of adaptation. He described that sometimes it is not easy to safeguard the traditional conditions because people do not want to live in such a way. This fact has been observed in several nuclei of Pantaneiro horses, described earlier.

For the conservation of the Pantaneiro horse, the conservation of the Pantanal region, considered that the patrimony of humanity, is also important. Farms in the Pantanal explore natural resources. The impact of the introduction of domesticated animals, such as horses and cattle, was so long ago that there is no record of the changes that occurred or the organisms that were lost. Today, the major challenge in rangeland management centres on how to manipulate grazing and browsing animals so as to maintain the ecological sustainability. Thus, ecological sustainability is a pre-requisite for social sustainability. A practice that is not ecologically sustainable will be neither economically sustainable nor socially acceptable in the long-term (Heitschmidt and Walker, 1997), therefore, the knowledge of key processes such as diet and habitat selection is fundamental. Santos *et al*. (1993, 1999) studied seasonal forages and habitat use of Pantaneiro horses in two subregions: Nhecolândia and Abobral (low Pantanal). In the Nhecolândia region, horses selected 'open grasslands' in the dry season (April/September) and the edge of 'permanent ponds' in the rainy season (October/March), with percentage of use of 64 and 47.5 percent, respectively. In the dry season, the most consumed forages were *Axonopus purpusii* (40 percent) and *Panicum repens* (13 percent). In the rainy season, the forages consumed included *Reimarochloa brasiliensis* (28.3 percent) and *Axonopus purpusii* (14.7 percent). In the Abobral subregion, horses selected lowlands, mainly 'temporary ponds' during the dry year (without inundation) and 'open grassland' and 'lowlands' during the wet year. The forage species most commonly consumed by horses were *Panicum laxum*, *Eleocharis minima*, *Reimarochloa brasiliensis and Axonopus purpusii*. The lowland areas are the habitat selected by Pantaneiro horses because they provide preferred forage species. Santos (1997) established recommendations on nutritional management for horses on native pastures in the Pantanal. However, more studies are necessary on adequate stocking rates compatible with environmental considerations.

Table 3. Muscle fibre types in Pantaneiro horse (%).

Group/Fibre	Type I	Type II	Type III
Mares	64.24±6.23	16.33±4.26	19.42±5.02
Foals	46.12±9.51	27.56±6.04	26.30±10.52
Stallions	60.28±6.11	27.16±5.08	12.55±2.04
Castrated males	65.62±2.61	17.91±2.97	16.45±4.97

Figure 4. Pantaneiro Stallion (Source: Sandra Aparecida Santos).

In the Pantanal, several diseases have caused high mortality in horses, such as Infectious Equine Anemia (AIE), Pitiose Equina, Encefalites and respiratory diseases. The most important of these is AIE, an infectious viral disease. It may occur as an acute, subacute or chronic illness, but has a marked tendency to assume a subclinical form. AIE was probably introduced in the middle of the 20th century and prophylaxis is suggested. Positively tested Pantaneiro horses are not registered by the ABCCP. However, due to the high prevalence of AIE (49 percent) in the Pantanal, it became impractical to sacrifice all positive horses and the control of AIE for Pantanal horses was proposed (Silva *et al*., 1997). Segregation, isolation and / or destruction of all infected horses; testing of all incoming horses to prevent the re-introduction of AIE carriers; and no re-use of needles and isolation of foals out of positive mares with a re-test after six months of age, were recommended. Bodó (1990) considered it dangerous to develop populations resistant to infectious diseases because the whole stock may be destroyed. In some cases there is the danger of infecting human population and other domestic and wild animals.

In the Nhumirim' nucleus, where the test is taken annually, all horses are negative for AIE. The horses are vaccinated against rabies and encephalitis. The herd (five percent) suffered from '*Pitiose equina*', which produces ulcerative granulomas and occurs mainly during the inundation period. The main etiologic agent is a fungus *Pythium insidiosum*. Studies are being carried out with the objective to develop a vaccine against '*Pitiose equina*' (Catto, personal information).

General considerations

Worldwide, there has been homogenization of the mean weight of horse populations and a disappearance of local breeds. This trend is mainly dictated by fashion, that is, the development of a modern sport horse. Today, the Pantaneiro horse is not an endangered

breed due to the creation of the ABCCP. However, the population has a vulnerable status. Characterization studies have shown that a combination of genetic and physical characteristics of the Pantaneiro indicted that it is a unique population that must be conserved.

Breeders of the Pantaneiro are interested in selection within the breed. This aims mainly at the improvement of the conformation and an increase in size. However, selection of the Pantaneiro should maintain its valuable characters acquired through natural selection.

For conservation purposes, the breed should be kept as much as possible in its natural habitat and its genetic diversity maintained. According to Cook (1992), most breeders of pedigree horses currently favour genetic uniformity (homozygosity), however, both genetic conservation and long-term breed development, depend on retaining genetic diversity. Audiot *et al*. (1992) considered that in conservation programmes, it is essential to take into account the variety of interests and tendencies of the breeders, attempting to adapt individual projects to a single common interest project. Only with cooperation among different institutions (regional, national and international), breeders and the ABCCP, will it be possible to define adequate conservation programmes which maximize effective population size. Thus, the establishment of a specific research entity (laboratory, place for physical tests, etc.) for the evaluation and study of the breed is necessary.

According to Alderson (1992), in medium-sized populations, plans would be based on a rotational mating system, which involves some line-breeding to maintain distinctive lines and cyclic crossing to restrict the increase in the level of inbreeding in the total population. Thus, studies are necessary on the genealogy of the Pantaneiro horse through registry data. Alternatively, DNA fingerprinting can be employed to study the genetic structure of the breed in which the pedigree record is absent or unreliable (Cook, 1992). In addition to conservation programmes, a system of breed evaluation needs to be established. For this, it is necessary to carry out more studies on characterization and evaluations of biological merit (e.g. adaptability and resistance to the local environment).

Pantaneiro horse conservation through DNA storage is carried out by Embrapa Recursos Genéticos e Biotecnologia (Cenargen).

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Characterization of Beldi chicken and turkeys in rural poultry flocks of Morocco. Current state and future outlook

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Summary

The main characteristics of Beldi (meaning "native" in Arabic) poultry raised in rural areas were studied in the Khenifra Region through extensive surveys.

Beldi chickens have large phenotypic variability. Black, brown, grey and white colours, pure or mixed, are frequently observed in chickens' featherings while turkeys are predominantly bronze. Plumage types were fairly homogeneous in both species. Single combs and dented combs were respectively predominant in chicken hens and roosters.

Sexual maturity was reached at 154 days for roosters, 168 for hens in chicken, around 217 days for toms and 231 for turkey hens. The age at first egg averaged 5.8 months for hens and 8.4 months for turkey hens. The number of eggs laid per hen per year was 78 for chicken and 69 for turkey. Hatchability rate was 78 and 80 percent for chicken and turkeys, respectively. Diseases were the main cause of mortality, which could affect up to 77 percent of chicken flocks.

Few preliminary urgent steps for the conservation of Beldi poultry are discussed with other production improvement proposals.

Résumé

Les caractéristiques des volailles Beldi (locales en arabe) élevées dans le milieu rural ont été étudiées dans la région de Khénifra à l'aide d'enquêtes exhaustives. Outre l'observation directe et la description, les performances de production, de reproduction et les taux de mortalité des animaux (et leurs causes) ont été relevés. Les conditions de logement, d'alimentation et d'abreuvement ont été décrites.

Les volailles demeurent caractérisées par une variabilité phénotypique étendue. Les couleurs noire, brune, grise, et blanche, dominantes ou associées ont été fréquemment observées au niveau des plumages des poules alors que le noir est dominant pour les dindons. L'emplumement est régulier chez les deux espèces. Les crêtes sont plutôt simples chez les poules et dentées chez les coqs.

La maturité sexuelle a été atteinte vers 154 jours chez les coqs (168 chez les poules) et vers 217 jours chez les dindons (231 chez les dindes). L'âge moyen d'entrée en ponte a été de 5.8 mois pour les poules et de 8.4 mois chez les dindes. La ponte annuelle a été de 78 œufs par poule (celle des dindes a été de 69). Les taux d'éclosion observés ont été de 78 et 80 pourcent chez les poules et les dindes respectivement. Les maladies ont été les principales causes de mortalité dont les taux peuvent atteindre 77 pourcent.

Quelques étapes préliminaires urgentes préalables à la conservation des caractéristiques du Beldi ont été discutées avec d'autres propositions d'amélioration des productions.

Keywords*: Breeds, Chickens, Genetic resources, Morocco, Phenotypic characteristics, Performance, Poultry, Turkey, Strains.*

Introduction

In spite of the exponential growth observed in the industrial sector of poultry production in Morocco, rural poultry flocks remain a steady supplier of highly appreciated products by the consumers (Benabdeljelil, 1983).

The rural poultry, distinguished from the common white imported broad breasted strains of broilers, are called “Beldi”: a standard name for a variety of birds meaning “native” in Arabic. Poultry products from traditional systems have always contributed to the diet of the local population as a readily available and economical meat source.

In a review of the history of poultry production on the eve of the start of its industrial sector, Agenor (1973) reported that exports of eggs and poultry had always been a significant component in trade in Morocco.

The relative adaptation to harsh conditions and scarce feeding resources have made the Beldi flocks a long-term sustainable supplier to the local population of high quality nutriments with distinct characteristics. Various reports described the Beldi as a light weight bird with no specific laying or growth abilities producing "white eggs", (from beige to brown) ranging in weight from 35 to 45 g. Its laying rate runs from 50 to 60 eggs per year. No special housing is provided and flocks are often decimated by diseases (Agenor, 1973).

Virtually all farmers in most regions of Morocco keep poultry flocks of variable sizes raised in back-yard systems, intensive or semi–intensive production systems or on range. While Beldi chickens are widely distributed in most villages and towns, turkey flocks are rather confined to plain areas (Tadla, Doukkala, Chaouia) where rangeland is available. Water fowl is frequently encountered in areas where water is plentiful (e.g. Gharb, Tangerois, etc.) (Vaysse, 1950).

The demand on Beldi poultry products has increased because of their nutritious and healthy image as natural products, as the

Figure 1. Laying hens with various phenotypic characteristics.

Figure 2. The desired type of roosters.

birds are raised in a clean environment with no industrial residues. Furthermore, there is somehow a unanimous recognition of the high organoleptic properties of their meat and eggs, markedly superior to that of the so-called industrial modern birds (considered as lacking flavour and taste).

Beldi birds whether chickens or turkeys are always priced higher than other birds.

Very little is known however, about these flocks, their management, bird performance, disease resistance and adaptation to local conditions.

The aim of this study was to assess the current state of Beldi flock farming, to investigate their performance, management and productivity. Special attention was given to the assessment of the most limiting factors to raising Beldi chickens in rural systems and specific recommendations were also discussed.

Material and Methods

Location

The Khenifra Region was selected for this study because it was representative of several villages of the Middle-Atlas Mountains. The people of that Region preserved much of their cultural identity and traditions with very little input from the city. The area selected for the enquires was considered relatively uninfluenced by large-scale urbanization and yet relatively easily accessible at all times.

Duration

The information for the study was gathered in 2000 and 2001, after the usual harsh conditions of the wintertime.

Data collection and analysis

Participants in this study included all local households raising poultry (i.e. 52 out of 106 households) and those involved in the selling channels (nearly 12 intermediaries). All the households were interviewed by a team to provide an overall view of the socio-economic environment of the flocks and their owners. This preliminary phase lasted for the first three months of the study and was further completed during two yearly investigations conducted.

All data regarding flock size and composition, productive and reproductive performance and management were analysed with descriptive statistical methods and involved 554 chickens and 168 turkeys in 52 households.

Results

General information

Rural poultry keeping was essentially women's business. Seventy-three percent of the flocks were managed by women and represented their main activity in 58 percent of the cases. Ninety-four percent of the households owned chickens and 36 percent owned turkeys.

Fifty-four percent of the birds in the flocks were hatched on the farms while 46 percent were purchased mostly from the weekly rural markets. Poultry were by far the most prevalent livestock raised on the farm with flock size ranging from 0 to 58.

Each household owned on average 11 chickens and / or nine turkeys. The size of each individual turkey flock ranged from two to 25 birds, most of the flocks having between six and 11 turkeys. These numbers were for turkeys especially, survivors of larger clutches (hatched usually by a hen). The ratio of males to female was 1:1.7 for turkeys and 1:4.6 for chicken flocks (both figures did not seem to be a specific target aimed at by farmers). Beldi chicken flocks ranged in size from 1 to 38. Occasionally, turkeys and guinea fowls were kept with the chicken.

Description of the birds

Beldi chickens were characterized by a wide phenotypic variability particularly in plumage colour. Various colours were present (Figures 1 to 3).

Black, brown, grey and white colours pure or mixed, were frequently observed whereas mainly bronze turkeys were encountered. Fourteen naked necks (3.1 percent of the total birds observed) and no frizzled feathering was observed in chicken.

Barred, mottled and "mille fleur" patterns were observed in feathering in chickens. Four types of combs were the most frequently encountered; namely lobular (33 and 30 percent), dented (37 and 28 percent) leafy (4 and 4 percent) and single (26 and 38 percent) in roosters and chicken hens, respectively. Eggshell colour ranged from white to dark brown in chickens.

Management conditions

Rudimentary housing consisting of a variety of home-made shelters was made available in 79 percent of the households (an increased ratio compared to 64 percent in 1986 and 71 percent in 1993). Local materials such as bamboo, wood, stones and plastic screens were used in small unpaved windowless compound yards (Figure 4 and 6).

The birds spent the night in most cases on trees, in barns, on roofs and in sheepfolds, etc. The newly hatched chicks were usually kept in open areas of the houses whereas the

Figure 3. Birds with naked necks

Figure 4. A turkey clutch fed in the open area of a house.

young and laying birds were kept around the house in enclosed plots of land. Rarely were the flocks kept in total enclosure.

Poultry were encouraged to forage in and around the compound of the households and in leaf litter, with little or no feed supplementation.

Supplementary feeds provided (i.e. wheat bran, barley, wheat, screenings, corn, compound feed, dry bread and kitchen leftovers) were mostly locally available (25 to 95 percent of the cases) and were given on the floor or in recycled pots. Cereals, weed seeds, insects, worms and various herbs were the main feed resources scavenged by the birds.

About 94 percent of the surveyed farmers supplied their birds with water in rudimentary pottery pots, earth and plastic ware, cans and a variety of other recipients from their wells (61 percent) or from natural springs (9 percent).

Reproductive performance

Sexual maturity was reached at about 154 and 168 days for roosters and hens and around 217 and 231 days for turkey toms and hens, respectively. The age at which hens laid their first egg was 5.8 months for hens and 8.4 months for turkeys. Sixty-nine days separated two laying cycles on average for chickens whereas the number of clutches per year amounted to two or three. Hatchability figures were 78 percent (from 46-100 percent) for chickens and 80 percent (from 0-94 percent) for turkeys as shown on table 1.

Owners selected eggs for incubation based on hen performance, body size, egg size and colour and the presence or absence of males in the flocks. Rankings of these parameters were quite variable among households reviewed. Clutch size was on average 14 for a chicken hen (from eight to 20) and 19 for a turkey hen (14-30) depending on egg size and hen body size. The average number of

Table 1. Reproductive performance of Beldi chickens and turkeys.

	Chickens				Turkeys			
Performances	n[1]	Average	Min	Max[2]	n[1]	Average	Min	Max[2]
Sexual maturity								
Male (month)	50	5.50±1.33	-	10	19	7.70±2.75	-	12
Female (month)	50	5.80±1.24	-	10	19	8.20±3.37	-	18
Age at first egg (days)	52	5.80±1.13	4	10	19	8.40±2.56	5	12
Laying cycle duration (days)	52	27.00±8.90	15	60	19	31.0±5.90	20	40
Number of clutches per year	50	3.00±0.82	1	5		2.00±0.71	1	4
Clutch size (number of eggs)	50	14.00±2.10	8	20		19.0±3.5	14	30
Hatchability (%)	50	78±14	46	100		80±21	0	94

[1]Number of observations.
[2]Average, minimum and maximum values observed.

clutches per year was three for chickens (ranging from one to five) and two for turkeys (one to four). Quite often turkey eggs were hatched by hens, the newly hatched chicks serving as guides for the rest of the chicks.

Productive performance

The number of laying hens per household varied from zero to five in chickens. They laid eggs all year round with a marked peak in spring and summer (39 and 22 percent of the participants, respectively). Egg production averaged 78 eggs per hen per year (from 49-150) and 59 per turkey hens (from 25 to 100). Culling age was nearly two and a half years for chicken laying hens as shown in table 2.

Average body size was 1.2-1.4 kg. Body size and conformation were fairly homogeneous among birds, probably due to the low nutritional state of the flocks.

Mortality

Mortality rates were higher among young birds and laying hens. They ranged from 46-76 percent in young chicken and from 38-77 percent in mature ones and 46 and 12 percent, respectively for turkeys with a high incidence in winter and summer (Table 2). Mortality was essentially attributed to diseases with symptoms compatible with those of New Castle disease. Winter cold weather increased mortality rate by nearly 10 percent in cold years. A major concern for people raising Beldi chickens remains the high mortality rates which decimate several flocks in spite of the use of a variety of traditional medicines such as olive oil, onion, garlic, pepper, paprika and others.

Poultry products use

Most people recognize excellent organoleptic properties of both eggs and meat of Beldi chickens and turkeys, markedly superior to those of the modern breeds, which allegedly lack flavour and taste.

Poultry products are often used for local consumption (48 percent) and sales (52 percent) (Figure 5). Some exchange of fertile eggs occurs when there are no roosters in a given flock. On average household consumption is 16 chickens and about 11 turkeys and respectively, 50 and 36 eggs per year.

Table 2. Productive performance of Beldi poultry.

	Chickens				Turkeys			
Performance	n[1]	Average[2]	Min	Max	n[1]	Average[2]	Min	Max
Number of egg laid	52	78.0±20.9	49	150	19	59.0±21.0	25	100
Mortality (%)	52	Young	46	76	19	Young	46	
		Adults	30	77		Adults	12	

[1]Number of observations.
[2]Average, minimum and maximum observed.

The long time taken for growth along with the seasonal demand were claimed to be the main reasons for high prices of adult turkeys which may range from 95-133 Dh per tom and 69-93 Dh per hen, respectively (US$1=10 Dh); whereas chicken prices varied from 54-62 Dh for roosters and 34-43 Dh per hen.

The tradition of raising Beldi poultry also had a strong sense of pride for women who kept several types of birds.

Figure 5. Roosters for sale in Khenifra city.

Discussion

Scientific reports or investigations on Beldi chicken and turkeys are lacking. Further investigations are currently undertaken to precisely measure, for example, on-farm specific targeted weight; and average weight gains at different ages for each sex and species.

The preliminary data observed on flock management and rearing techniques of Beldi chickens are fairly similar to those encountered elsewhere. Bird productive performance such as body size, rate of lay and egg weight are slightly higher than those recently reported from Sénégal (Missohou, 1998) or Cameroon (Agbede *et al.*, 1995).

Exposure to disease outbreaks, drought and other environmental conditions have led to naturally selected strains of chicken and turkeys with high rusticity and wide diversity that may help create crosses for specific purposes. Indeed cross-breeding offers a possible strategy to use local breeds for farm poultry production. Cross-breeding offers the possibility to benefit from heterosis and the development of synthetic lines. Previous work from our laboratory has shown that special crosses of local lines and a special commercial cross may sustain acceptable performance levels with an overall economic profitability (Benabdeljelil and Merat, 1992).

The concomitant improvement of raising conditions in association with efficient sanitary programmes will significantly reduce mortality losses and increase productivity. Mallia (1998) describes Mediterranean breeds as light breeds with a low weight and slender appearance. They are characterized by a well developed single comb and prominent white ear lobes. The males have a rather large arched tail with prominent sickles. The hens are non-sitting and lay white-shelled eggs. These characteristics also found in the Beldi chickens are quite different from their African counterparts such as in Senegal (Missohu, 1998) and Cameroon (Agbede, 1995). Given Morocco's geographical location, it seems likely that Beldi chicken have had more random cross- breeding with strong Mediterranean influence than with other populations.

Conclusion

There is a great sense of urgency and need to preserve the genetic variability of the Beldi poultry in Morocco. More information needs to be collected and assessed to prevent their extinction and to promote their utilization.

Further studies should focus on a detailed assessment of morphometric characteristics and production data on samples taken from

Figure 6. Birds of various species housed in metal and wooden boxes.

different regions of the country. They should emphasize the genetic characterization of the populations.

Acknowledgements

The authors would like to thank the people of Agoudim villages (Khenifra) for their kind collaboration and the Benson Institute (BYU University, Provot USA) for their financial support.

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Report of Second *ad hoc* session of International Stakeholders in Animal Genetic Resources FAO, Rome (Italy), 5-6 June 2001

Main conclusions of the session

- Animal genetic resources are global assets that will increasingly contribute to food security and alleviation of poverty, and must be wisely used, developed and conserved, to meet current and future demands for animals and animal products.
- FAO has been given the important task to coordinate the preparation of the First Report on the State of the World's Animal Genetic Resources, which will for the first time bring together all those with primary interests and responsibilities for the management of animal genetic resources. In order to undertake this important initiative, stakeholders and donors should enhance their efforts to support FAO.
- To facilitate the involvement of the donors and stakeholders, FAO should clarify the outcomes that result from the preparation of the First Report on the State of the World's Animal Genetic Resources. FAO also needs to increase understanding of the financial and other resources required to undertake these activities, continue to identify opportunities for the involvement of donors and stakeholders throughout the process, and define modalities for their involvement, including the establishment of formal arrangements for collaboration.
- The initial phase of the process for developing the First Report on the State of the World's Animal Genetic Resources will focus on the preparation of Country Reports. These are intended to be planning instruments enabling countries to strategically plan the management of animal genetic resources to increase the contribution of animals and animal products to food security and economic development. Stakeholders and donors agreed that it will be essential that a large number of Country Reports be prepared over the next 18 months to encourage and assist all countries to participate in this important initiative.
- Many developing countries might not have sufficient financial resources to undertake preparation of their Country Reports. Donors and stakeholders have agreed to assist FAO to seek financial and other resources necessary to undertake the preparation of the First Report on the State of the World's Animal Genetic Resources, including the preparation of Country Reports. In order to facilitate this collaboration, FAO should prepare documentation of the required resources, and the countries and regions that need assistance.
- Donors and stakeholders have agreed to increase awareness of the First Report on the State of the World's Animal Genetic Resources using their networks of contacts, meetings, workshops, and other events. The following intergovernmental meetings were identified as important events where animal genetic resources should be profiled: the seventh meeting of the Subsidiary Body on Scientific, Technical and Technological Advice to the Convention on Biological Diversity (SBSTTA 7 - November 2001); regional biological diversity convention preparatory meetings; the sixth meeting of Parties to the Convention on Biological Diversity (COP 6 - April 2002); and Regional Conferences of FAO (2002).
- Efforts by FAO to involve and expand the range of stakeholders should continue in the preparation of the First Report on the State of the World's Animal Genetic Resources, further engaging international organizations, regional institutions and networks, agricultural production and research organizations, national universities, professional and scientific

societies, private sector interests, consumer associations, relevant international nongovernmental organizations, zoos and farm parks, and other stakeholders. It was recognized that many of these interests would require financial support to enable their full participation and contribution to the preparation of the First Report.

- FAO should establish or enhance existing mechanisms to ensure regular, preferably monthly, updating and reporting to all interested parties of activities related to the preparation of the First Report on the State of the World's Animal Genetic Resources. The update should report on progress and indicate opportunities for the involvement of donors and stakeholders, and the issues that require their assistance.
- Opportunities for national stakeholders to be involved in the process of developing Country Reports should be identified, especially to ensure the participation of farmers, breeders, and local and indigenous communities. Donors and stakeholders have agreed that if the recommended process described in the Guidelines for the Development of Country Report is followed, opportunities for contributions of a wide range of national stakeholders can be achieved.
- Pilot projects are necessary to demonstrate the roles and values of Country Reports as strategic documents that will enable the better management of animal genetic resources. Pilot projects involving donors and stakeholders should be initiated as soon as possible to put into practice the strategic priorities identified in the Country Reports. They should also be undertaken to initiate action in response to the Strategic Priorities Report that will result from the synthesis of the first available Country Reports.
- Donors and stakeholders concluded that the preparation of Country Reports by August 2002 is an extremely ambitious schedule. However, they supported this schedule, indicating the need to complete Country Reports in order to ensure preparation of the Strategic Priority Report by 2003 and its presentation to the Commission on Genetic Resources for Food and Agriculture, and to ensure completion of the First Report on the State of the World's Animal Genetic Resources by 2005.

Workshop on "Community-Based Management of Animal Genetic Resources" 7-11 May, 2001 Mbabane, Swaziland

The workshop was jointly planned and organized by the SADC/FAO/UNDP project on "Management of Farm Animal Genetic Resources in the SADC Region", the Southern Africa Centre for Cooperation in Agricultural Research and Training (SACCAR), the SADC Livestock Coordination in Botswana and the German Technical Cooperation (GTZ) through the project "Managing Agrobiodiversity in Rural Areas". The workshop was hosted by the Department of Veterinary and Livestock Services of the Kingdom of Swaziland. Seventy one participants from the SADC region and beyond attended.

The workshop was a joint venture of interested to enhance the potential of Animal Genetic Resources (AnGR) for the improvement of rural livelihoods and conserving genetic diversity in SADC region. The aspect of community-based management is relatively new with regard to the animal genetic resources. Therefore, the workshop aimed at reaching a common perspective and shared understanding among the major players in the SADC region and to identify joint learning opportunities for future action. During the workshop a group was formed who tried to capture the essence of the output in a short statement to be presented to relevant fora. Instead of a summary, this statement will be shown here:

The workshop was a first step to develop a conceptual framework for community-based management of animal genetic resources (CBMAnGR). This concept is based on the assumption that farmers are the custodians of Farm Animal Genetic Resources (FAnGR) and, therefore much better placed to manage these resources. CBMAnGR is an approach that integrates the livelihood needs of local communities (food security and poverty alleviation) and the call of the Convention on Biological Diversity to conserve biodiversity in its "natural habitats" through sustainable use.

Objectives of the workshop were to:

- elaborate recommendations to policy makers, donors, NGOs and other relevant actors of the SADC region with regard to community-based *in situ* conservation;
- develop strategic elements for *in situ*-conservation of AnGR at the political, institutional and communal level of the management of agricultural biodiversity;
- strengthen networking on AnGR in SADC and further the harmonisation of AnGR-related national policies and strategies.

The workshop provided an opportunity for scientists, extensionists and representatives from NGOs from the SADC region to meet together with some international colleagues and exchange experiences and ideas. The highly motivated participants created a momentum for further developing and implementing the concept of CBMAnGR. The achieved results and recommendations provide input to SADC processes dealing with FAnGR management and will be brought to the respective FAO and CBD processes for consideration. It was recommended to formulate policies for the support of CBMAnGr in the SADC region. The next steps will be the publication of the papers and case studies and the outputs of the theme groups established.

Seventh session of the "Subsidiary body for scientific, technical and technological advice of the Convention on Biological Diversity" 12-16 November 2001, Montreal, Canada

The seventh session of the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA-7) of the Convention on Biological Diversity (CBD) met from 12-16 November 2001, in Montreal, Canada. Over 515 participants from 113 governments, joined by representatives from intergovernmental, non-governmental, academic and indigenous organisations, attended the meeting. Delegates met in two working groups. Working Group I , focusing on forest biodiversity, held general discussions on a recommendation addressing bushmeat and status, trends and threats, as well as on a work programme with elements on: conservation, sustainable use and benefit sharing; institutional and socioeconomic enabling environments; and knowledge, assessment and monitoring. Working Group II considered and prepared recommendations on agricultural biodiversity, including the International Pollinators Initiative, the plant conservation strategy; incentive measures; indicators; and environmental impact assessment.

The forest work programme proved to be a considerable undertaking, which will require extensive intersessional work on actors, timeframes and process indicators. Overall, delegates were pleased with the substance of the final outputs, while noting that the challenge ahead is prioritization of activities within the forest work programme. Delegates also appreciated Working Group II's expedient discussions on agricultural biodiversity, the plant conservation strategy, incentives, indicators, and environmental impact assessment. The recommendations from SBSTTA-7 will be forwarded to the sixth meeting of the Conference of the Parties (COP-6), to be held from 8-19 April 2002, in The Hague, the Netherlands. The task for COP-6 will be to make the necessary political decisions to ensure effective implementation of the work of the SBSTTA and other intersessional processes under the Convention.

Proceedings of the 2001 International Conference on Boer Goats

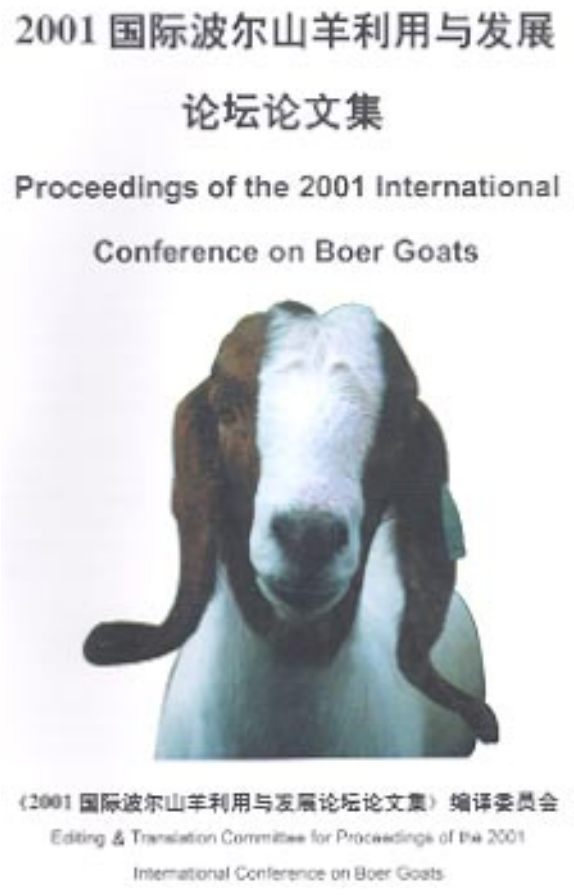
Guizhou, China, 21-24 October 2001
Sponsored by International Goat Association (IGA), Society of Sheep and Goat Research (SSGR) and Chinese Association of Animal Science & Veterinary Medicine (CAAV)
Edited by Boer Goat Breeding Co. Ltd, Guizhou
Boer Park Ganbao Anshun, P.O. Box 99, 561014 Anshun
Guizhou, China
Published in 2001, pp. 328

The 2001 International Conference on Boer Goats was held in Guizhou, China, from 21 to 24 October. The meeting was initiated by the Guizhou Boer Goat Company, Ltd. and the Guizhou Provincial Agriculture Department, strongly supported by Heifer International (HI) China Office, sponsored by the International Goat Association (IGA), the Society of Sheep and Goat Research (SSGR) and the Chinese Association of Animal Science & Veterinary Medicine (CAAV).

This conference was a great opportunity for promoting communication among academic researches, the exchange of production experiences and marketing information for the advancing of meat (Boer) goat industry in China.

The opening ceremony was held on October 21, chaired by Prof. Huang Yonghong, President of the Organising Committee. 101 participants from USA, Korea, Australia and China attended the conferences. Prof. Christopher D. Lu, Vice President of IGA, Dean of School of Agriculture & Natural Resource of New York State University, inaugurated the opening ceremony, analysing the goat industry development in China and appointing much importance to local goat genetic resources. Prof. Lu also introduced what IGA is and its mission

Nineteen speakers presented their paper during the plenary session. Following the plenary session, two sub-groups were formed, focusing on basic theory of breeding and production application, respectively. The works of these two sub-groups analysed the relationship between goats and environmental conservation, local breeds' preservation, marketing management of Boer goats, reproduction, extension of Boer goats among the family farms.

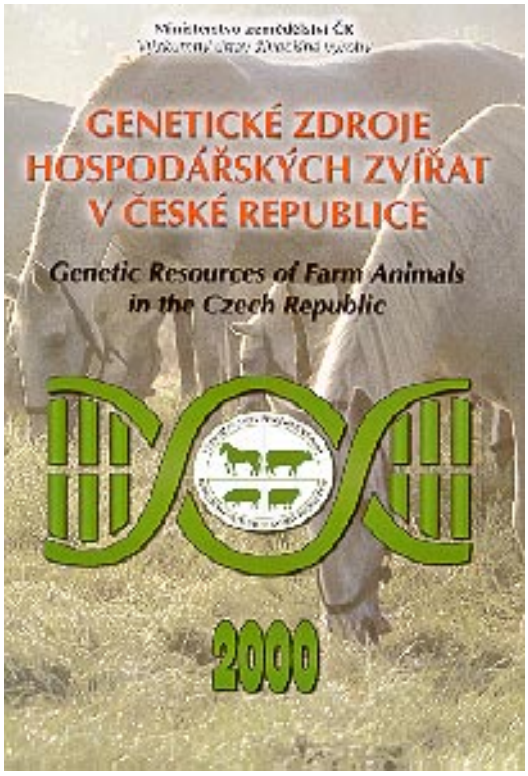


Genetic Resources of Farm Animals in the Czech Republic

Research Institute of Animal Production,
Ministry of Agriculture, Prague, Czech Republic
Published in 2000, pp. 42

This small pamphlet, in Czech and English, covers genetic resources in cattle, pigs, sheep, goats, horses, poultry, rabbit and nutria, fish and bee. It is obvious that the pamphlet does not cover all breeds in these species and it is not clear on what basis the reported breeds were chosen. In all species, but bee and fish, the publication unfortunately reports only 15 breeds, while the corresponding number of breeds in the FAO DAD-IS is 74. Quality colored photos are provided for the reported breeds.

For each breed, the national structure for animal controls and methods of breeding and conservation are briefly exposed, together with a short summary of their production characteristics, population numbers and economic values. In some cases, short historical notes are also given, in order to provide a frame of the national animal genetic resources.

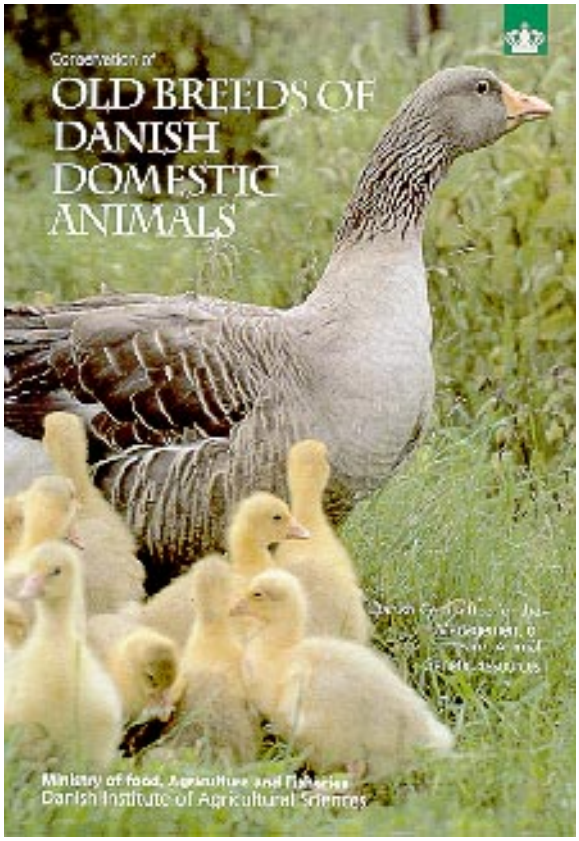


Old Breeds of Danish Domestic Animals

Danish Institute of Agricultural Sciences, Ministry of Food, Agriculture and Fisheries, P.O. Box 50 DK-8830 Tjele, Denmark.
ISBN: 87-7026-2918. pp. 35, English (no explicit year of publication)

This brochure describes the start of the animal genetic resources conservation in Denmark and the activities of the Danish Genetic Resources Committee. The publication gives description and the state of population for 20 old breeds; 3 horse, 4 cattle, 2 pigs, 1 sheep, 1 goat, 1 rabbit, 1 fowl, 1 goose, 1 duck, 3 pigeon, 1 bee and 1 dog with quality photos for each of them. The brochure provides what actions are being taken to safeguard some of these breeds.

A brief description of the conservation activities undertaken in Denmark are also listed and a summary of the future conservation work is described. Clear photos of the reported breeds illustrate to the reader the individual physical characteristics of the animals and production data report the economic relevance, justifying the preservation work.



Management of Animal Genetic Resources Diversity at Community Level

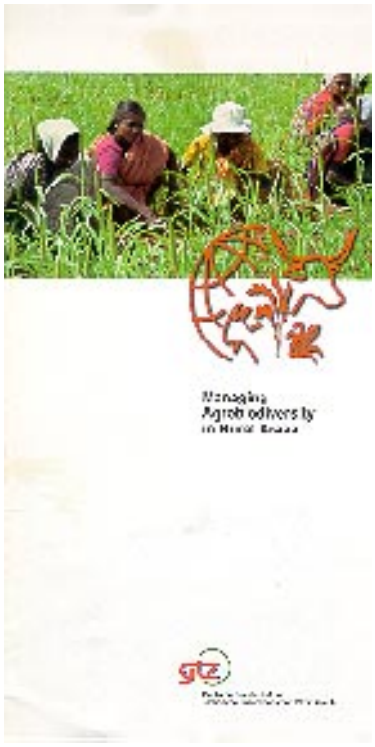
I. Kohler-Rollefson (Ed.)
Deutsche Gesellschaft Fur Technische Zusammenarbeit (GTZ) GmbH
Published in 2000, pp. 24

This publication, dealing with management of genetic diversity in agriculture, summarises different aspects of general biodiversity by the same publisher.

The historical framework, that has as starting point the Convention of Biodiversity signed in Rio de Janeiro (1992), is reported, following the temporal steps through which the public awareness was aroused.

The publication emphasizes the importance of local breeds and the indigenous knowledge in maintaining genetic resources, menaced by erosion and loss.

Interestingly, the publication criticises the attitude of policy makers and donor community, GOs and NGOs, for pushing exotic breeds without clear view of their sustainability in the foreign environments. It gives examples / elements of how to initiate community-based conservation programs for the development of livestock breeds. The publication is quite readable with an extensive list of relevant bibliography.



Pig Genetic Resources in Europe

L. Ollivier, F. Labroue, P. Glodek, G. Gandini & J.V. Delgado (Eds)
EAAP publication no. 104
WageningenPers, P.O. Box 42, 6700 AA Wageningen, The Netherlands
Published in 2001
ISBN 9074134939
ISSN 0071-2477, pp. 150

Europe shares a large part of the world pig population (circa 20%) as well as of the world pig genetic diversity (circa 46% of the breeds in the world inventory). However, the European pig industry relies on a rather limited number of breeds, among which the Yorkshire pig, named also Large White, is largely predominant.

The necessity to maintain diversity and to develop alternative stocks for meeting a wide variety of production / market conditions is recognised, as well as the ensuing need to establish sound conservation programmes. This book presents an overview of the situation of pig genetic resources in 4 major pig producing countries of the European Union, namely France, Germany, Italy and Spain. The information gathered is intended as a basis for rationalising the conservation of European pig genetic resources, through a better characterisation of the available breeds and an evaluation of their genetic diversity. Conservation policies are also outlined, addressing both live animals and cryopreserved germplasm; in particular recommendations are given for establishing gene banks from local breeds exposed to serious risks of genetic erosion if not complete extinction.

Contributions from a large number of European experts in the field of pig production and genetics, conservation genetics and reproductive physiology have been gathered in this book: it should thus be of interest for a wide audience throughout the pig industry.

Students and researchers will find in it information of scientific interest on a very diverse sample of breeds. Finally, the economic dimension given to the various conservation strategies should be of some benefit to decision-makers in the area of domestic animal conservation under European conditions.

Horses of the Anglo Boer War

F J. van der Merwe (Ed.)
P.O. Box 664, Kleinmond 7195, South Africa
Published in 2001 (in English and Afrikaans)
ISBN 0-620-25889-6
pp. 50

Commemorating the centenary of the Anglo Boer War, it is more than fitting to also pay attention to the role played by hundreds of thousands of horses in that dreadful conflict which lasted for three years between the British and the South Africans; a war which - amongst other horrible outcomes - dealt a devastating blow to the South African horse-breeding industry.

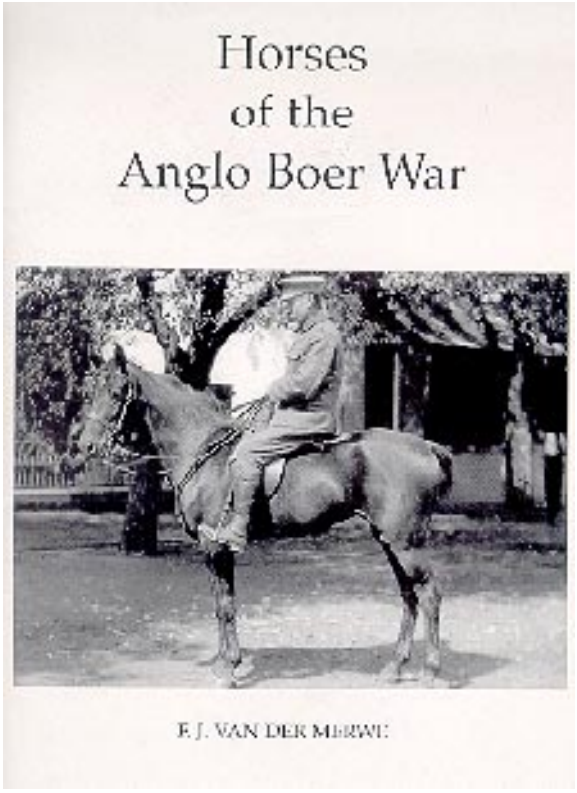
It is also entirely fitting that the Nooitgedacht Horse Breeders' Association should have taken the initiative, to undertake a symbolic, commemorative ride on Nooitgedacht horses from Cape Town to Pretoria.

The present-day Nooitgedacht horses can be taken as direct descendants of a true South African breed - the Basuto pony - which was ridden by combatants on both sides in the war and which themselves were direct descendants of the erstwhile world-renowned Cape Horse.

In preparing this brief publication the Author tried, in words and pictures, to bring to the reader some perception of the absolutely essential role played by horses in the war in South Africa; of the pain and suffering they endured.

In researching the subject, the Author found on the British side a wealth of printed information of all aspects of the part played by their horses and of the severe problems the British forces had with the supply and maintenance of this part of their army.

Unfortunately, during his research, the Author also showed that there are virtually no statistics or other objectively written evidence on the numbers of horses taking part on the Boer side, and of the losses in terms of riding and breeding stock.



The Preserved Slovenian Autochthonous Domestic Animals

D. Kompan, A. Salehar & A. Holcman (Eds)
Published by Slovenian Ministry of Agriculture Forestry and Food and by University of Ljubljana, Biotechnical Facylty, Zootechnical Dept.
Published in 1999, pp. 40
www.bfro.uni-lj.si/zoo/publikacije/avtohtone_pasme

The rearing of domestic animals in Slovenia was well developed as far back as the middle-ages. This is illustrated in a fresco painted calendar in the medieval church of Hrastovlje. Valvasor (1689) writes about the rearing of horses, cattle, sheep, goats, pigs, donkeys, etc. in the Kraniska province. He stresses the fact that the Karst horses from Kranjska region are among the best in Europe, known for their persistency, longevity, their patience with riders and willingness to work.

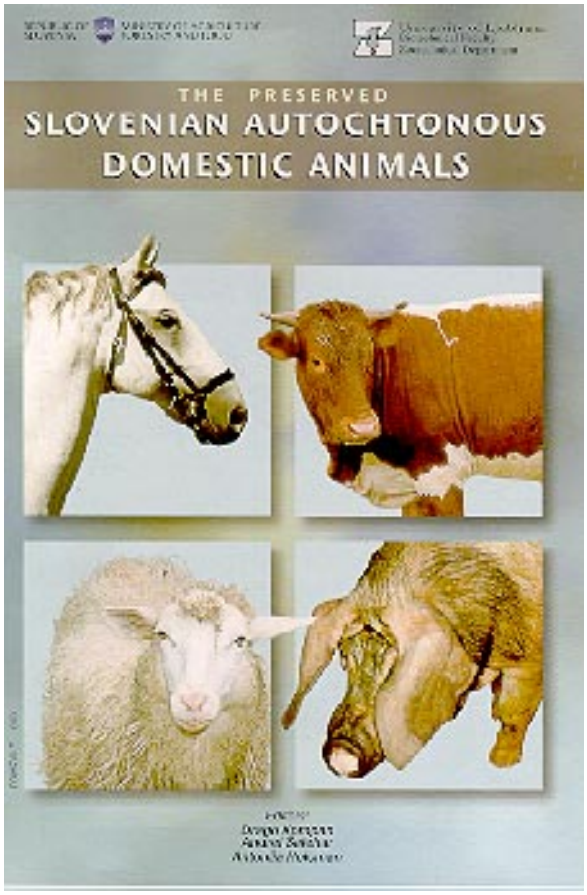
At the beginning of the century there were 713 502 heads of cattle (in 1998 there were 453 097), 166 398 sheep (72 361), 25 600 goats (16 779), 62 208 horses (9 898 in 1997) and 527 736 pigs (592 378) recorded in the inventory. Numerically, Slovenia had more animals in the past century than now. Of these animals, the Slovenian autochthons brought farmers the greatest share of their income. In some animal husbandry branches - namely chicken and pig rearing - the native breeds from a century ago have almost completely been replaced by today's modern breeds.

Today, the autochthonous domestic animals are relied upon as an important source of these unique animal's genes, that will retain biological diversity and contribute to the implantation of specific characteristics into the genotypes of modern breeds. For this reason, scientists have been trying to recover these ancient breeds.

Since 1991 the Slovenian Ministry of Agriculture, Forestry and Food has financially supported an on going project of conservation of native Slovenian species of domestic animals.

Thus, this small booklet summarises the national framework for the conservation of these genetic resources and show clear photos of the morphological characteristics of the breeds, including some well-known breeds as the Lipizzan horse, the Istrian Pramenka sheep and the Cika cattle.

This booklet does well in increasing the awareness for the importance of the conservation of these genetic resources.



Progress in South American Camelids Research

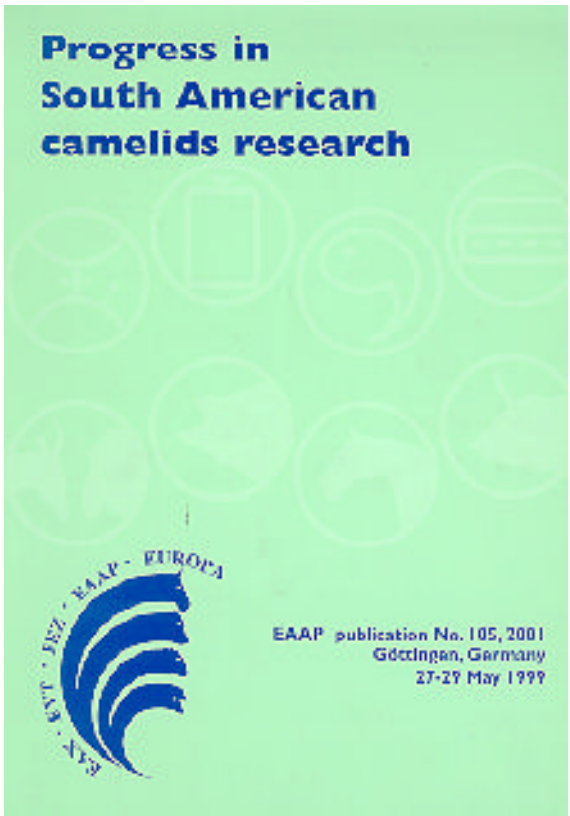
M. Gerken & C. Renieri (Eds)
Proceedings of the 3rd European Symposium on South American Camelids and SUPREME European Seminar, Gottingen, Germany 27-29 May 1999
EAAP publication no. 105
WageningenPers, P.O. Box 42, 6700 AA Wageningen, The Netherlands
Published in 2001
ISBN 9074134912
ISSN 0071-2477, pp. 350

Advanced and up-to-date research results are reported in these proceedings of the 3rd European Symposium on South American Camelids (Gottingen, Germany). Results were presented by European researchers working both on domesticated South American camelids (llama & alpaca) and Wild South American camelids (vicuna & guanaco), as well as by the EU research project SUPREME (Sustainable Production of Natural Resources and Management of Ecosystems). Results carried out on domestic camelids by research companies and NGOs from 4 different European (EU) countries (France, Germany, Italy & U.K.) and 5 Latin-American countries (Argentina, Bolivia, Chile, Ecuador & Peru) are also reported and presented.

The main themes of discussion were the following: Ecology, Sustainability and Socio-economics, Breeding and Genetics, Reproduction and Pathology, Fibre and Meat Production and Nutrition. Results were reported in three final round-table meetings "EU-Politics for the development of the Andean regions", "Sustainable use of South American camelids in South America" and "Breeders and keepers".

The significant attendance of farmers, as well as of private companies willing to engage in Camelid farming, along with the great interest shown on importing South American camelids into Europe, was noticeable at this symposium.

These proceedings thus constitute an important step towards the understanding of technical and socio-economic problems in South American camelids production. Researchers and farmers will find this volume a valid instrument for up-to-date knowledge on South American camelids, as well as for practical solutions to farming problems.



Editorial Policies and Procedures

The mission of the Animal Genetic Resources Information Bulletin (AGRI) is the promotion of information on the better use of animal genetic resources of interest to food and agriculture production, under the Global Strategy for the Management of Farm Animal Genetic Resources. All aspects of the characterization, conservation and utilization of these resources are included, in accordance with the Convention on Biological Diversity. AGRI will highlight information on the genetic, phenotypic and economic surveying and comparative description, use, development and maintenance of animal genetic resources; and on the development of operational strategies and procedures which enable their more cost-effective management. In doing this AGRI will give special attention to contributions dealing with breeds and procedures capable of contributing to the sustainable intensification of the world's medium to low input production environments (agro-ecosystems), which account for the substantial majority of the land area involved in livestock production; the total production of food and agriculture from livestock; and of our remaining farm animal genetic resources.

Views expressed in the paper published in AGRI represent the opinions of the author(s) and do not necessarily reflect those of the institutions which the authors are affiliated, FAO or the Editors.

The suitability of manuscripts for publication in AGRI is judged by the Editors and reviewers.

Electronic publication

AGRI is available in full electronically on the Internet, in addition to being published in hard copy, at:
<< http://www.fao.org/dad-is>>

Types of Articles

The following types of articles are published in AGRI.

Research articles

Findings of work on characterization, conservation and utilization of farm animal genetic resources (AnGR) in well described production environments, will be considered for publication in AGRI. Quality photographs of these genetic resources viewed in the primary production environment to which they are adapted, accompanying the manuscripts are encouraged.

Review articles

Unsolicited articles reviewing agro-ecosystems, country-level, regional or global developments on one or more aspects of the management of animal genetic resources, including state-of-the-art review articles on specific fields in AnGR, will be considered for publication in AGRI.

Position papers

Solicited papers on topical issues will also be published as deemed required.

Other published material

This includes book reviews, news and notes covering relevant meetings, training courses and major national, regional and international events and conclusions and recommendations associated with the outcomes of these major events. Readers are encouraged to send such items to the editors.

Guidelines for Authors

Manuscript submission

Manuscripts prepared in English, French or Spanish with an English summary and

another summary in either French or Spanish, should be submitted to AGRI Editor, AGAP, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy. Alternatively a manuscript may be sent as a WinWord Electronic Mail attachment to < agri@fao.org >. Photographs, coloured or black and white, and figures must be always sent by mail.

Manuscripts should be typed double-spaced and with lines numbered in the left margin. All pages, including those of references, tables etc., must be consecutively numbered. The corresponding author is notified of the receipt of a manuscript.

For manuscripts that are accepted after revision, authors are encouraged to submit a last version (3½" disc format) in Word 6.0 for Windows of their revised manuscript along with the printed copy.

Preparation of the manuscript

The first page of the manuscript must include the running head (abbreviated title), title, names of authors, institutions, full addresses including postal codes and telephone number and other communication details (fax, e-mail, etc.) of the corresponding author. The running head not exceeding 45 characters plus spaces, should appear at the top of page 1 of the manuscript entirely in capital letters. The title of the manuscript is typed in upper and lower case letters. The title should be as brief as possible not exceeding 150 characters (including spaces) with species names when applicable. Authors, institutions and addresses are in upper and lower case italics. There is one blank line between the title and the authors. Addresses are typed as footnotes to the authors after leaving one blank line. Footnotes are designated numerically. Two lines are left below the footnotes.

Headings

Headings of sections, for example Summary, Introduction, etc., are left-justified. Leave two blank lines between addresses footnotes and Summary and between the heading Summary and its text. Summary should not exceed 200 words . It should be an objective summary briefly describing the procedures and findings and not simply stating that the study was carried on such and such and results are presented, etc. Leave one line between the summary text and Keywords which is written in italics as well as the keywords themselves. All headings of sections (14 regular) and sub-sections (12 regular) are typed bold and preceded and succeeded by one blank line and their text begins with no indention. The heading of a sub-subsection is written in italics, and ends with a dot after which the text follows on the same line. Keywords come immediately after the summaries. They should be no more than six, with no "and" or "&".

Tables and figures

Tables and figures must be enclosed with the paper and attached at the end of the text according their citation in the document. Photos will not be returned

Tables

Tables, including footnotes, should be preceded and succeeded by 2 blank lines. Table number and caption are written, above the table, in italics (12) followed by a dot, then one blank line. For each column or line title or sub-title, only the 1st letter of the 1st word is capitalized. Tables should be numbered consecutively in Arabic numerals. Tables and captions should be left justified as is the text. Use horizontal or vertical lines only when necessary. Do not use tabs or space-bar to create a table but only the appropriate commands.

Figures

Figures including titles and legends should be preceded and succeeded by two blank lines. Figure number and title are written, below the figure, in italics (12) and end with a dot. The term figures includes photos, line drawings, maps, diagrams etc.

All the submitted diagrams, must be

accompanied with the original matrix of the data used to create them. It is strongly advised to submit diagrams in Word 6.0 or Excel 5.0. Figures should be numbered consecutively in Arabic numerals.

References

Every reference cited in the text should be included in the reference list and every reference in the reference list should have been mentioned in the text at least once. References should be ordered firstly alphabetically by the first author's surname and secondly by year.

Example for reference in a periodical is:

Köhler-Rollefson, I., 1992; The camel breeds of India in social and historical perspective. Animal Genetic Resources Information 10, 53-64.

When there are more than one author:

Matos, C.A.P., D.L. Thomas, D. Gianola, R.J. Tempelman & L.D. Young, 1997; Genetic analysis of discrete reproductive traits in sheep using linear and nonnlinear models: 1. Estimation of genetic parameters 75, 76-87.

For a book or an ad hoc publication, e.g., reports, theses, etc.:

Cockril, W.R., (Ed), 1994; The Husbandry and Health of the Domestic Buffalo. FAO, Rome, Italy, pp 993.

For an article in the proceedings of a meeting:

Hammond, K., 1996; FAO's programme for the management of farm animal genetic resources. In C. Devendra (Ed.) Proceedings of IGA/FAO Round Table on the Global Management of Small Ruminant Genetic Resources, Beijing, May 1996, FAO, Bangkok, Thailand, 4-13.

Where information included in the article has been obtained or derived from a World Wide Web site, then quote in the text, e.g. "derived from FAO. 1996" and in the References quote the URL standard form:

FAO, 1996; Domestic Animal Diversity Information System <http://www.fao.org/dad-is/>, FAO, Rome

For all future manuscript dispatch and correspondence regarding AGRI, please use the following mailbox:

agri-bulletin@fao.org

Thanks for the collaboration

Normes et règles éditoriales

L'objectif du Bulletin d'Information sur les Ressources Génétiques Animales (AGRI) est la vulgarisation de l'information disponible sur la meilleure gestion des ressources génétiques animales d'intérêt pour la production alimentaire et agricole, d'après les recommendations de la Stratégie Mondiale pour la Gestion des Ressources Génétiques des Animaux Domestiques. Tous les aspects relatifs à la caractérisation, la conservation et l'utilisation de ces ressources seront pris en considération, suivant les normes de la Convention pour la Biodiversité.

AGRI désire diffuser de l'information sur la génétique, les enquêtes phénotypiques et économiques et les desciptions comparatives, l'utilisation et la conservation des ressources génétiques animales, ainsi que toute information sur le développement de stratégies opérationnelles et de normes qui puissent permettre une meilleure gestion de la relation coût/efficacité. C'est pour cela que AGRI prendra spécialement en considération toutes les contributions référées aux races et aux normes capables de permettre une intensification durable des milieux (agroécosystèmes) à revenus moyens et bas dans le monde; qui comprennent la majeur partie des terres consacrées à l'élevage, à la production totale des aliments et l'agriculture provenants de l'élevage; et tout ce qui reste comme ressources génétiques des animaux domestiques.

Les opinions exprimées dans les articles publiés dans AGRI appartiennent seulement aux auteurs et donc ne représentent pas nécessairement l'opinion des instituts pour lesquels ils travaillent, la FAO ou les éditeurs.

L'opportunité ou non de publier un article dans AGRI sera jugée par les éditeurs et les réviseurs.

Publication électronique

En plus de sa version imprimée, la version totale de AGRI se trouve disponible sur Internet, sur le site:
<<http://www.fao.org/dad-is/>>

Types d'articles

Les articles suivants pourront être publiés sur AGRI:

Articles de recherche

Seront prises en considération pour leur publication sur AGRI les études sur la caractérisation, la conservation et l'utilisation des ressources génétiques des animaux domestiques (AnGR) accompagnées d'une bonne description du milieu. On encourage les auteurs à envoyer des photographies de bonne qualité qui montrent les races en question dans leur milieu naturel de production.

Révisions

Occasionnellement, des articles contenant une révision des agroécosystèmes, au niveau national, régional ou mondial, avec un ou plusieurs aspects se rapportant à la gestion des ressources génétiques animales, y comprises les mises à jour des différentes zones de AnGR, seront pris en considération.

Articles spécifiques

Ponctuellement, des articles sur des thèmes spécifiques pourront être demandés pour la publication d'éditions spéciales.

Autre matériel pour publication

Ceci comprend la révision de livres, nouvelles et notes de réunions importantes, cours de formation et principaux évènements nationaux, régionaux et internationaux; ainsi que les conclusions et recommendations par rapport aux objectifs des ces principaux évènements. Les auteurs sont priés d'envoyer ce genre de matériel aux éditeurs.

Guide pour les auteurs

Présentation du manuscript

Les articles se présenteront en anglais, français ou espagnol, avec un résumé en anglais et sa traduction en français ou en espagnol; et seront envoyés à l'éditeur de AGRI, AGAP, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italie. L'autre possibilité est d'envoyer l'article par courrier électronique avec le document adjoint en version WinWord à <agri@fao.org>. Les photographies, en couleur ou en blanc et noir, seront toujours envoyées par courrier normal.

Les manuscripts se présenteront à double interligne et avec le numéro correspondant à chaque ligne sur la marge gauche. Toutes les pages seront numérotées, y comprises celles avec les références bibliographiques, les tableaux, etc. L'auteur recevra une lettre lui donnant bonne réception de son document.

Lorsqu'un article, après sa révision, sera accepté, on demandera à l'auteur d'envoyer la version finale révisée sur disquette (format 3 1/2") en Word 6.0 x Windows, ainsi qu'une copie sur papier.

Préparation du manuscript

Sur la première page du manuscript on indiquera le titre de l'article en abrégé, le titre et noms des auteurs, des institutions, les adresses complètes (y compris code postal et numéro de téléphone); ainsi que tout autre moyen de contact tel que fax, e-mail, etc. avec l'auteur principal. Le titre abrégé ne devra pas dépasser les 45 caractères, plus les espaces nécessaires, et s'écrira sur la partie supérieure de la page 1 du manuscript en majuscules. Le titre en entier du manuscript sera écrit en majuscules et minuscules; il devra être aussi bref que possible, sans dépasser les 150 caractères (y compris les espaces nécessaires), et avec l'indication des noms des espèces. Les noms des auteurs, des institutions et les adresses seront en italique et en lettres majuscules et minuscules. On laissera un espace en blanc entre le titre et les noms des auteurs. Les adresses seront indiquées comme des notes à pied de page pour chacun des auteurs après avoir laissé un espace en blanc après les noms. Chaque note de pied de page sera numérotée. On laissera deux espaces en blanc après les adresses.

Titres

Les titres de chaque chapitre, par example Résumé, Introduction, etc. seront alignés à gauche. Laisser deux espaces en blanc entre les notes de pied de page avec les adresses et le Résumé, et entre le titre Résumé et le texte qui suit. Le résumé ne devra pas dépasser les 200 mots. Il s'agira d'un résumé objectif qui fasse une brève description des processus utilisés et des résultats obtenus, et non pas une simple présentation du travail réalisé avec une description générale des résultats. Laisser un espace en blanc entre la fin du texte du résumé et les mots-clés, qui seront écrits en italique ainsi que le titre Mots-clés. Les mots-clés seront au maximum six et il ne devra pas y avoir de "et" ou "&". Tous les titres principaux de chapitre (14 regular) et sous-chapitre (12 regular) seront en gras avec un espace en blanc avant et après. Le texte commencera sans retrait. Un titre à l'intérieur d'un sous-chapitre s'écrira en italique, suivi d'un point, avec le texte à continuation.

Tableaux et figures

Les tableaux et les figures iront à la fin du texte en suivant l'ordre d'apparition dans le texte. Les photographies ne seront pas dévolues aux auteurs.

Tableaux

Les tableaux, y compris les notes de pied de page, devront avoir un espace en blanc avant et après. Le numéro du tableau et le titre s'écriront sur la partie supérieure en italique (12) avec un point à la fin et un espace en blanc en dessous. Sur chaque colonne, titre d'en-tête ou sous-titre, seulement la première lettre du premier mot sera en majuscule. Les tableaux et leur titre seront alignés à gauche, ainsi que le texte. Les lignes verticales et

horizontales seront utilisées seulement si nécessaires. Ne pas utiliser les tabs ou la barre de séparation pour créer un tableau.

Figures

Les figures, y compris les titres et les légendes, seront précédés et suivis de deux espaces en blanc. Le numéro de la figure et le titre s'écriront sur la partie supérieure en italique (12) avec un point à la fin. Sous la rubrique figure on trouvera les photographies, les graphiques, les cartes, les diagrammes, etc. Dans le cas des diagrammes, la matrice originale avec les données utilisées pour son élaboration devra être envoyée. On recommande l'utilisation de Word 6.0 ou Excel 5.0 pour la présentation des diagrammes.

Références

Toute référence présente dans le texte devra apparaître sur la liste des références, et chaque référence de la liste aura été citée au moins une fois dans le texte. Les références iront en ordre alphabétique du nom de l'auteur, suivi de l'année. Example dans le cas d'une référence sur une revue:

Köhler-Rollefson, I.,1992; The camel breeds of India in social and historical perspective. Animal Genetic Resources Information 10, 53-64.

Lorsqu'il s'agit de plus d'un auteur:

Matos, C.A.P., D.L. Thomas, D. Gianola, R.J. Tempelman & L.D. Young, 1997; Genetic analysis of discrete reproductive traits in sheep using linear and nonnlinear models: 1. Estimation of genetic parameters 75, 76-87.

Dans le cas d'un livre ou d'une publication ad hoc, par example un rapport, une thèse, etc.:

Cockril, W.R., (Ed), 1994; The Husbandry and Health of the Domestic Buffalo. FAO, Rome, Italy, pp 993.

S'il s'agit d'un acte d'une réunion:

Hammond, K., 1996; FAO's programme for the management of farm animal genetic resources. In C. Devendra (Ed.) Proceedings of IGA/FAO Round Table on the Global Management of Small Ruminant Genetic Resources, Beijing, May 1996, FAO, Bangkok, Thailand, 4-13.

Lorsque l'information contenue dans l'article ait été obtenue ou dérive d'un site World Wide Web, il faudra mettre le texte entre guillemets; par example "tiré de la FAO. 1996" et indiquer dans les Références la forme standard URL:

FAO, 1996; Domestic Animal Diversity Information System <http://www.fao.org/dad-is/>, FAO, Rome

Pour tout envoi de manuscripts ou correspondence au sujet d'AGRI, vous êtes prié d'utiliser l'adresse suivante:

agri-bulletin@fao.org

Merci pour votre collaboration

Reglas y normas editoriales

El objetivo del Boletín de Información sobre Recursos Genéticos Animales (AGRI) es la divulgación de la información sobre una mejor gestión de los recursos genéticos animales de interés para la producción alimentaria y agrícola, siguiendo la Estrategia Mundial para la Gestión de los Recursos Genéticos de los Animales Domésticos. Todos los aspectos referidos a la caracterización, la conservación y el uso de estos recursos serán tomados en consideración, de acuerdo con la Convención sobre la Biodiversidad.

AGRI publicará información sobre genética, encuestas fenotípicas y económicas y descripciones comparativas, uso, desarrollo y conservación de los recursos genéticos animales, así como sobre el desarrollo de estrategias operacionales y normas que permitan una gestión más eficaz de la relación costo/eficacia. Por ello, AGRI prestará especial atención a las contribuciones referidas a razas y normas capaces de contribuir a la intensificación sostenible de los medios (agroecosistemas) con ingresos medio y bajos en el mundo, que comprenden casi la mayor parte de las tierras dedicadas a la producción ganadera; la producción total de alimentos y agricultura provenientes de la ganadería; y el resto de los recursos genéticos de animales domésticos.

Los puntos de vista expresados en los artículos publicados en AGRI son solamente las opiniones de los autores y, por tanto, no reflejan necesariamente la opinión de las instituciones para las cuales trabajan dichos autores, de la FAO o de los editores.

La oportunidad o no de publicar un artículo en AGRI será juzgada por los editores y revisores.

Publicación electrónica

Además de su publicación impresa, la versión íntegra de AGRI se encuentra disponible electrónicamente sobre Internet, en el sito: <<http://www.fao.org/dad-is/>>

Tipos de artículos

Serán publicados en AGRI los siguientes tipos de artículos:

Artículos sobre investigación

Se tomarán en consideración para su publicación en AGRI los estudios sobre la caracterización, conservación y uso de los recursos genéticos de los animales domésticos (AnGR) con una buena descripción del entorno. Se agradecerá el envío de fotografías de calidad que presenten a las razas en cuestión en su ambiente natural de producción.

Artículos de revisión

Se podrán tener en consideración ocasionalmente aquellos artículos que presenten una revisión de los agroecosistemas, a nivel nacional, regional o mundial, con el desarrollo de uno o más aspectos referidos a la gestión de los recursos genéticos animales, incluidas las revisiones sobre el estado actual de las distintas áreas de AnGR.

Artículos específicos

Se solicitarán puntualmente artículos sobre temas específicos para ediciones especiales.

Otro material para publicación

Incluye la revisión de libros, noticias y notas referidas a reuniones importantes, cursos de formación y principales eventos nacionales, regionales e internacionales, así como conclusiones y recomendaciones relacionadas con los objetivos de estos principales eventos. Se invita a los lectores a enviar este tipo de material a los editores.

Guía para los autores

Presentación del manuscrito

Los artículos se presentarán en inglés, francés o español, junto con un resumen en inglés y su traducción en francés o español, y se enviarán al editor de AGRI, AGAP, FAO, Viale delle Terme di Caracalla, 00100 Roma, Italia. Otra posibilidad es enviar el artículo por correo electrónico adjuntando el documento en versión WinWord a <agri@fao.org>. Las fotografías, a color o en blanco y negro, se enviarán siempre por correo normal.

Los manuscritos se presentarán con doble espacio y con el número correspondiente a cada línea en el margen izquierdo. Todas las páginas serán numeradas, incluidas las de las referencias bibliográficas, cuadros, etc. El autor recibirá una notificación sobre la recepción de su documento.

En el caso de aceptación de un artículo después de su revisión, se solicitará al autor una versión final de su artículo revisado en disquete (formato 3$^{1}/_{2}$") en Word 6.0 x Windows, así como una copia impresa del mismo.

Preparación del manuscrito

En la primera página del manuscrito se indicará el título abreviado del artículo, títulos y nombres de los autores, instituciones, direcciones completas (incluido código postal y número de teléfono); así como otros medios de contacto tales como fax, e-mail, etc., del autor principal. El título abreviado no deberá sobrepasar los 45 caracteres más los espacios correspondientes, y aparecerá en la parte superior de la página 1 del manuscrito en mayúsculas. El título entero del manuscrito viene escrito en mayúsculas y minúsculas. Dicho título debe ser lo más breve posible y no sobrepasar los 150 caracteres (incluidos los espacios necesarios), con los nombres de las especies, si necesario. Los nombres de los autores, instituciones y direcciones se escribirán en cursiva y en letras mayúsculas y minúsculas. Se dejará una línea en blanco entre el título y los nombres de los autores. Las direcciones se escribirán como notas de pie de página de cada autor después de dejar una línea en blanco entre los nombres y éstas. Cada nota de pie de página con la dirección vendrá indicada numéricamente. Se dejarán dos líneas en blanco después de las direcciones.

Títulos

Los títulos de cada sección, por ejemplo Resumen, Introducción, etc., vienen alineados a la izquierda. Dejar dos líneas en blanco entre las notas de pie de página con las direcciones y el Resumen y entre el título Resumen y el texto que sigue. El resumen no deberá exceder de 200 palabras. Deberá ser un resumen objetivo que describa brevemente los procesos y logros obtenidos, y no una presentación de cómo se ha llevado a cabo el estudio y una descripción genérica de los resultados. Dejar una línea en blanco entre el final del texto del resumen y las palabras clave, que se escribirán en cursiva así como el titulo Palabras clave. No deberán ser más de seis y no deberán contener "y" o "&". Todos los títulos principales de capítulo (14 regular) y subcapítulo (12 regular) serán en negrita e irán precedidos y seguidos de una línea en blanco. El texto correspondiente empezará sin sangrado. Un título dentro de un subcapítulo se escribirá en cursiva e ira seguido de un punto con a continuación el texto correspondiente.

Cuadros y figuras

Los cuadros y las figuras se incluirán al final del texto siguiendo el orden de cita dentro del mismo. Las fotografías no serán devueltas a sus autores.

Cuadros

Los cuadros, incluidas las notas de pie de página, deberán ir precedidos y seguidos por dos líneas en blanco. El numero del cuadro y su título se escribirán en la parte superior en cursiva (12) con un punto al final y seguido

de una línea en blanco. En cada columna o título de encabezamiento o subtítulo, sólo la primera letra de la primera palabra irá en mayúscula. Los cuadros irán numerados de forma consecutiva con números árabes. Los cuadros y sus títulos se alinearán a la izquierda, así como el texto. Se utilizarán líneas horizontales o verticales sólo cuando sea necesario. No utilizar tabuladores o la barra espaciadora para crear un cuadro.

Figuras

Las figuras, incluidos los títulos y leyendas, irán precedidas y seguidas de dos líneas en blanco. El número de la figura y el título se escribirán en la parte superior en cursiva (12) con un punto al final. La palabra figura incluye las fotografías, los gráficos, los mapas, los diagramas, etc. En el caso del diagrama se enviará la matriz original con los datos utilizados para crearlo. Se recomienda encarecidamente la utilización de Word 6.0 o Excel 5.0 para la presentación de los diagramas.

Referencias

Toda referencia presente en el texto deberá aparecer en la lista de referencias y, de la misma manera, cada referencia de la lista deberá haber sido citada por lo menos una vez en el texto. Las referencias deben ir en orden alfabético del apellido del autor, seguido por el año.

Ejemplo en el caso de una referencia de una revista:

Köhler-Rollefson, I.,1992; The camel breeds of India in social and historical perspective. Animal Genetic Resources Information 10, 53-64.

Cuando se trata de más de un autor:

Matos, C.A.P., D.L. Thomas, D. Gianola, R.J. Tempelman & L.D. Young, 1997; Genetic analysis of discrete reproductive traits in sheep using linear and nonnlinear models: 1. Estimation of genetic parameters 75, 76-87.

En el caso de un libro o de una publicación ad hoc, por ejemplo informes, tesis, etc.:

Cockril, W.R., (Ed), 1994; The Husbandry and Health of the Domestic Buffalo. FAO, Rome, Italy, pp 993.

Cuando se trate de un artículo dentro de las actas de una reunión:

Hammond, K., 1996; FAO's programme for the management of farm animal genetic resources. In C. Devendra (Ed.) Proceedings of IGA/FAO Round Table on the Global Management of Small Ruminant Genetic Resources, Beijing, May 1996, FAO, Bangkok, Thailand, 4-13.

Cuando la información contenida en el artículo haya sido obtenida o derive de un sito World Wide Web, poner el texto entre comillas; por ejemplo "sacado de la FAO. 1996" e indicar en las Referencias la forma estándar URL:

FAO, 1996; Domestic Animal Diversity Information System <http://www.fao.org/dad-is/>, FAO, Rome

Se ruega enviar los manuscritos o la correspondencia relativa a AGRI a la dirección siguiente:

agri-bulletin@fao.org

Gracias por su colaboración