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SUR LE RESSOURCES
GÉNÉTIQUES ANIMALES

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DE INFORMACION
SOBRE RECURSOS
GENETICOS ANIMALES



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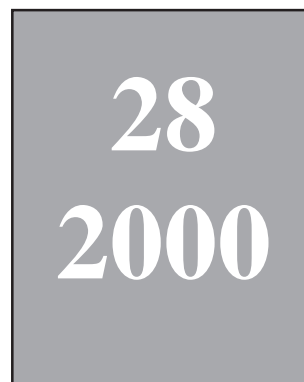
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BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

BOLETÍN DE INFORMACIÓN SOBRE RECURSOS GENÉTICOS ANIMALES



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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE
ORGANIZACION DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION

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Editorial: Green light for Animal Genetic Resources

Global recognition of the essential contribution of animal genetic resources to food security, sustainable rural development, and management of natural resources has led to the initiation of the first global assessment of the state of these resources. The initiative was taken in 1999 by the FAO Commission on Genetic Resources for Food and Agriculture, which has 161 members and is the major international forum for developing policies on genetic resources for food and agriculture. The Commission requested that FAO should co-ordinate the development of a country-driven *Report on the State of the World's Animal Genetic Resources*. It noted the need for guidelines to assist country participation in the preparation of the *Report*. The Commission also requested that the Intergovernmental Technical Working Group on Animal Genetic Resources review the guidelines which was done at its second session on 4-6 September 2000. This session also established the timeline for countries to prepare their Reports.

Countries will be invited by FAO to prepare their Country Reports using the approved guidelines. The Country Report will be an official government document that provides a strategic assessment of the state of animal genetic resources and the capacity to manage them. National Consultative Committees will be formed to oversee preparation of the Country Reports. These bodies will include representatives from the entire range of interests in animal genetic resources, including government agencies, industry, non-government organizations, and local communities. Networks should be established covering the range of important animal species and production systems. National Committees will ensure that their Country Reports address three fundamental strategic questions: Where is the country in terms of the management of animal genetic

resources? Where does the country need to be in terms of the management of these resources over the next 5 to 10 years? How does the country get to where it needs to be? The most important objective of the Country Report is to provide a strategic assessment of the country's animal genetic resources sector, so that it enables development of a strategic plan for animal genetic resources management.

Country Reports will be based on collation and analysis of existing data and information on animal genetic resources within their relevant production systems, to support the strategic analysis. This will include data and information on the state of understanding of the diversity of the countries' animal genetic resources, the state of capacity to manage them, and data and information to assist the National Committee to predict future country needs.

Country and regional networking will be essential to assemble the best available data and information. Also, networking will help stimulate greater awareness of the many roles and values of these essential resources and gain appreciation of the need for investments in their wise use and development. Investments are also required in conservation to meet the many challenges posed by changing consumer demands and environmental conditions.

Regional networks are essential to facilitate the identification of strategic priorities for co-operation and collaboration among countries with common or shared animal genetic resources, and those with common production systems and/or issues.

FAO will provide a supporting and co-ordination role, by providing guidelines, training, planning and monitoring, data collection and analysis, and Country Report

tools within DAD-IS, providing on-line support to National Committees, and by providing regional training workshops.

Country Reports are to be completed by the end of 2001 to enable the synthesis of the report at the global level, as well as to incorporate data, information, and strategic priorities provided from relevant international organizations. The first product of the synthesis, the Report on Strategic Priority Actions will be presented to the Commission in 2003. The first *Report on the State of the World's Animal Genetic Resources* and its follow-up mechanism will be presented to the Commission in 2005.

The challenging and demanding efforts to prepare Country Reports will provide an essential foundation for the better management of animal genetic resources.

These resources are rapidly eroding and it is clear that in many countries, locally adapted breeds are not being utilized or developed to their potential. Faced with food shortages, many countries feel forced to import exotic animal genetic resources without either the tools or capacity to properly assess their appropriate use and long-term impacts, or to consider how best to use their indigenous resources. In many countries, the Reports will provide for the first time a strategic basis to assess and plan the better management of animal genetic resources. Country Reports and the first *Report on the State of the World's Animal Genetic Resources* will provide a strong signal for enhanced regional and global co-operation to achieve the better use of animal genetic resources and to prevent their indiscriminate use.

The Editors

Editorial: Feu vert pour les Ressources Génétiques Animales

La reconnaissance mondiale de la contribution essentielle des ressources génétiques animales à la sécurité alimentaire, au développement rural durable et à la gestion des ressources naturelles a porté à la première évaluation mondiale sur la situation de ces ressources. L'initiative avait été prise en 1999 par la Commission pour les Ressources Génétiques pour l'Alimentation et l'Agriculture de la FAO, qui compte 161 membres et est le forum international le plus important pour le développement des politiques des ressources génétiques pour l'alimentation et l'agriculture. La Commission a sollicité à la FAO de coordonner le développement d'un rapport à base nationale sur *La Situation des Ressources Génétiques dans le Monde*. La Commission a aussi noté le besoin de lignes guide pour aider la participation des pays à la préparation de ce rapport. La Commission a demandé également que le Groupe Technique Inter Gouvernemental de Travail pour les Ressources Génétiques Animales revoie les lignes guides qui avaient été préparées lors de sa deuxième session du 4-6 septembre 2000. Cette session a par ailleurs établi les dates limites pour les pays pour la préparation de leurs rapports.

Les pays seront invités par la FAO à préparer leur Rapport National en utilisant les lignes guides approuvées. Le Rapport National sera un document gouvernemental officiel qui fournira une évaluation stratégique sur la situation des ressources génétiques animales et la capacité existante pour leur gestion. Les Comités de Consultation seront formés sur la base des Rapports Nationaux présentés. Ces Comités inclueront des représentants venant de tous les domaines d'intérêt pour les ressources génétiques animales, y compris les agences gouvernementales, l'industrie, les organisations non gouvernementales et les communautés locales. Des réseaux seront

établis pour couvrir toutes les espèces animales et les systèmes de productions plus importants. Les Comités Nationaux assureront que leur Rapport National tient compte de trois questions stratégiques fondamentales: A quel point se trouve le pays en termes de gestion des ressources génétiques animales? A quel niveau pensent-ils se trouver dans 5 à 10 ans en termes de gestion des ressources génétiques animales? Que pense faire le pays pour atteindre son but? L'objectif le plus important du Rapport National est de fournir une évaluation stratégique du secteur national des ressources génétiques animales, de façon à permettre le développement d'un plan stratégique de gestion de ces ressources.

Les Rapports Nationaux seront basés sur la collation et l'analyse des données et l'information existantes sur les ressources génétiques animales dans le contexte de leurs systèmes de production afin d'aider l'analyse stratégique. Ceci devra inclure des données et l'information sur la situation de sensibilisation de la diversité des ressources génétiques animales dans le pays, la capacité de gestion de ces ressources, et les données et information nécessaires pour aider le Comité National à prévoir les besoins futurs du pays.

Les réseaux nationaux et régionaux seront essentiels pour rassembler les données et l'information disponibles plus intéressantes. En outre, les réseaux aideront à stimuler une plus grande conscience des différents rôles et valeurs de ces ressources essentielles ainsi qu'à augmenter la nécessité du besoin d'investissements pour leur plus large utilisation et développement. Les investissements seront aussi nécessaires pour la conservation afin de faire face aux différents défis posés par les changements dans la demande des consommateurs et des conditions environnementales.

Les réseaux régionaux sont essentiels pour faciliter l'identification des priorités stratégiques pour la coopération et la collaboration entre les pays pour les ressources génétiques animales communes ou partagées, ainsi que ceux avec des systèmes de production et/ou des débouchés communs.

La FAO aura un rôle d'appui et de coordination et fournira donc les lignes guides, la formation, la planification et suivi, la saisie et l'analyse de données, et les outils de DAD-IS pour le Rapport National, à travers une aide *on line* aux Comités Nationaux et l'organisation d'ateliers de formation au niveau régional.

Les Rapports Nationaux devront être complétés avant la fin de 2001 pour permettre la synthèse du rapport au niveau mondial ainsi que l'introduction de données, d'information et de priorités stratégiques fournis par les organisations internationales pertinentes. Le premier résultat de synthèse, le Rapport sur les Actions Stratégiques Prioritaires, sera présenté à la Commission en 2003. Le premier Rapport sur la Situation Mondiale des Ressources Génétiques Animales et son mécanisme de suivi sera présenté à la Commission en 2005.

Les efforts de stimulation et de demande nécessaires pour préparer les Rapports Nationaux fourniront une base essentielle pour une meilleure gestion des ressources génétiques animales. Ces ressources souffrent d'une érosion rapide et il est clair que dans beaucoup de pays les races adaptées aux conditions locales ne sont pas utilisées ou développées aux limites de leur potentiel. Face au déficit alimentaire, beaucoup de pays se sentent obligés à importer des ressources génétiques exotiques sans avoir pour autant les outils ou la capacité pour évaluer correctement leur utilisation exacte et l'impact possible à long terme, ou bien pour considérer comment mieux utiliser leurs ressources autochtones. Dans beaucoup de pays les Rapports fourniront pour la première fois les bases stratégiques pour évaluer et planifier une meilleure gestion des ressources génétiques animales. Les Rapports Nationaux et le premier Rapport sur la Situation Mondiale des Ressources Génétiques Animales lanceront un important signal d'encouragement pour une coopération régionale et mondiale à atteindre une meilleure utilisation des ressources génétiques animales et à prévenir leur utilisation indiscriminée.

Les Editeurs

Editorial: Luz Verde para los Recursos Genéticos Animales

El reconocimiento mundial de la contribución esencial de los recursos genéticos animales a la seguridad alimentaria, al desarrollo rural sostenible y a la gestión de los recursos naturales ha llevado a la primera evaluación mundial sobre la situación de estos recursos. La iniciativa fue tomada en 1999 por la Comisión para los Recursos Genéticos para la Alimentación y la Agricultura de la FAO, que cuenta con 161 miembros y es el forum internacional más importante para el desarrollo de políticas sobre recursos genéticos para la alimentación y la agricultura. La Comisión solicitó a la FAO que coordinase el desarrollo de un informe sobre base nacional sobre *La Situación de los Recursos Genéticos en el Mundo*. La Comisión también subrayó la necesidad de establecer directrices para fomentar la participación de los países en la preparación de dicho informe. La Comisión pidió también que el Grupo Técnico Inter Gubernamental de Trabajo para los Recursos Genéticos Animales revisara las directrices que habían sido preparadas durante su segunda sesión del 406 septiembre 2000. Por otra part, esta sesión estableció las fechas límite para la preparación de los informes por parte de los países.

La FAO invitará los países a preparar su Informe Nacional utilizando las directrices aprobadas. El Informe Nacional será un documento gubernamental oficial que proveerá una evaluación estratégica sobre la situación de los recursos genéticos animales y la capacidad existente para su gestión. Los Comités de Consulta se formarán en base a los Informes Nacionales presentados. Estos Comités incluirán representantes provenientes de todos los sectores di interés para los recursos genéticos animales, incluidas las agencias gubernamentales, la industria, las organizaciones non gubernamentales y las comunidad locales. Se establecerán redes para cubrir todas las

especies animales y los sistemas de producción más importantes. Los Comités Nacionales se aseguraran que sus Informes Nacionales tienen en cuenta tres cuestiones estratégicas fundamentales: A que punto se encuentra el país en términos de gestión de los recursos genéticos animales? Que nivel piensan poder alcanzar en un plazo de 5 a 10 años en cuestión de gestión de los recursos genéticos animales? Que piensa hacer el país para alcanzar su objetivo? El objetivo más importante del Informe Nacional es proveer una evaluación estratégica del sector nacional de los recursos genéticos animales, para permitir el desarrollo de un plan estratégico de gestión de estos recursos.

Los Informes Nacionales se basarán en la comparación y el análisis de datos e información existentes sobre los recursos genéticos animales dentro del contexto de sus sistemas de producción, con el fin de facilitar el análisis estratégico. Para ello, se incluirán los datos y la información sobre el estado de sensibilización frente a la diversidad de los recursos genéticos animales en el país, la capacidad de gestión de estos recursos, y los datos e información necesarios para ayudar al Comité Nacional en su previsión de las necesidades futuras del país.

Las redes nacionales y regionales serán esenciales para recoger los datos y la información más interesante disponibles. Además, las redes ayudarán a estimular una mayor conciencia sobre los distintos papeles y valores que representan estos recursos esenciales, así como a aumentar la necesidad de inversión para una mayor utilización y desarrollo de los mismos. Las inversiones serán también necesarias para la conservación, para poder enfrentarse a los distintos desafíos planteados por los cambios de tendencia en la demanda de los consumidores y por las condiciones ambientales.

Las redes regionales son esenciales para facilitar la identificación de prioridades estratégicas para la cooperación y la colaboración entre países con recursos genéticos animales comunes o compartidos, así como para aquéllos con sistemas de producción y/o salidas comunes.

La FAO jugará un papel de apoyo y coordinación y proveerá las directrices, la formación, la planificación y seguimiento, la introducción y el análisis de datos, así como las herramientas de DAD-IS para el Informe Nacional, a través de una ayuda *on line* a los Comités Nacionales y la organización de talleres de formación a nivel regional.

Los Informes Nacionales deberán ser completados antes de finales del 2001 para permitir una síntesis del informe a nivel mundial así como la introducción de datos, información y prioridades estratégicas remitidos por las organizaciones internacionales pertinentes. El primer resultado de síntesis, el Informe sobre la Situación Mundial de los Recursos Genéticos Animales y su mecanismo de seguimiento, será presentado a la Comisión en el 2005.

Los desafíos y las solicitudes a las que habrá que enfrentarse para preparar los

Informes Nacionales proporcionarán una base esencial para una mejor gestión de los recursos genéticos animales. Estos recursos padecen de una erosión rápida y está claro que en muchos países las razas adaptadas a las condiciones locales no vienen utilizadas o desarrolladas hasta el límite de su potencialidad. Frente al déficit alimentario, muchos países se sienten obligados a importar recursos genéticos exóticos sin poseer las herramientas necesarias o la capacidad para evaluar correctamente el uso exacto y el posible impacto a largo plazo, como tampoco saben cómo utilizar mejor sus propios recursos autóctonos. En muchos países los Informes permitirán por primera vez contar con bases estratégicas para evaluar y planificar una mejor gestión de los recursos genéticos animales. Los Informes Nacionales y el primer Informe sobre la Situación Mundial de los Recursos Genéticos Animales lanzarán un importante señal para fomentar una mayor cooperación regional y mundial y obtener así una mejor utilización de los recursos genéticos animales así como una prevención del uso indiscriminado.

Los Editores

Introducing the country-driven process for preparing the First Report on the State of the World's Animal Genetic Resources

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The 181 Members of FAO have resolved that the Organisation, their technical secretariat for food and agriculture, will assist them over the next 5 years to plan and execute a new initiative, preparation of a first Report on the State of the World's Animal Genetic Resources.

Governments Endorse Preparation of the First Report on the State of the World's Animal Genetic Resources

At its first meeting 8-10 September 1998, FAO's Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture (ITWG-AnGR) recommended that FAO co-ordinate the development of a country-driven Report on the State of the World's Animal Genetic Resources, that could provide an assessment of countries' animal genetic resources programmes and the state of farm animal genetic resources. In making this recommendation, the ITWG-AnGR stressed a number of requirements, including:

- The importance of enhancing the understanding and awareness of the status of animal genetic resources, the state of country capacity to manage their resources and the state of the art, in terms of the methodologies and technologies available for the better use, development and conservation of these resources.

- Further development of the functionality of the Domestic Animal Diversity Information System (DAD-IS) to assist countries in the reporting process.
- The need for the process of preparation of the Report on the State of the World's Animal Genetic Resources to be developed in a manner that would build national capacity particularly through early training and would lay the basis for regular and cost-effective updating of the relevant data and information.
- Noting that Countries' capacities to report on the state of their animal genetic resources vary considerably, the Working Group had also stressed "the need to design an approach, including consultation with countries on practical guidelines, to the preparation of the Report on the State of the World's Animal Genetic Resources that makes allowance for these different capacities and to ensure that sufficient time is available in the light of individual countries capacities".

The recommendations of the ITWG-AnGR regarding the preparation of the first Report on the State of the World's Animal Genetic Resources were endorsed by the Commission on Genetic Resources for Food and Agriculture (CGRFA) at its Eighth Regular Session, 19-23 April 1999, and by the FAO Council at its 116 1h session, 1419 June 1999. The CGRFA asked the ITWG-AnGR to finalise the Guidelines for Country Report preparation.

The Scope and Purpose of the First Report on the State of the World's Animal Genetic Resources

The Report of the State of the World's Animal Genetic Resources will enable cost-effective implementation at the country and regional levels of the Global Strategy for the Management of Farm Animal Genetic Resources. The Report will not only provide a comprehensive inventory of the animal genetic resources, it will describe the present and future status and roles of these resources and allow for animal genetic resources to be assessed in terms of their contribution to sustainable development and food security. Specifically, the contribution of the State of the World's process (the Process) as well as the first Report itself (the Report) will be to further develop and implement the Global Strategy by:

- Providing national governments and stakeholders, including country networks, with enhanced understanding of the state of animal genetic resources, clarifying needs and strategic priorities, and providing an understanding of existing capacity to manage these resources. This will contribute directly to improved understanding, use, development and conservation of these resources, and introduce a firm foundation for capacity building to ensure long-term sustainable use and development of these resources, on a sound basis for enhancing the important contribution of the animal sector of agriculture in achieving global food security and rural development;
- Enhancing country technical capacity particularly in the area of animal genetic resources inventory, characterisation, data and information management, and communication for use in developing cost-effective action in sustainable intensification and, as required, conservation;
- Providing the Commission on Genetics Resources for Food and Agriculture and its

Intergovernmental Technical Working Group on Animal Genetic Resources, and national Governments with data and information on animal genetic resources for establishing priorities for improved policy development and capacity building in this sector, and the need for and requirements of international and national regulations and codes of conduct;

- Providing donors and stakeholders with a framework from which to establish priorities, create synergies and mobilise necessary financial resources to implement actions aimed at the enhanced use, development and conservation of animal genetic resources;
- Providing FAO with a foundation for the Early Warning and Reaction System for animal genetic resources, and a basis for preparing national and international emergency plans and response to genetic resources that are at risk of being lost; and
- Providing the Commission for Genetic Resources with a foundation and capacity to monitor the state of animal genetic resources, and provide guidance to relevant stakeholders such as donors, international organisations and Parties to the Convention on Biological Diversity.

The Planning Process

Global Co-ordination

FAO will provide the Global Focal Point to assist countries undertake preparation of their Country Reports, and will undertake a synthesis of Country Reports and other reports to develop during the Process a Strategic Priority Actions Report and subsequently the first Report on the State of the World's Animal Genetic Resources. The first preparatory step has been the planning and development of Guidelines for Country Reports, which were endorsed for use at the Second Session of the ITWG-AnGR held in September 2000. FAO is also developing a SOW-AnGR functionality within DAD-IS that provides on-line support to National Consultative Committees for Animal Genetic

Resources and their networks, to assist countries to efficiently undertake preparation of their Country Reports. FAO will also develop training material and co-ordinate regional training workshops. This formative work is being done by utilising a broad spectrum of experts from all regions of the world. The Global Focal Point will also ensure opportunities for the involvement of intergovernmental organisations, research institutions, and non-government organisations in all phases of the development of the first Report on the State of the World's Animal Genetic Resources.

An estimated 120 to 150 countries are expected to accept the invitation from FAO to be involved over 2001 to 2005 in the preparation of the first Report. Beginning January 2001, FAO will co-ordinate the comprehensive training programme that is anticipated to involve as many as 2 500 experts throughout the world, including experts in traditional knowledge.

FAO's Information Department will assist 'in the development and execution of an overall communication strategy and a public awareness programme implemented focusing on the roles and values of animal genetic resources and support for enhanced use, development, and conservation of these essential resources. DAD-IS and the electronic media will also be used in this action.

FAO is actively seeking extra-budgetary resources that are necessary to support the core preparatory work for the first Report; and is involving in the preparatory process the range of international stakeholders.

Country Reports

The process for developing the first Report must be country-driven, ensuring that national and regional capacities, issues, priorities, and needs are reliably identified. The Guidelines to assist countries prepare their Country Reports are intended to facilitate country assessments of policy and technical management issues, capacity building needs, achievements and an analysis of the trends and demands within the farm

animal sector. Countries are encouraged to provide an in depth analysis of their livestock sector in order to determine both successes and failures in the use and development of animal genetic resources and the reasons for success and failure.

The Guidelines for Country Reports contain common elements in order to allow compilation of the Country Reports to provide a foundation for the first Report. The Guidelines have been structured to provide an assessment 'in four basic areas, which are: the state of animal genetic resources; the state of capacity to manage animal genetic resources; an assessment of capacity building requirements; and the state of the art. Analysis in these key areas will produce strategic priorities for action at national, regional, and global levels.

Countries accepting participation in the process will be invited to attend regional workshops where all aspects of the Process and its importance to the characterisation, use, development and conservation of AnGR will be discussed. The country experts will receive in-depth training in the co-ordination of the State of the World in-country process, including in the use of the Guidelines and of the SOW-AnGR reporting module of DADIS. Guidance on the range of technical data and information which, when collated will provide a sound platform for use in developing the Country Report, will also be provided in the training sessions. A copy of the Guidelines for Development of Country Reports follows this Introduction to the Process.

The Guidelines recommend the establishment of a National Consultative Committee (NCC) for animal genetic resources, which includes the National Co-ordinator for animal genetic resources. The Committee will be responsible for all Country Report preparatory activities. They will work through 2001 to frame out and develop the Country Report, ready for clearance by the Government and submission to FAO for analysis along with Reports from all other countries. The NCC may determine appropriate mechanisms for involving

national and international stakeholders. A strong NCC is essential to develop strategic Country Reports for use in planning further priority action. To achieve its objectives, the Process for preparing the Country Report must promote and facilitate from the first phases, the widest involvement of stakeholders and set the stage for effective action.

The NCC responsible for developing Country Reports, is one of the determining factors in achieving successful implementation of the SOW-AnGR process. The training for the preparation of the first SOW-AnGR Report will be comprehensive and will involve development of a global pool of regional trainers and consultants. Sub-regional training of key country trainers will be undertaken as the critical extra-budgetary resources are secured. These country trainers will be primarily responsible for fully informing the NCC as well as training in the broad country networks which should collate the necessary data and information to support the identification of issues, needs and priorities that will be presented in the Country Reports.

The NCC will, with some global and regional support, be responsible for developing the framework for the Country Report, for co-ordinating collection and assembly of data, and for analysing and synthesising this data and information ready for use in completing the Report development work. This data, information, and analysis will enable soundly based description of the state of the countries animal genetic resources diversity, the state of their capacity to manage these resources and the state of the art in terms of available policies, methodologies, technologies, and expertise.

The NCC will also be responsible for identifying and presenting the essential findings and their country's strategic priorities for action. These will constitute the basis of the draft Country Report, ready for acceptance by the Government and submission to FAO. It is hoped that the main

body of the Country Report be about 25-30 pages in length with a maximum of 60 pages.

As recommended at the first meeting of the ITWG-AnGR, and in light of experience gained with the preparation of Country Reports on Plant Genetic Resources, sufficient time must be allowed for the preparation of Country Reports for animal genetic resources. Thus, it proposed that the Country Reports and reports by international organisations, be completed by 28 February 2002.

Reports from relevant International Organisations

Key international organisations involved in animal genetic resources will also be requested to contribute data, information and strategic directions in the preparation of the first Report. FAO will interact with appropriate organisations to obtain their input. FAO, will also commission selected reports on specific issues to contribute to the global assessment of the state of animal genetic resources, the capacity to manage them, and strategic priorities, as required.

Synthesis of Country Reports and Reports from Organisations

Beginning early in 2002, the Global Focal Point in consultation with Regional Co-ordinators will begin the process of compilation, analysis and synthesis of Country Reports and reports from organisations. Draft regional reports may also be prepared by FAO and considered at intergovernmental regional meetings. Advisory or review panels may be established to review specific sections of the draft Report. Appropriate international governmental and non-government organisations will also be included in the review process through regular sessions of the international stakeholder mechanism of the Global Strategy. It is proposed that the ITWG-AnGR meet in 2002 to evaluate progress.

The Report on Strategic Priority Action and the follow-up mechanism

The first major expected result of the synthesis of Country Reports and reports from organisations will be a Report on Strategic Priority Actions, which will be presented first for consideration of the ITWG-AnGR, then to the Commission in 2003. The Strategic Priority Actions Report will identify both capacity building requirements and specific needs for urgent action at the (sub-)regional and global levels and will provide a basis for the ITWG-AnGR and the Commission to consider an appropriate implementation mechanism to ensure action on the strategic findings. Presentation of this Strategic Priority Actions Report will provide governments and international collaborators with a basis to respond to high priority areas of common interest and concern, and will also assist in the further development and implementation of the Global Strategy.

Experience with the State of the World's Plant Genetic Resources indicates that closely coupling the development of the follow-up mechanism to the reporting process is crucial during the preparatory phase of the first Report on the State of the World's Animal Genetic Resources. Therefore, the ITWG-AnGR will consider the options for a follow-up mechanism to ensure a successful

transition from reporting to implementation, and will make recommendations to the Commission during their Fourth Session in 2003. The Commission will then consider the advice from the ITWG-AnGR and options for the follow-up mechanism, at their Tenth Session in 2003.

The First Report on the State of the World's Animal Genetic Resources

The ITWG-AnGR and the Commission will in addition to considering the Report on Strategic Priority Actions in 2003, will also adopt the content and format of the First Report on the State of the World's Animal Genetic Resources. FAO will then be able to continue the synthesis and report preparation activities in order to ensure completion of the Report in 2005 for consideration by the ITWG-AnGR, and then consideration and adoption by the Eleventh Session of the Commission.

Progress monitoring through AGRI

This, and subsequent issues of AGRI, will incorporate a new section to report on progress in developing this major global initiative for the livestock sector of food and agriculture.

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El ganado criollo Sanmartinero (SM) y su potencial productivo

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Resumen

Con este artículo se trata de resaltar aspectos zootécnicos y económicos de la raza Sanmartinera y su utilización en forma racional y sostenible, como fuente genética para el desarrollo eficiente de la ganadería Orinoquense.

Se describen sus cualidades y aptitudes productivas, como raza pura y en cruces con Cebú (Brahman), Santa Gertrudis y Charoláis; igualmente, los resultados comparativos de peso presacrificio y rendimiento en canal de cruces F_1 $\frac{1}{2}$ SM x $\frac{1}{2}$ Cebú y Cebú puro.

Summary

This paper has a primary objective to highlight the zootechnical and economic aspects of the Sanmartinero Creole and call attention to the need to use it in a more rational and sustainable way as a basic genetic source to develop an efficient livestock enterprise in the Orinoquia region.

Its qualities and productive aptitudes as a purebred and in crosses with Zebu (Brahman), Santa Gertrudis and Charoláis were also described. Similarly the comparative results of pre-slaughtered weight and dressing percent of F_1 $\frac{1}{2}$ SM x $\frac{1}{2}$ Zebu and pure Zebu were shown.

Key words: Creole breeds, Sanmartinero, Beef cattle, Heterosis, Cross-breeding.

Introducción

La raza Sanmartinera (SM) se formó en el piedemonte llanero, Orinoquia colombiana, gracias al trabajo de la selección natural y al esfuerzo zootécnico de los jesuitas, en el siglo XVII, con los bovinos introducidos por los españoles en el siglo XV.

Está adaptado a las subregiones del piedemonte y altillanura de la región Orinoquense, representativas de las zonas de Bosque Húmedo Tropical (BHT) y Muy Húmedo Tropical (BMHT) (Holdrige y Hunter, 1961), las cuales se caracterizan por su topografía plana y ondulada, suelos ácidos, con deficiencias minerales, especialmente de P, Cu, Zn y altos contenidos de Al; temperatura media de 26 ° C con variaciones bruscas durante las 24 horas del día; humedad relativa de 87 por ciento en la época lluviosa (abril a noviembre) y de 55 por ciento en la época seca (noviembre a marzo). La precipitación varía entre 2 700 (altillanura) y 3 500 (piedemonte) mm/año, con régimen monomodal de distribución de lluvias.

Las principales gramíneas nativas de las dos subregiones son: el Pasto Negro (*Paspalum plicatulum*), Gramalote (*Paspalum fascilatum*), Guaratará (*Axonopus purpussi*), Lamedora (*Leersia hexandra*), Carretera (*Parateria prostrata*), y variedades de pajas del llano como la Paja Peluda (*Trachypogon vestitus*). Entre las principales gramíneas introducidas se encuentran los *Brachiaria* spp. *decumbens*, *humidicola*, *dictyoneura*, *bryzantha*, el Pasto Puntero (*Hyparrhenia rufa*) y en menor proporción el Pasto gordura (*Melinis minutiflora*). Entre las leguminosas existentes

merecen mencionarse el Kudzú (*Pueraria phaseoloides*), Maní forrajero (*Arachis pintoi*), Pega Pega (*Desmodium sp.*) y otras especies nativas sin clasificar (Huertas, 1998).

Las condiciones ambientales y el sistema de manejo extensivo a que ha sido sometido, desarrollaron en el SM características de gran importancia económica, tales como rusticidad, resistencia, capacidad para vivir en grandes extensiones, donde los forrajes son escasos y las aguas distantes, cierta tolerancia a ectoparásitos y a condiciones extremas de temperatura y humedad, así como habilidad para utilizar forrajes fibrosos; constituyéndose así en patrimonio biológico y económico para la provisión eficiente de alimentos (carne, leche), pieles y trabajo.

Hasta comienzos del siglo XX, el SM era la raza más utilizada para la producción de carne y leche en la altillanura y piedemonte del departamento del Meta; sin embargo, en la actualidad, sólo existen 3 166 cabezas de

este ganado, distribuidas en los Bancos de Germoplasma de ICA-CORPOICA, en los centros de investigación La Libertad (Villavicencio) y Carimagua (Puerto Gaitán), en los hatos de multiplicación de la Secretaría de Agricultura (Granja Iracá – San Martín) y de la Universidad de los Llanos, UNILLANOS (Granja Manacacias – Puerto Gaitán) y en poder de algunos particulares.

La razón principal de la drástica disminución de la población fue el cruzamiento absorbente e indiscriminado que se hizo con el Cebú (C), tipo Brahman. El mejor comportamiento productivo de los híbridos, obtenidos con toros C, fue atribuido al aporte genético de éste y no a la combinación favorable de genes no aditivos y a la habilidad combinatoria que se generó al cruzar estas razas (Martínez y col., 1996; Martínez, 1999; Elzo y col., 1999).



Figura 1. Toro adulto de 10 años, 700 kg.

Reseña histórica

Varias teorías se han expuesto sobre el origen del ganado SM. Algunas de ellas aceptan cierta influencia de razas inglesas y otras sostienen la intervención de razas africanas y asiáticas.

En el primer caso y teniendo en cuenta la época del descubrimiento de América, es poco probable que así haya ocurrido porque el mejoramiento y creación de razas inglesas, comenzó a mediados del siglo XVIII.

Es más probable la segunda teoría, ya que durante esa época, por la invasión de los moros a España, su ganadería podría estar conformada parcialmente por razas importadas, especialmente al sur- occidente de la península Ibérica, punto de partida de los ganados para el nuevo mundo.

El origen del ganado ibérico y la validez de las teorías se remontan a tiempos tan lejanos que esta discusión se haría interminable. En resumen, todos los autores están de acuerdo en afirmar que las razas criollas de América, descienden de los ganados provenientes de la península Ibérica y que fueron traídos por los conquistadores.

Se podría concluir entonces que el ganado SM tiene sus ancestros en el ganado español, concretamente en la región de Extremadura. Libros españoles de ganadería escritos por autores de reconocida prestancia, Santos Arán y Zacarías Salazar, describen y muestran fotografías del ganado extremeño, con características casi idénticas al SM (González, 1999).

Características morfológicas y fisiológicas

El ganado SM por su conformación se clasifica como *mesolíneo* y por su tamaño como *eumétrico*. La alzada, medida en la vertical de la cruz, es de 130 y 135 cm, para hembras y machos, respectivamente (Figuras de 1 a 6).

El cuerpo alargado, con mayor desarrollo del tren anterior en los machos, tiene cuello voluminoso, tórax profundo y dorso largo. La capacidad torácica en las vacas es de 178 cm y

de 185 en los toros. La línea dorsal ligeramente débil, anca caída y desprendimiento de cola alto, con pecho ancho, costillas arqueadas y grupa alargada.

Cabeza grande y fuerte con perfil rectilíneo; orejas pequeñas, redondeadas y con abundante cantidad de pelos. Cuernos fuertes y bien implantados, de color claro en la raíz con tonos más oscuros en las puntas. En los machos son gruesos y dirigidos hacia delante en forma de corona, mientras que en las hembras son en forma de lira (retorcidos hacia delante, hacia atrás y arriba).

Extremidades proporcionales al cuerpo con aplomos sólidos. Cola gruesa, larga y cubierta de pelos que termina en una borla abundante de pelos largos, cuyo color está de acuerdo con el color del animal.

La piel tiene grosor aproximado de 12 milímetros, pigmentada de color negro o marrón definidos y en algunos casos se encuentra moteada. El color de las mucosas corresponde al color del pigmento predominante.

El pelo es de longitud media, 5 milímetros, no es grasoso y se han contado entre 6 y 7 mil pelos por cm². El color del pelo, como en la mayoría de las razas criollas, es amarillo con tres tonalidades: Bayo, Colorado y Hosco; sin embargo, en poblaciones aisladas de la altillanura Colombiana es frecuente encontrar animales negros, pardos, overos, isabelas y barcinos.

El sistema mamario poco profundo, con ubre bien implantada; medida en cms tiene 30 de altura, 25 de longitud, 33 de ancho y 17 de profundidad. Las venas mamarias prominentes con un diámetro de 2 cm. La conformación de la ubre no es estética ya que los pezones delanteros de 6.5 centímetros, son más largos que los posteriores de 4.7 centímetros. Igualmente, el perímetro de 9.5 cm de los pezones anteriores superan los 8.2 cm de los posteriores (González, 1999).

Los testículos son firmes y bien proporcionados con circunferencia escrotal media de 38 cm en animales adultos. Su volumen medio de eyaculado es de 4.5 ml, con concentración espermática media de 800 millones por mililitro (Jiménez y col.,



Figura 2. Toro y vaca en un rancho de la altillanura colombiana.

1996); la capacidad de penetración de oocitos bovinos del SM es superior a la de toros C (Obando, 1999).

Una de las particularidades de importancia económica en las hembras SM es su facilidad de parto puesto que la expulsión del feto, con la vaca en posición de pie en el 86 por ciento de los casos, ocurre en aproximadamente 5 minutos (Velásquez, 1999), lo cual está relacionado con el pequeño tamaño de sus crías al nacer, factor que favorece la rápida recuperación posparto de las hembras y permite, en consecuencia, una acelerada reconcepción (Martínez, 1999).

Animales SM y sus híbridos con C poseen una resistencia intermedia al estrés calórico entre el C y razas *Bos taurus* como el Holstein Friessian. El SM utiliza como principal mecanismo para disipar calor el aumento de la frecuencia respiratoria, pero, a diferencia del Holstein, no aumenta su profundidad, lo que garantiza su *status* ácido básico, hecho demostrado por la no alteración del pH sanguíneo. Los terneros SM tienen, al nacer, mayor proporción de niveles protectores de inmunoglobulinas séricas que

los C, factor que les garantiza una mayor probabilidad de supervivencia (Velásquez y col., 1999). Igualmente, se encontró que el SM y sus híbridos con C poseen una resistencia intermedia a las garrapatas entre el C y cruces de éste con razas de origen europeo (Villar y Martínez, 1996).

Características productivas

Los valores medios de reproducción y crecimiento de SM, C y sus híbridos se presentan en las tablas 1, 2, 3 y 4.

Los animales del estudio de cruzamiento con C, Charoláis (CH) y Santa Gertrudis (SG) pertenecían al hato de conservación, multiplicación y fomento mantenido en el Centro de Investigaciones La Libertad, ubicado en la región del piedemonte, zona representativa de BHT de la Orinoquia colombiana.

El sistema de monta fue estacional (90 días), desde mayo hasta julio (los meses de mayor precipitación). Los partos ocurrieron entre enero y marzo (época de

Tabla 1. Tasas de natalidad, mortalidad y destete en diferentes grupos de apareamiento de SM, C y sus cruces. Centro de Investigación La Libertad. 1971-1986.

Raza toro	Raza vaca	No.	Natalidad %	Mortalidad %	Destete %
SM	SM	985	75.4	4.0	72.4
SM	C	321	78.3	2.5	76.3
SM	SM x C	94	82.2	1.5	81.0
C	SM	213	69.1	2.0	67.7
C	C	433	79.2	8.5	72.5
C	SM x C	192	81.6	1.5	80.4
SMxC	SM x C	248	84.8	5.0	80.6
Total		2 486	78.7	3.6	75.8

sequía). El plan de cruzamientos contempló el uso de toros SM, C, cruzados F_1 $\frac{1}{2}$ SM x $\frac{1}{2}$ C y $\frac{1}{2}$ C x $\frac{1}{2}$ SM, CH y SG, apareados con vacas SM, C y F_1 $\frac{1}{2}$ SM x $\frac{1}{2}$ C y $\frac{1}{2}$ C x $\frac{1}{2}$ SM.

Los animales para el estudio de producción de leche se mantuvieron en el Centro Agropecuario Los Naranjos, ubicación representativa del BMHT, con suelos fértiles y

alto grado de acidez. Se midió, entre 1981 y 1990, la producción de leche de SM, mantenido en pastoreo rotacional (2.8 an/ha) de *Brachiaria humidicola* (80 por ciento) y *Brachiaria decumbens* (20 por ciento) (González y col., 1995).



Figura 3. Toro y vaca típicos en la serranía de San Martín (Foto: Ramiro Hernández).

En este caso se utilizó monta directa en apareamiento continuo con suplementación mineral de 6 a 8 por ciento de fósforo en forma permanente y a voluntad. El ordeño se realizó en forma manual, con apoyo del ternero. La producción media de leche, en lactancias de 240 días, fue de 790 kg, 3.29 kg/día.

Reproducción y supervivencia

Las novillas SM obtuvieron su primer parto a una edad promedio de 43.1 meses, las C a los 45.4; mientras que las híbridas F_1 $\frac{1}{2}$ SM x $\frac{1}{2}$ C y $\frac{1}{2}$ C x $\frac{1}{2}$ SM lo presentaron a los 37.8 meses. Martínez y col. (1993), en un estudio similar con Blanco Orejinegro (BON), C y sus cruces recíprocos encontraron valores similares y heterosis de -12 por ciento.

El promedio general de intervalo entre partos (IEP) fue 16.4 meses, valor inferior al reportado para la región, 18 meses. Las hembras C superaron a las SM en 28.9 días ($P > 0.10$) y el promedio de éstas (SM y C, 502.6 días) fue mayor ($P < 0.01$) en 41.5 que el

de las recíprocas F_1 (460.7 días), -8.2 por ciento de heterosis; valor similar al reportado para otros estudios con ganado criollo (Martínez y col., 1993; Hernández, 1981).

En las tabla 1 se presentan las tasas de natalidad, supervivencia y destete de hembras SM, C y sus cruces recíprocos F_1 SM x C y C x SM.

Los valores medios de natalidad (78.7 por ciento) y destete (75.8 por ciento), por vacas expuestas a toro y el de mortalidad (3.6 por ciento), por el número de terneros nacidos vivos, son índices superiores a los reportados en la región: natalidad 65 por ciento, destete 58.5 por ciento y mortalidad 10 por ciento.

La menor natalidad del SM, obedeció, según Martínez (1999), a la "discriminación racial" de los grupos de apareamiento de toros C con vacas SM (69.1 por ciento), que repercutió negativamente en el comportamiento reproductivo general de las vacas criollas. Esta manifestación discriminatoria del toro C fue observado con otras razas criollas como Romosinuano

Tabla 2. Valores de heterosis individual (hi) y materna (hm) de peso al nacer (PN), destete (PD, 8 meses), 16 meses de edad (P16m) y ganancias diarias (g/d) predestete (GPD) y postdestete (GPPD) de SM, C y cruces con CH y SG. Centro de Investigación La Libertad. 1971-1986.

Raza Toro	Raza Vaca	n	PN kg.	GPD g/d	PD kg.	GPPD g/d	P16m kg.
SM	SM	743	26.6	561	161.3	194	211.8
SM	C	251	24.9	611	171.7	274	241.6
C	SM	147	31.4	611	178.1	295	252.2
C	C	343	24.6	545	155.8	199	207.7
Heterosis Individual		%	10.0	10.50	10.6	44.80	17.7
SG+CH	SM+C	96	29.4	615	177.0	258	241.6
SG+CH	SMxC+CxSM	113	30.1	663	189.1	210	242.8
Heterosis Materna		%	2.5	7.8	6.8	-18.53	0.5
Promedio general		1 693	27.84	601	172.2	238	233.0

Adaptado de Martínez, 1999.



Figura 4. Vaca pura (topizada) y su cría en el Centro de Investigaciones (CI) La Libertad, Villavicencio.

(Romo) y BON (Castro y col., 1971; Martínez y col., 1993); las vacas con mayor natalidad fueron las F_1 (83.2 por ciento).

La mayor tasa de mortalidad de terneros 8.5 por ciento, se presentó en el grupo C x C, sus causas no fueron suficientemente documentadas; sin embargo, no fue raro observar casos de “síndrome de ternero débil”. En el grupo inter-sé (F_1 x F_1), la mortalidad (5.0 por ciento) podría atribuirse a los apareamientos consanguíneos (hermanos medios) que contrarrestarían los beneficios biológicos de la hibridación (Martínez, 1999).

Crecimiento pre y posdestete

Crecimiento pre y posdestete

Con la excepción del apareamiento de toros y vacas C (24.6 kg), los toros SM produjeron los terneros más livianos al nacimiento, hecho que concuerda con los hallazgos de

investigaciones con BON y Romo (Martínez y col., 1994; Hernández, 1981). Esta característica, sumada a la mayor supervivencia de sus crías, es una cualidad de suma importancia pues presentan menores dificultades al parto, y por tanto una más rápida involución uterina, pronta reconcepción y en consecuencia, menor IEP.

Contrario al comportamiento de los toros, las vacas SM, excepto cuando se aparearon con toros de su misma raza, produjeron los terneros más pesados al nacer (31.2 kg). Las vacas Romo y BON presentaron la misma tendencia (Hernández, 1981).

Los valores de hi y hm se presentan en la tabla 2. Variaron desde 10.0 hasta 44.8 por ciento para PN y GPPD, respectivamente. Los valores de hi de las características predestete son similares a los reportados en estudios con BON y Romo (Martínez y col., 1994; Hernández, 1981), pero los valores para las características posdestete son superiores a los reportados en los estudios antes citados.

Como corolario de lo dicho anteriormente, en la tabla 3 se presenta el cálculo de producción de carne al destete por vaca expuesta a toro en el hato, obtenido al multiplicar el porcentaje de destete por el peso a dicha edad. Este cálculo permite estimar conjuntamente características de crecimiento y reproducción. Se presenta solamente para el tipo de cruzamientos que podría hacerse a nivel comercial. La escasa población de SM debería confinarse en hatos puros para aumentar la población y producir toros tanto para programas de mejoramiento del hato puro como de hibridación con vacada C, la más abundante en el país.

El esfuerzo primario con el criollo SM deberá orientarse a su multiplicación y mejoramiento, es decir, las hembras SM no deben estar contempladas en ningún plan de cruzamientos, a menos que se trate de otras necesidades de investigación futuras, puesto que se ha demostrado una mejor habilidad

materna sobre la vaca C y que supera en dicha característica a hembras criollas de otras razas como la BON y Romo, lo que permitiría su ordeño en sistemas extensivos de producción.

En la tabla 3 se aprecia que todos los grupos de híbridos producen significativamente más carne por vaca expuesta a toro en el hato que el C x C, debido no solo a los mayores índices de destete sino de mayor peso a dicha edad. Las diferencias de C x C con SM x C fueron de 16 por ciento (equivalentes a 18.2 kg/vaca/año) y de 34.4 por ciento (equivalentes a 38.9 kg/vaca/año) en el retrocruce de vacas F_1 con toro C; el retrocruce de vacas F_1 con toro SM y el uso de toros cruzados con dichas vacas arrojó resultados similares con 27.9 y 29.8 por ciento más carne al destete por vaca en el hato que en un sistema comercial C x C.



Figura 5. Lote de vacas puras en el CI La Libertad.



Figura 6. Vaca característica de la raza en condiciones de la serranía, San Martín, Meta, (Foto: Ramiro Hernández).

Tabla 3. Producción de carne al destete por vaca expuesta (kg/ vaca/ año) en apareamientos comerciales entre SM, C y sus cruces.

Raza toro	Raza vaca	Destete %	PD kg	Kg/vaca/año kg.	Relación/ cebú
C	C	72.5	155.8	112.9	100.0
SM	C	76.3	171.8	131.1	116.0
SM	CxSM	81.0	178.4	144.5	127.9
C	SMxC	80.4	188.8	151.8	134.4
SMxC + CxSM	SMxC + CxSM	80.5	182.1	146.6	129.8

Adaptado de Martínez, 1999.

Peso presacrificio y rendimiento en canal

En estudios comparativos de acabado y rendimiento en canal, en dos localidades de la Orinoquia (piedemonte y altillanura) se encontró, en animales en pastoreo con 36 meses de edad, que el peso presacrificio, el de la canal fría y el rendimiento fueron

ligeramente superiores en el C que en $F_1 \frac{1}{2} SM \times \frac{1}{2} C$: 473 vs. 469 kg 282 vs. 267 kg 9.6 vs. 56.9 por ciento, respectivamente; sin embargo, los F_1 presentaron canales más magras, con mayor cantidad de carne (65.5 vs. 62.0 por ciento), menor cantidad de grasa de cobertura (12 vs. 16.5 por ciento) y similar proporción de hueso (21 vs. 21 por ciento).

Conclusiones

La Orinoquia colombiana, caracterizada por condiciones climáticas adversas, no es apta para la explotación de razas europeas que requieren ambientes y manejo mejorados, cuyos costos elevados no permiten un grado de rentabilidad aceptable para la ganadería tropical.

El ganado criollo SM por sus sobresalientes características adaptativas, reflejadas en adecuadas tasas de reproducción y sobrevivencia y, especialmente, por su gran habilidad combinatoria con el C, es la mejor alternativa competitiva y sustentable para mejorar la producción, rentabilidad y calidad del producto final, principalmente carne, de los sistemas de cría y leche de la Orinoquia Colombiana.

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The Muzaffarnagari sheep, a mutton breed in India

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Summary

The Muzaffarnagari is the largest and heaviest sheep breed of India. It is well adapted to the hot humid irrigated regions. This breed is generally found in the Muzaffarnagari, Bulandshahr, Saharanpur, Meerut, Bijnor and Dehradun districts of Uttar Pradesh and in some parts of Delhi and Haryana. The fast body growth coupled with high feed conversion efficiency are the main characteristics of this breed. The animals are medium to large in size, having slight convex face lines. The coat is generally white and dense but relatively coarse and the head is large with long and drooping ears. Both male and females are polled. The tail is very long and extends to the fetlock joint. The average body weights at birth, 3, 6, 9 and 12 months of age were 3.49 ± 0.04 , 15 ± 0.20 , 26.5 ± 3.56 , 30.4 ± 0.40 and 33.4 ± 0.46 kg, respectively.

Resumen

La raza Muzaffarnagari es la raza ovina más importante y de mayor peso en la India. Está bien adaptada a las regiones húmedas y cálidas con riego. Esta raza se encuentra en general en los distritos de Muzaffarnagari, Bulandshahr, Saharanpur, Meerut, Bijnor y Dehradun de la zona de Uttar Pradesh, así como en algunos lugares de Delhi y Haryana. El crecimiento corporal veloz unido al eficaz nivel de conversión alimentaria, son las características más sobresalientes de esta raza. Los animales son de tamaño medio grande y presentan líneas faciales ligeramente

convexas. El manto es generalmente blanco y denso pero relativamente basto y la cabeza es ancha con orejas largas y caídas. Tanto el macho como la hembra no tienen cuernos. La cola es muy larga y se extiende hasta el menudillo. La media del peso al nacimiento a 3, 6, 9 y 12 meses es, respectivamente, $3,49 \pm 0,04$, $15 \pm 0,20$, $26,5 \pm 3,56$, $30,4 \pm 0,40$ y $33,4 \pm 0,46$.

Key words: Muzaffarnagari sheep, Production characteristics, Conservation, Characterization, Body measurements.

Introduction

The Muzaffarnagari sheep are one of the most important mutton breeds in the northwestern region of India. The home tract of this breed is the Muzaffarnagari district in Uttar Pradesh from which the name of this breed originates. Another name of this breed is 'Bulandshari' as it is also available in the Bulandshahr area, U.P. However, the breed is available in vast pockets of Uttar Pradesh comprising Muzaffarnagari, Bulandshahr, Saharanpur, Meerut, Bijnor and Dehradun districts and also in some parts of Delhi and Haryana (Acharya, 1982) (Figure 1). The breed exhibits the excellent capacity to adapt to this region. Muzaffarnagari is known for its faster growth rate (Singh, 1995) and high feed conversion efficiency (Anonymous, 1990). Beside meat, this breed also produces coarse carpet wool (Anonymous, 1990).

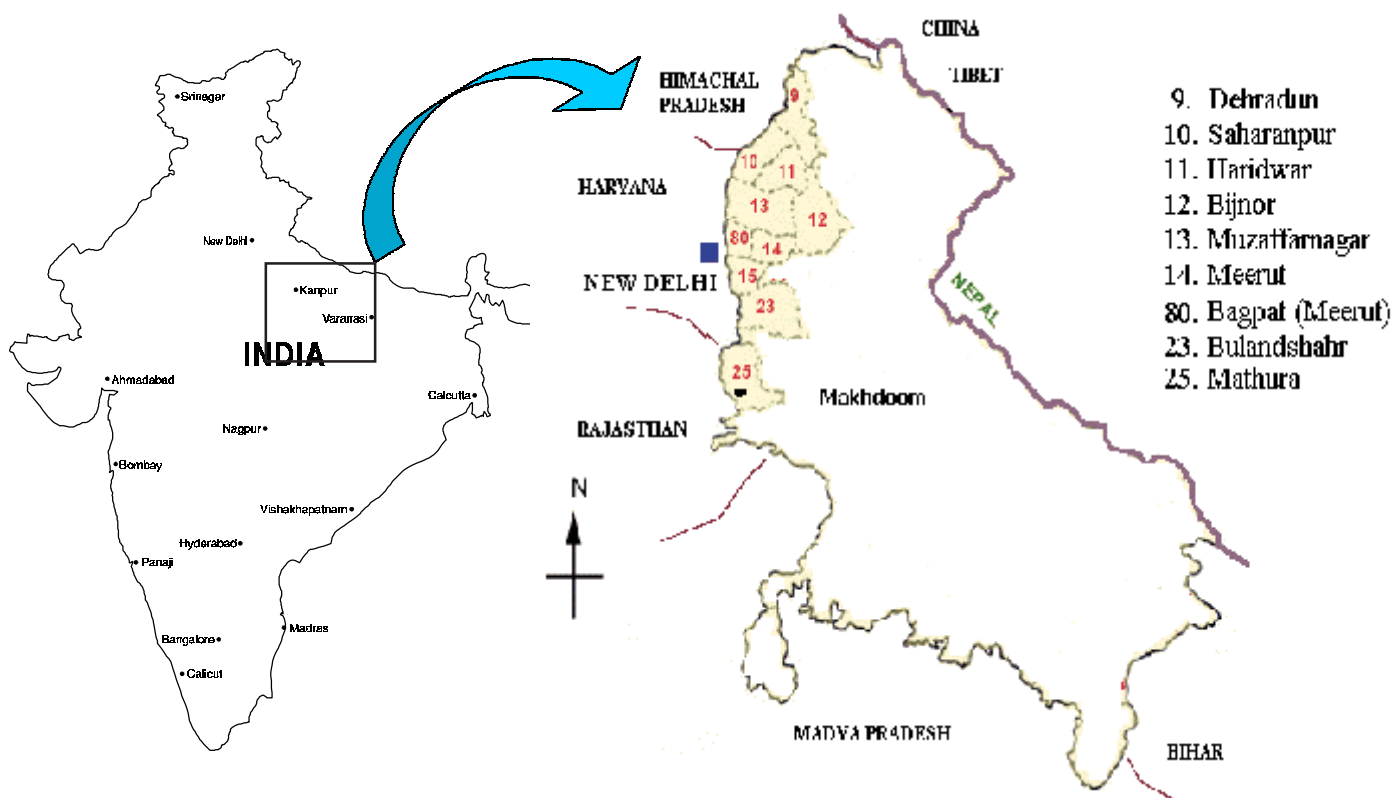


Figure 1. Distribution of Muzaffarnagari sheep in India.

The present study is aimed at describing the Muzaffarnagari sheep along with the husbandry practices, phenotypic measurements and their production and reproduction performance.

Breed Characteristics

The Muzaffarnagari sheep breed is one of the heaviest and largest breeds in India and is well adapted to irrigated areas. The animals are medium to large in size, having slightly convex face lines. The coat colour is generally white but a considerable portion of the population (20-25 percent) shows black and brown patches in one or more regions of the body, particularly, the head, face, neck, ears and limbs. The head is large with long and drooping ears. The coat is dense but relatively coarse and covers the entire body except belly, leg and face regions. Both male and females are polled, however, the males sometimes possess rudimentary horns. The tail is very long and extends up to the fetlock joint or

even further (Figure 2). The tail measures 26.9 ± 0.73 and 26.8 ± 0.45 cm in length in males and females, respectively at birth, whereas, in adults, it is 56.9 ± 2.36 and 54.5 ± 0.90 cm in ram and ewes, respectively. Other body measurements of the breed at different ages are presented in table 1.

Husbandry Practices

This breed is very hardy and well adapted to the varied climatic conditions extending from the cold climate of Dehradun to the semi-arid environments of Mathura, adjoining to Rajasthan, where they have been reared successfully since 1976. In village conditions, farmers generally graze the sheep for about eight to nine hours on common grazing land or on the roadsides and canals. In its home tract, the sheep are grazed on fallow lands during monsoon and in the post-harvested fields during some parts of the year starting from March to June and also during September and October. Generally, the



Figure 2. Muzaffarnagari male.

Table 1. Mean body measurements \pm SE of Muzaffarnagari breed in village conditions.

Age group	Parameters					
	Length (cm)		Height (cm)		Heart girth (cm)	
	Male	Female	Male	Female	Male	Female
0 -7 days	35.0 \pm 0.94 (31)	34.6 \pm 0.69 (44)	34.0 \pm 0.86 (31)	33.9 \pm 0.65 (44)	36.3 \pm 0.88 (31)	37.3 \pm 0.63 (44)
15-30 days	41.3 \pm 0.99 (18)	38.4 \pm 0.74 (27)	41.0 \pm 1.20 (18)	39.5 \pm 0.15 (27)	43.0 \pm 0.98 (18)	41.3 \pm 0.80 (27)
3 months	57.5 \pm 1.39 (13)	57.0 \pm 2.04 (10)	56.1 \pm 1.32 (13)	56.6 \pm 1.90 (10)	58.8 \pm 1.05 (13)	58.9 \pm 2.70 (10)
6 months	64.7 \pm 1.16 (21)	63.7 \pm 0.70 (63)	63.7 \pm 1.17 (21)	63.5 \pm 0.61 (63)	66.4 \pm 0.82 (21)	66.2 \pm 0.64 (63)
12 months	68.8 \pm 3.95 (4)	69.9 \pm 1.41 (7)	70.0 \pm 3.28 (4)	70.0 \pm 1.45 (7)	70.8 \pm 3.71 (4)	71.4 \pm 1.99 (7)
Adult	80.0 \pm 0.98 (9)	72.3 \pm 0.34 (173)	81.0 \pm 0.83 (9)	73.1 \pm 0.35 (173)	82.5 \pm 1.09 (9)	75.2 \pm 0.35 (173)

Figures in parentheses are the number of observations. (From Annual Report, 1994-95, CIRG, Makhdoom).

grazing starts in the early hours of the day and continues until evening. However, the animals are brought to the water points for watering in the afternoon. During the extreme summer, the grazing is generally restricted to the cooler hours of the day (Figure 3). Both males and females are allowed to graze

together. The sheep are kept in sheds during the night. However, during summer when it becomes too hot, they are kept in the open, but sometimes in temporary enclosures made of dried bushes and thorny materials. In village conditions, shepherds usually keep their animals in thatched sheds which have a



Figure 3. Muzaffarnagari flock in summer.

“kachcha” floor (consisting of straw, sand and mud), are erected from wooden materials and have mud walls. As a rule, the ewes in advanced pregnancy and young lambs are kept separately.

Production Characteristics

The performance of a flock of the Muzaffarnagari maintained since 1976 at the Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, Uttar Pradesh, under the All India Coordinated Research

Project (AICRP) on sheep, was studied in detail. The research station (CIRG) is situated in the semi-arid agro-climatic zone where the average ambient temperature ranges from 0-48°C or more. The sheep flock is maintained within a semi-intensive system of management with about six hours of grazing. The average weights at birth, 3, 6, 9 and 12 months were 3.49±0.04, 15±0.20, 26.5±3.56, 30.4±0.40 and 33.4±0.46 kg, respectively. The estimates of these weights during different years ranged from 3.15±0.07 to 3.66±0.06, 10.6±0.31 to 17.7±0.26, 24.1±4.10 to 29.0±4.79, 28±0.41 to 33.1±0.69 and 33.3±0.46 to

Table 2. Mean body weights \pm SE (in kg) of Muzaffarnagari sheep at different ages in farm conditions.

Parameter	No.	Male	No.	Female	No.	Pooled
Birth wt.	424	3.56±0.40	419	3.42±0.04	843	3.49±0.04
Weaning wt.	424	15.6±0.23	419	14.3±0.23	843	15±0.20
6 months wt.	352	28.4±3.86	368	24.5±4.15	720	26.5±3.56
9 months wt.	167	33±0.47	224	27.9±0.47	391	30.4±0.40
12 month wt.	101	36.9±0.55	239	29.9±0.53	340	33.4±0.46

(From Annual Report, 1996-97, CIRG, Makhdoom).

Table 3. Average daily body weight gain \pm SE (g) in Muzaffarnagari sheep in farm conditions.

Parameter	No.	Male	No.	Female	No.	Pooled
Pre-weaning (0-3month)	440	161 \pm 2.4	675	149 \pm 2.5	1 115	155 \pm 2.2
Post-weaning (3-6months)	440	116 \pm 3.1	675	84 \pm 3.2	1 115	100 \pm 2.9

(From Annual Report, 1995-96, CIRG, Makhdoom).

Table 4. Reproduction performance of Muzaffarnagari sheep in farm conditions.

Parameter	Unit
Age at first heat	553 \pm 40.6 days
Weight at first heat	27.3 \pm 0.90 kg
Age at service	620 \pm 73.25 days
Weight at first service	28.6 \pm 1.45 kg
Gestation period	150.6 \pm 1.15 days
Breeding season	May-June and October-November
Lambing percent	88-91%
Lambing interval	399 \pm 54.9 days

(From Terminal Report, 1993, CIRG, Makhdoom).

36 \pm 0.77 kg, respectively. Male lambs exhibited the potential to achieve 39 kg body weight at six months of age at farm level (Figure 4). Male animals are always heavier than their female counterparts at all ages (Sinha and Singh, 1997) (Table 2). Average pre-weaning (0-3 months) daily weight gain was 155 \pm 2.2 gr while post weaning (3-6 months) gain was 101 \pm 2.9 gr (Table 3). These values are reported to range from 141 to 169 gr and 73 to 134 gr, respectively, during different years. The feed conversion efficiency is higher in males than in females. However, the average feed conversion efficiency was 14.5 \pm 0.03 percent and is reported to vary from 10 to 16 percent. The Muzaffarnagari ewes are very poor milk producers and are not generally milked. The average milk yield recorded varied from 50 to 350 gr/day. Shearing of animals is done twice a year i.e. spring (March-April) and autumn (September-October). The average six monthly greasy fleece yield for adults was

506.94 \pm 13.56 gr. The average fibre diameter, medullation, staple length and density of fleece of adult animals, were reported as 45.2 \pm 0.37 μ , 69.9 \pm 0.87 percent, 3.72 \pm 0.05 cm and 811.0 \pm 74.2/cm² (Acharya, 1982).

Reproduction Performance

As a rule, farmers only allow their animals to be naturally bred. Since the rams and ewes are housed and grazed together, no controlled mating is practiced at farmer level. Only one breeding ram is kept in a flock consisting of 15-20 ewes. However, in Government/commercial farms, controlled mating is practiced. At the farmer level, the age at first mating was estimated as 15-18 months. However, the studies under the All India Coordinated Research Project (AICRP) on sheep breeding reported 14-16 months as the age at first mating in ewes and 20-22 months as the age at first lambing under the controlled breeding programme. Twinning



Figure 4. Muzaffarnagari female.

percentage in this breed is estimated as 1-2 percent. Estimates of reproduction parameters of the Muzaffarnagari breed are presented in table 4.

Survivability

Under farm conditions, the overall survival rate in adults of this breed is estimated at 95-96 percent (Annual Report, 1993-94). The pre-weaning mortality rate averaged for both sexes is reported to range from 3-4 percent, whereas, post weaning mortality is still low. The major cause of mortality in field conditions is low birth weight, pneumonia, etc. Deworming and vaccination against sheep pox and Haemorrhagic septicaemia are the common preventive measures generally adopted by villagers.

Attempts for Conservation and Improvement

The All India Coordinated Research Project (AICRP) on sheep breeding for mutton was started in 1972 at the Indian Veterinary Research Institute (IVRI), Izatnagar, under the semi-intensive (grazing supplemented with stall feeding) system of management to increase productivity. Subsequently, in 1976 the unit was transferred to the Central Institute for Research on Goats (CIRG), Makhdoom, with the objective of cross-breeding the Muzaffarnagari sheep with Dorset Horn and Suffolk rams. Studies revealed that six and nine month body weight as well as wool production of this breed were in no way inferior to the cross-breds (F_1 and F_2) (Annual Report, 1985). However, Kaila *et al.* (1989) reported that some improvement occurred in body weights among Suffolk and Muzaffarnagari crosses but crossbreds showed poor adaptability to the prevailing environments resulting in high morbidity and mortality. In view of these results, the

cross-breeding programme was discontinued and the study of the pure-bred performance of Muzaffarnagari was initiated.

There was a severe decline in the population of the breed in its home tract from 1972-1973 onwards. The population of this breed was 500 000 in 1972 and 10 989 in 1973 according to the survey carried out by the Uttar Pradesh Government. The population in 1973-74 was only 0.11 percent of the total population. So there is a need for conservation of this breed. A flock of 250 breedable sheep is being maintained by the Central Institute for Research on Goats (CIRG), Makhdoom and the selection of superior rams has started based on their liveweight at six months and fleece weight. The selected rams were supplied in the field for effecting improvement in farmer flocks. The maintenance of an elite flock of the Muzaffarnagari sheep at CIRG is an attempt in this direction. Genetic improvement at farmer level is hoped to generate more benefits which could promote the conservation of the germplasm of this breed. Research on front-line areas like biotechnology and a developmental programme for improving the production performance needs to be undertaken for proper identification of superior animals and their propagation to enhance the rate of genetic improvement.

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The Wool-Less Canary Sheep and their relationship with the present breeds in America

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Summary

When the Spaniards discovered and conquered the Canary Islands in the 15th Century, they found a type of hair sheep, a breed described by the colonists as “white in colour, large in size and with horns in the males”. This discovery provokes the question: from where did these sheep originate? All other breeds of wool-less sheep in the world in that period were located in the sub-Saharan regions, far away from the Canary Islands and with no possible connection.

Archaeologists claim that Northwest Africa was populated by wool sheep from 4000-3000 BC. Northwest Africa is the nearest geographical point of the African continent to the Canary Archipelago. It was also there that the native pre-Hispanic human population is thought to have originated. Did the wool-less sheep breed arrive with these people? The answer is probably yes. It is likely that the population of hair sheep arrived between 3000-2000 BC in a northern expansion of these animals, accompanying the first inhabitants of the islands.

After the Spanish conquest, the Canary Islands provided a necessary stop for the explorers of the New World. Various testimonies exist describing the arrival of the first sheep to the Caribbean Islands. This process of animal introduction started with Columbus' second voyage, after which domestic animals formed a usual part of the

shipment arrangements. This raises a third question: what role did the Canary Island sheep play in the origin and evolution of the present Caribbean and Latin-American hair breeds? The majority of researchers working with these animals in America and the Caribbean think that the origin of their wool-less sheep breeds is related to the traffic of black slaves during the 17th and 18th centuries. It may be claimed that this influence of sub-Saharan animals exists as an additional influence of other wool-less sheep breeds, which arrived in the Caribbean from the Canary Islands two centuries earlier. Today, the ancient native hair sheep breed is extinct in the Canary Islands although some wool-less sheep have recently been introduced from Venezuela.

All these questions and ideas are investigated in this paper, through historical references and current research.

Resumen

En el siglo XV tras el descubrimiento y conquista de las Islas Canarias los españoles encontraron un tipo de oveja sin lana (oveja de pelo), una raza descrita por los colonos como de color blanco, de gran formato y los machos con cuernos.

Este descubrimiento provoca la siguiente cuestión: ¿Dónde se originó esta oveja? Todas las otras razas de ovejas de pelo en el mundo en esa época estaban localizadas en la región

subsahariana, muy alejadas de la latitud de las Islas Canarias y sin posibilidad de conexión. Los arqueólogos postulan que el noroeste de Africa estuvo poblado por ovejas de lana entre los 4000 a 3000 años AC. El noroeste de Africa es el punto geográfico más cercano del continente con el Archipiélago Canario. ¿Arribaron las poblaciones de ovejas de pelo con el hombre? La respuesta para esta cuestión es probablemente, sí. Igualmente que las poblaciones de ovejas de pelo llegaron entre 3000 y 2000 años AC en una expansión al norte de estas razas acompañando a los primeros habitantes de las islas.

Después de la conquista española, las Islas Canarias constituían una parada necesaria para los exploradores del Nuevo Mundo. Existen diversos testimonios que describen la llegada de las primeras ovejas a las islas caribeñas. Este proceso de introducción de animales se inició en el segundo viaje de Colón, continuando los animales domésticos como parte habitual de los embarques. Este hecho suscita una tercera cuestión: ¿Qué papel jugaron las ovejas de las Islas Canarias en el origen y evolución de las actuales razas ovinas de pelo del Caribe e Iberoamérica?.

La mayoría de los investigadores que trabajan con estos animales en América y en el Caribe piensan que estas razas ovinas de pelo se relacionan con el tráfico de esclavos negros durante los siglos XVII y XVIII. Se puede postular que esta influencia de animales subsaharianos es absolutamente real, pero como una influencia adicional de otras poblaciones de ovejas de pelo, que arribaron al Caribe procedentes de las Islas Canarias dos siglos antes. Hoy, los ancestros, poblaciones nativas de ovejas de pelo están en extinción en las Islas Canarias. Sin embargo, algunos animales pelibuey han sido introducidos desde Venezuela.

En el presente trabajo investigamos todas estas ideas y cuestiones, soportadas profundamente en referencias históricas y en investigaciones recientes.

Key words: *Discovery and colonization of America, Origin of wool-less sheep, Spain, Canary Islands*

Introduction

The Canary Islands are an Atlantic archipelago located off the northwest coast of Africa. Before Spanish colonization in the 15th Century, the human population of these islands comprised of at least three ethnic groups, negro, cromagnoids and Mediterraneans. The third formed both the majority and the dominant group. Cuscoi (1968) reports that they showed morphological, cultural and linguistic relationships with the ancient Berber tribes of North Africa.

An interesting and important fact that must be brought to the reader's attention at this point is that the human population of these islands was completely isolated from the continent before the 15th Century. This is supported by the fact that:

- the early Canary Island inhabitants did not know how to navigate. People of the seven islands maintained the same racial types, although with different (but related) languages, religion, social organization, etc.;
- the early Canary Island inhabitants were culturally located in the Neolithic era, while the North African population was in the middle ages.

When the Spaniards began the conquest and colonization of these islands, they found an agricultural system based on pigs, sheep and goats and a large number of dogs (Canary, coming from "*canis*" the Latin word for dog). Surprisingly, the sheep discovered did not correspond to the wool sheep type spreading across the north of Africa and Europe in those days. In the Canaries, sheep were wool-less, similar to the breeds which inhabited sub-Saharan Africa during the 15th Century. This fact is of great importance to historians and evolutionists and all those interested in animal production. It sheds new light on the controversy concerning when, where and how the Canary Islands were colonized by man in the first place. A further point of interest regarding the Canary hair sheep is its possible influence on the origin and evolution of the currently

widely-distributed hair sheep breed population of the Caribbean Islands, South, Central and North America.

The conquest of the Canary Archipelago was not concluded during Columbus' first visit to the Caribbean and he returned to the archipelago many times. The chronicles of his second voyage state that domestic animals were on board and species which were present in the Canary Islands (pigs, sheep and goats) were always loaded there rather than the Spanish mainland. The long journeys to the New World started from the southwest coast of Spain, especially the ports of Seville and Sanlucar. From there they sailed to the Canary Islands where the crew finalized arrangements before crossing the Atlantic

Ocean. From the Canaries, the ship followed a southward direction to waters near the Cabo Verde Archipelago, where they met the Alisius winds which would take them directly to the Caribbean Sea islands.

This journey took around two months and sometimes the journey from the Spanish coast to the Canaries was as rough as that from the Canaries of the Caribbean Sea. For this reason, live animals were shipped as far as possible in the journey and then pigs, sheep and goats were shipped from the Canary Islands to the Antilles.

The animals left on the Caribbean Islands adapted extraordinarily well to the tropical climate. Their number increased rapidly. These species were then distributed to the American continent. All this historical information has been documented in depth by Morales Padrón (1968, 1977).

Present Distribution of the Wool-Less Sheep

At present, hair sheep are widely distributed in the world, usually located in the tropics and sub-tropics where they are very well adapted. Most hair breeds have been found in Africa and Latin-America. According to DAD-IS (<http://www.fao.org/dad-is>), all breeds of this type are found in Africa in a meridian position south of the Sahara desert (Figure 1). In America several breeds are found in the Caribbean Islands and similar genetic resources in Central, North and South America as shown in figure 2.

The relationship among all these resources is clear. After the discovery and conquest of America, the same genetic type arrived on the continent, rapidly increasing in number in tropical and sub-tropical areas. In this paper we examine the role played by the extinct ancient wool-less Canary sheep in the livestock colonization of the American continent.

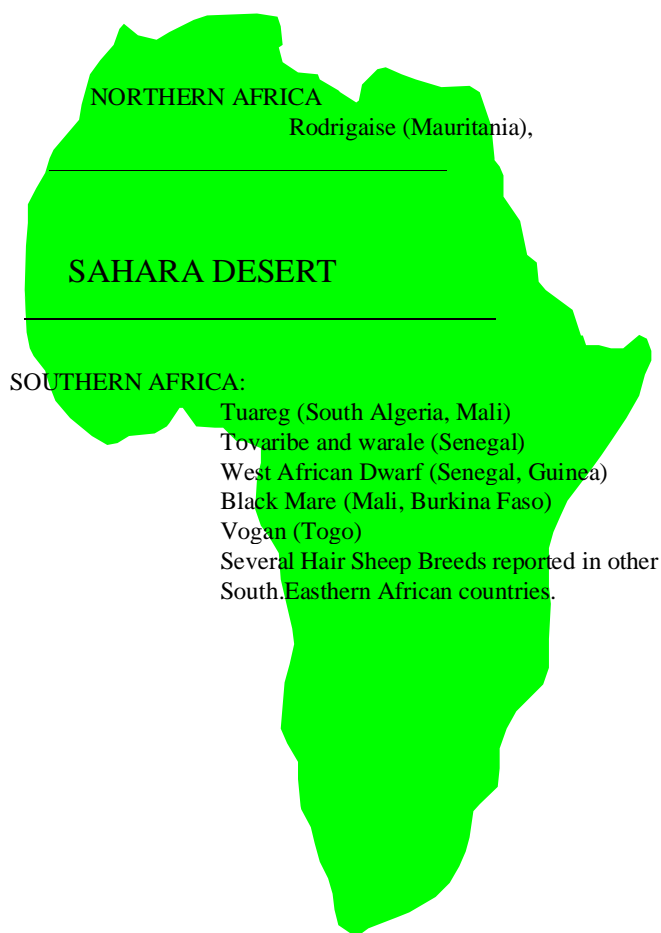


Figure 1. Present distribution of Hair Sheep breeds in Africa.

Brief description of the ancient Canary Wool-Less Sheep

According to Meco Cabrera (1992) the paleo-canary sheep were large (approximately 60-80 cm in height), with hair and had a tendency to carry a large amount of fat. They were characterized by white skin and the rams were mostly horned and the ewes polled. This description coincides with several modern hair sheep breeds present in the Americas, such as the Tabasco white of Mexico (Figures 3 and 4). These animals were not milked, but usually raised for meat production; their skin was used for clothing

(Abreu Galindo, 1977). Their management system consisted of seasonal movements between the mountains (summer), midlands (autumn and spring) and the coast (winter), following available pastures. Reports of some feral stock are frequent (Cioranescu, 1980).

Where Did These Sheep Come from? When did They Arrive in the Canary Islands?

The arrival of humans in the Canary Islands is still shrouded in mystery. Consequently the arrival of domestic mammals is also difficult to explain. Several arguments exist that suggest the origin of the human population of the Canary Islands to be the nearby African coast. It can be claimed that domestic animals arrived along with humans. However, further investigation of this theory raises several inexplicable questions. Based on archaeological data, scientists date the first arrival of humans to the Canary Islands around 5thC BC (Tejera, 1993). However, this is difficult to believe because of the demonstrated isolation between the Canary dwellers and the African population: how does one explain their Neolithic culture and their lack of navigation skills? Moreover, how does one explain the arrival of wool-less sheep from a latitude populated by breeds of sheep with wool from approximately 4000-2000 BC (Sierra, 1992)?

The only logical explanation is that the human populations arrived on these islands, with the hair sheep before this date (5000 BC). It is likely that during a period of favourable weather at that time, the wool-less sheep moved northwards in Africa from southern areas of the continent. It can be theorised that in later times they were displaced and forced southwards by dry weather, which established the Saharan desert as a frontier between wool - (Northern) and wool-less - (Southern) sheep (Figure 5). Furthermore, this claim supports the hypothesis of the early arrival of humans in the Canary Islands. It explains the Neolithic



Figure 2. Present distribution of Hair-Sheep breeds in America



Figure 3. Example of modern hair sheep: Tabasco White of Mexico.

cultural presence, sounds more logical than admitting a cultural regression from 5000 to 4000 BC.

Domestic animals are a human patrimony. They can be used to determine some events in history. This investigation of the evolution of the hair sheep provokes the formation of a new hypothesis surrounding the origin of the ancient Canary Islands' human population and their animals.

The Role of the Animals of the Canary Islands in the Animal Colonization of America

During his second trip, Columbus stopped at La Gomera (one of the Canary Islands), where he loaded pigs, goats, sheep, cattle, chickens and horses (Rodero *et al.*, 1992). This journey took place in 1493 when the colonization of this island by the Spaniards was in its early

stages. Thus, these pigs, sheep and goats were probably of pre-Hispanic origin. Other animals, such as horses, cattle and chickens, may have belonged to Canary Creole populations or may have been loaded in Spain.

The destination of this second trip was the Antilles. These islands are where it is believed that the present American population of hair sheep originated. It is thought that from this point their population expanded to several destinations in South, Central and North America, during different periods and via various routes (González-Stagnaro, 1997; Wildeus, 1997).

It is known that a combination of wind and navigation conditions forced the Spanish sailors to use the route Spain-Canary Islands-Sea of Cabo Verde-Antilles-New World. This allowed them to make full use of the Alisius winds (Primo, 1992). Space on board was very limited. A sailor required around 180 kg of food and water for a trip of about two months. A large animal (cattle or horse)



Figure 4. Tabasco White of Mexico.

needed around 780 kg and small animals (sheep, pig or goat) between 120 and 180 kg of food and water. For this reason, live animals were loaded at the latest possible point. Thus, the animals that could be loaded in the Canary Islands were not carried from Spain. When the Antilles were inhabited with domestic animals, these animals originated from both Spain and the Canary Islands. Therefore, the Antilles became the point from which the hair sheep sprang to the American continent (Rodero *et al.*, 1992) (Figure 6).

This account of history makes it easier to believe that the first sheep arriving in America were wool-less sheep coming from the Canary Islands. These animals were well adapted to tropical conditions. They rapidly expanded to form a widely distributed population, despite the fact that during later phases of colonization, Merino sheep were introduced from Spain in basin areas of Mexico and South America. Other sheep

belonging to the Churro branch were introduced into wet mountain areas where they were and still are being raised by the local people forming the foundation of new breeds, Chiapas sheep, Navajo-Churro and other creole breeds (Pedraza *et al.*, 1992; Sponenberg, 1992).

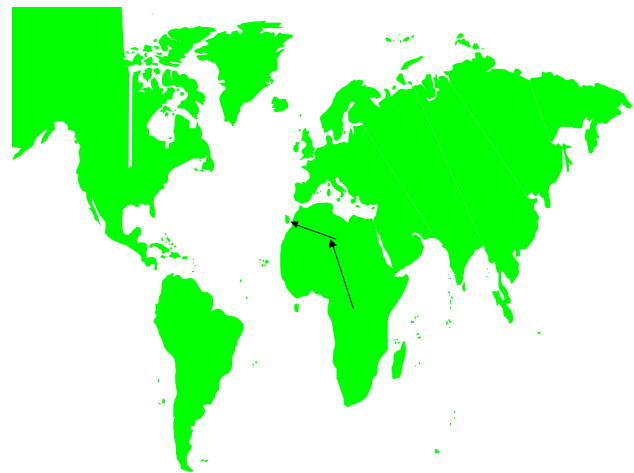


Figure 5. Where did these sheep come from? When did they arrive in the Canary Islands?

Alongside the traffic of black slaves from sub-Saharan Africa to the tropical areas of America some other wool-less sheep were introduced to America. These have also contributed to the evolution of breeds of sheep found in America today. Furthermore, even today, recent introduction of these animals from Africa are being reported (Wildeus, 1997). The aim of this paper is to bring to attention the often forgotten role-played by the ancient Canary hair sheep in the evolution of sheep throughout the Americas.

The Extinction of the Canary Hair Sheep

The conquest of the Canary Islands was difficult for the native population where they were forced to undergo a cultural evolution of 3 000-3 500 years in a very short time. They changed their language, their religion and their political systems, absorbing the

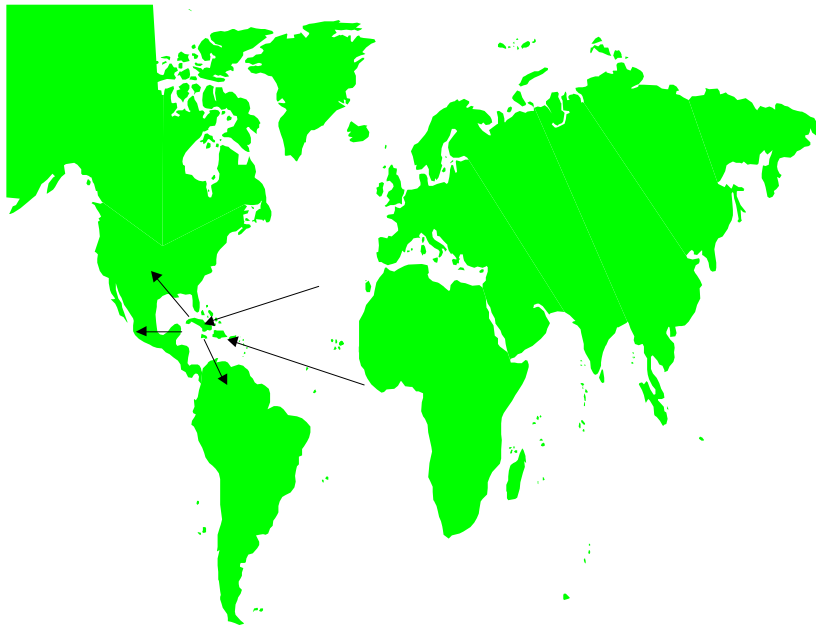


Figure 6. The role of the Canary Islands Hair-less sheep in the animal colonization of America.

European middle-ages culture. Livestock production systems were also altered, the main changes being:

- new species introduced from Europe, Spain (cattle, horses, chickens) and Africa (camels, donkeys) soon became Creole breeds;
- introduction of intensive agriculture;
- new distribution of the productive lands with an increase in areas devoted to agriculture. New species were farmed. The ancient extensive goat, sheep and pig production decreased;
- demand for new products arose: clothes made from leather were substituted by clothes made from textiles (primarily wool);
- the milking of sheep was introduced; and
- the introduction of European and African breeds of pigs, goats and sheep to improve production and therefore the ability of the system to meet the demands of the new cultural system (wool-less sheep, milk-sheep, for instance).

All these factors resulted in a massive cross-breeding of the Canary hair sheep and the creation of the present Canary sheep breed for dairy and wool (Delgado et al. 1990). Genes were mainly introduced from the Churro branch of sheep, a breed having close relations with most of the Creole sheep breeds of Latin-America.

It is likely that in the 16th-17th centuries, the Canary hair sheep became completely extinct. It must be noted, however, that some authors have mentioned the existence of these animals in the Archipelago as late as the 18th and 19th centuries (for example, Tejera, 1993).

Today, some stock of West African wool-less sheep (Pelibuey) are being introduced

back into Tenerife and La Palma islands from Venezuela. These flocks are increasing rapidly.

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Marwari goat of Indian desert

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Summary

Marwari is a desert goat breed of India and is found in the western part of the country. It is well known for its tolerance of hot and cold climates, disease resistance and thriving in very harsh nutritional conditions. It is a hairy black coloured goat. The means of the body length, body weight and ear length were estimated as 54 cm, 83 cm and 20 cm in males and 49 cm, 72 cm and 16 cm in females. Males have larger and stronger horns than females. The average adult body weight in males and females is 46 and 30 kg, respectively. The overall milk yield at 200 days is 98 kg. The kidding percentage in field conditions is 79.3 percent and multiple birth is about 19 percent. The Marwari is an early maturing breed as the average age of puberty is 306 days. The mortality in kid is 3.3 percent and in adults 3.5 percent in field conditions. The marketing and production economics of goats in its home tract have been analysed to ascertain viability of goat enterprise. The breed improvement programme was started in 1990-91 in its home tract involving farmers' flocks.

Résumé

La race Marwari est une race des Indes qui se trouve dans le désert à l'Ouest du pays. Cette race est très connue pour sa tolérance aux températures élevées et basses, sa résistance aux maladies et adaptation aux conditions nutritionnelles très difficiles. Il s'agit d'une chèvre à poils noir avec une hauteur de 54 cm, un poids corporel de 83 kg et longueur d'oreilles de 20 cm pour les mâles et 49 cm, 72 kg et 16 cm pour les femelles. Les mâles présentent des cornes plus grandes et dures

que les femelles. Le poids moyen adulte est de 46 kg chez les mâles et 30 kg chez les femelles. Le rendement moyen en lait à 200 jours est de 98 kg. Le pourcentage de mise-bas en conditions de terrain est de 79,3 et les mises-bas multiples représentent 19%. La race Marwari est une race précoce avec l'âge moyen de puberté à 306 jours. La mortalité à la naissance est de 3,3% et de 3,5% chez les adultes en conditions de terrain. On a analysé la commercialisation et la production économique dans son milieu pour s'assurer de la viabilité des entreprises dans ce domaine. Le programme d'amélioration de cette race a commencé en 1990-91 dans son milieu avec la participation des éleveurs qui possèdent des troupeaux.

Key words: *Genetic profile, Breed characteristics, Management practices, Production economics.*

Introduction

Marwari is an important goat breed from the hot-arid region of India, aptly called "Pride of the Desert" and is mainly distributed over the western part of the Rajasthan State (Khan, 1993). The typical characteristics of this breed is its long hairy coat and black colour and it seems that through natural selection over the years, it has evolved to thrive in harsh habitats. These goats contribute significantly to the economy of people inhabiting the vast arid and semi-arid region in India. The information on different aspects of Marwari goats is very limited. This paper presents information on the breed characteristics related to demographical distribution, morphological characteristics, management and production parameters recorded in field conditions.

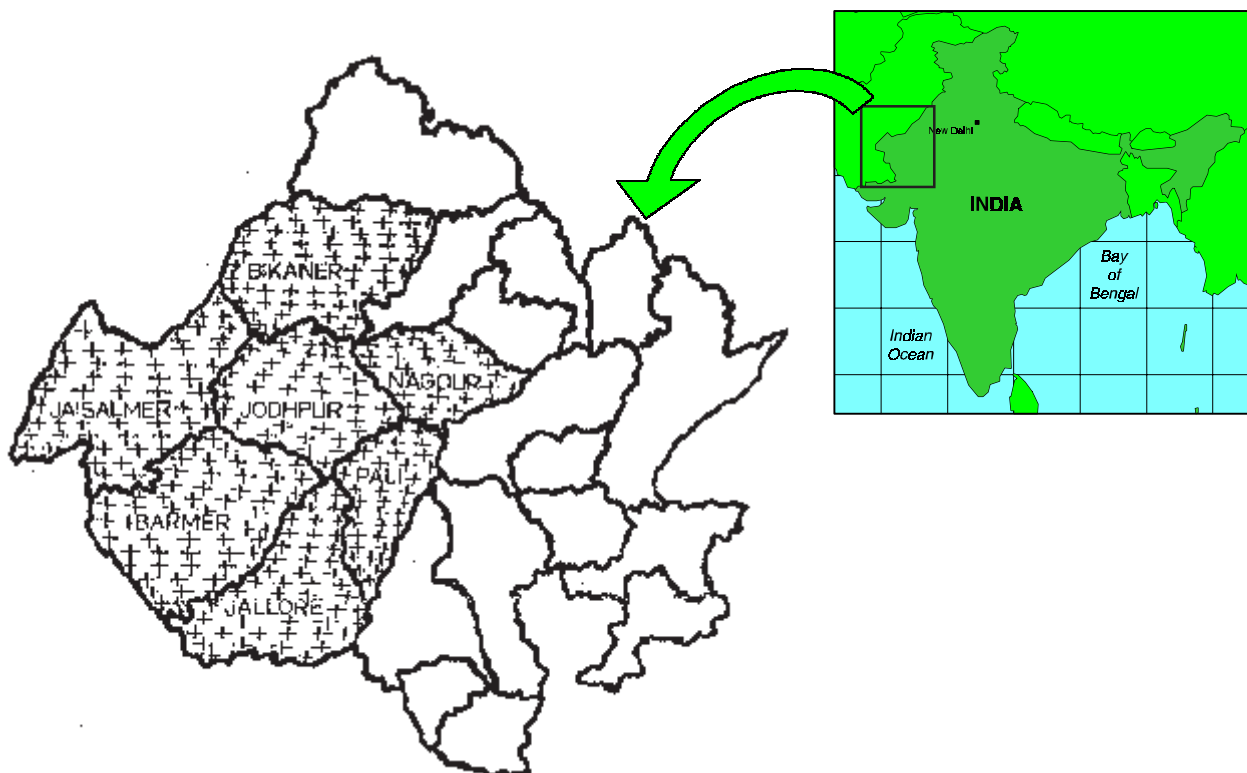


Figure 1. Distribution and home tract of Marwari goat.

Habitat and Distribution

The breed derives its name from the region “Marwar” which is the natural habitat of the breed and extends over an extensive area of western Rajasthan comprising of Barmer, Bikaner, Jaisalmer, Jalore, Jodhpur, Nagaur and Pali districts (Figure 1) covering an area of 157 626 km² which is 46 percent of the total geographical area of the state. Due to harsh climatic conditions and poor unproductive land, the human population is rather thin (49 heads/km²). The breed can also be found in the adjoining areas of northern Gujrat.

Climatic conditions

The climatic conditions of this region are extremely harsh. The temperature drops below 2°C in winter and shoots up to 48°C in summer. The rainfall is very scanty and averages about 264 mm in a year but it is very erratic forcing intermittent droughts and dry

spells in the region. The land is qualitatively of low grade and agricultural production is low due to poor quality of land, lack of irrigation facilities and other inputs. The rangelands are very poor and the programme for improving the available grazing lands is almost non-existent.

The climatological data (Table 1) of the Marwari tract indicate that this region has large variations in rainfall, temperature and humidity. The mean maximum monthly rainfall was recorded as 163.3 mm during the month of October which is a winter month. The mean maximum temperature was 43.5°C in the month of May and the mean minimum was 2.6°C in the month of December.

The humidity pattern was higher (81-91 percent) during winter months. The drastic variability in the environmental condition showed that the Marwari goats found in this region had better adapted to its surroundings since their productivity was least affected.

Table 1. Environmental conditions in the home tract of Marwari goats (Pooled monthly means) 1997-98. (Anonymous, 1998).

Months	Rainfall (mm)	Temperature (°C)		Humidity (%)	
		Maximum	Minimum	Maximum	Minimum
April	44.6	41.8	15.0	59	19
May	37.6	43.5	19.8	56	19
June	109.8	43.4	19.2	73	34
July	41.6	42.5	25.4	72	40
August	71.1	41.0	24.2	79	43
September	5.9	40.0	19.2	71	37
October	163.3	34.5	14.7	89	15
November	0.6	31.6	8.6	81	36
December	2.3	27.4	2.6	91	51
January	0.0	23.1	8.0	69	30
February	14.8	26.3	12.0	67	28
March	6.8	31.1	16.7	66	24

Population

The total goat population of this region is 3.53 million and this breed accounts for 28 percent of the total goat population in the state (Livestock census, 1988). The density of Marwari goat is about 22.4 goats per km². The flock sizes vary from a few goats (2-5) to larger sizes (100-500) but the migratory flocks are always larger (100-500). The flock holding also depends on the resources available to the owners besides their financial conditions. Normally flocks are maintained by the family members but sometimes the graziers are engaged on a payment basis.

Migration and trade

The goat breeders of this region are forced to migrate from the home tract along with their flocks and herds, due to paucity of pasture and shortage of water in this area. Migration is a routine practice in this region. Migration starts during the months of March and April and extends in many directions through their well-established routes year after year and they return back to their dwellings in the month of July. During the course of migration, the surplus stock and milk are sold

en route. They get remuneration from the landholder by keeping the flocks in the agricultural land for manuring. All of these things happen at the cost of genetic adulteration of the breed, since the intermixing with the local animals is an unpreventable malady.

Breed Characteristics

External features

The Marwari is a medium-sized breed with compact body (Figures 2 and 3). The coat colour is predominantly black but animals with brown and white markings are also found. The coat is shaggy and dull in appearance and contains long hairs. A mixture of colours in a large proportion of goats (27.8 percent) is a result of indiscriminate breeding.

The ears are long and floppy hanging downwards. The horns are of medium length, pointed at the tip and are directed upwards and backwards. An estimated 92% of males and females have horns. Males have longer and stronger horns than females. Wattles are present in a small proportion of animals (11.1 percent) and about one-third of the



Figure 2. Marwari buck.

population (29.9 percent) possesses beards. Males possess thicker and longer beards than females.

Body size

Body weight and size of adult Marwari goats (male/female) are presented in table 2. The males are heavier (46.6 ± 0.63 kg) than the females (30.0 ± 0.25 kg). Males also have higher body size with respect to body length, body

height, ear length and horn length as compared to females (Anonymous, 1993). However, Mittal (1988) reported lower body weights of Marwari goats which were maintained in farm conditions.

Body weights

The growth of Marwari male and female kids at different ages is given in table 3. Males were significantly heavier than females at all ages from birth to 12 months of age except

Table 2. Body weight and size of adult Marwari goats (Anonymous, 1993).

Traits	Male	Female
Body weight (kg)	46.6 ± 2.63 (11)	30.0 ± 0.25 (375)
Body length (cm)	54.0 ± 1.40 (11)	49.7 ± 0.20 (401)
Body height (cm)	83.2 ± 1.80 (11)	72.5 ± 0.20 (401)
Ear length (cm)	20.1 ± 1.30 (11)	16.7 ± 0.20 (390)
Horn length (cm)	20.4 ± 1.30 (9)	13.4 ± 0.20 (323)

Figures in parenthesis indicate the number of observation.

Table 3. Mean body weight (kg) of Marwari kids at different ages (Anonymous, 1993).

Body Weights	Male	Female
Birth	2.3±0.01 (480)	2.2±0.01 (619)
3 months	11.2±0.06 (385)	12.6±0.26 (518)
6 months	15.2±0.34 (167)	12.1±0.25 (168)
9 months	19.5±0.03 (113)	17.8±0.26 (104)
12 months	25.6±0.53 (66)	22.5±0.29 (123)

Figures in parenthesis indicate the number of observation.



Figure 3. Marwari flock.

females at three months. The body weight at one year of age was 25.6 kg and 22.5 kg in males and females, respectively. Mittal (1988) reported lower body weights at all ages in Marwari goats maintained in farm conditions.

Milk production

Milk yield in 150 days ranged between 84±5.7 kg to 113±7.0 kg during first to third lactations. The overall milk yield during

1st lactation was 98±7.0 kg in 201 days of lactation period. Milk yield during 150 days as well as total lactation yield indicated an increasing trend during the first to third lactations (Table 4) Anonymous, 1992. Barhat and Chaudhary (1978), however, reported lower values of milk production traits in Rajasthani goat breeds.

Table 4. Milk production performance of Marwari goats (Anonymous, 1992).

Lactation Order	Milk production traits		
	150 days (kg)	Lactation Yield (kg)	Lactation Period (days)
I	84±5.7 (19)	98±7.0 (19)	201±3.8 (19)
II	91±4.8 (27)	108±5.5 (28)	205±2.5 (28)
III	113±7.0 (17)	131±7.8 (17)	205±3.1 (17)

Figures in parenthesis indicate the number of observation.

Table 5. Reproduction performance of Marwari goats (Anonymous, 1993).

Traits	Pooled average
Age at Puberty (day)	306.0±1.5 (659)
Age at 1st Kidding (day)	471.1±2.0 (635)
Kidding interval (day)	313.4±0.7 (635)
Kidding Percent (No. kidded/No. available)	79.3 (10 265)
<i>Birth Status :</i>	
Single (%)	81.5 (2 061)
Twin (%)	17.5 (429)
Triplet (%)	1.5 (39)
Average litter size	1.2 (2 529)

Figures in parenthesis indicate the number of observation.

Table 6. Mortality rate (%) of Marwari goats in different age groups in field conditions. (Anonymous 1993).

Age Group	Male	Female	Total
1. 0-3 months	3.1 (1 147)	3.5 (1 286)	3.3 (2 433)
2. 3-12 months	3.7 (604)	4.5 (853)	4.1 (1 457)
3. Adult (Above 12 months)	7.0 (530)	2.9 (3 125)	3.5 (3 655)

Figures in parenthesis indicate the number of animals available.

Reproduction

Reproductive performance of Marwari goats in field conditions is described in table 5. The average age at puberty and age at first kidding were 306 ± 1.5 days and 471 ± 2.0 days, respectively. The kidding interval in farmers' flocks was 313 ± 0.7 days. The observation indicated that it is an early maturing breed. The reproductive efficiency in terms of kidding percent (number of does kidded/number of does available) was 79.3 percent. The prolificacy was found to be moderate with 17 percent twins and 1.5 percent triplets (average litter size 1.2). All these factors indicate that Marwari is a meat breed and there is scope for further improvement.

Disease pattern/Survivability

Marwari goat is considered as a hardy breed from the desert and the overall mortality in field conditions was extremely low (1.1 percent) in spite of poor feed resources (Anonymous, 1993). The kid mortality during 0-3 and 3-12 months was 3.3 percent and 4.1 percent, respectively. The adult mortality was 3.5 percent in field conditions (Table 6). The morbidity pattern in field conditions was 35.1 percent due to affliction of the alimentary system. The incidence of pneumonia was relatively less (9.8 percent). Among specific diseases, contagious ecthyma was a major ailment with an infection rate of 11.4 percent. An ecto-parasitic (ticks and lice) problem was reported to be very high in this breed due to the presence of long hairs on the body which provide shelter to ecto-parasites.

Management Practices

Housing system

Marwari goats are usually kept in open ranges throughout the day for browsing, except when there is intense heat waves or dust storms. They are usually kept in open corrals, fenced by thorny twigs. In some

places, the kids are kept away from their dams in "Kuccha" houses made of mud. During the winter, night protection from the cold is provided.

Feeding practices

The goats by and large are reared under an extensive system in open ranges. Concentrate feed is given occasionally to lactating does by progressive farmers. The period of grazing extends from sunrise to sunset. During summer, when grazing becomes difficult due to intense heat during the day time, late evening and early morning grazing is practised.

Production economics

Studies on production economics of the flocks maintained in field conditions revealed that a revenue of rupees 494 per adult unit per annum after meeting all expenses is obtained. The major income comes from sale of livestock (53.7 percent) followed by sale of milk (41 percent). Labour charges for grazing was less than 52.1 percent of the total expenditure. Therefore, utilisation of family members for grazing will reduce the cost of goat rearing and may enhance the profit which is the normal practices (Anonymous, 1993).

Marketing

It was found that there was no difficulty in selling the goats, this was also supported by a survey conducted by Ahuja and Rathore (1987) in some areas of Rajasthan. Sale is mostly accomplished at the door of the farmers or in the local markets held weekly. The purchasers visit the farmers who keep flocks of goats almost daily or weekly and sales are made as per the need of the farmer. A large number of sales are made between December to April i.e. three to six months after kidding. The selling cost of young male/female goats varies from Rs. 500 to 600 per goat.

Improvement Programme

A breed improvement programme for Marwari goats was started in the year 1990-91 with the aim of surveying, characterizing and improving the productivity of Marwari goats involving the farmers' flock in the natural habitat of the breed. The programme in vogue continued under the All India Coordinated Research Project on Goat Improvement and progressed well with the cooperation and participation of the farmers. The selection of young bucks was made based on their own body weights and dam's milk yield. The selected bucks from the farmers' flock were tested and made available to farmers for improvement of their existing flock. It was evident from the studies that farmers' participation in a breed improvement programme was commendable.

Conclusion

Marwari goats are an integral part of the agrarian economy in the desert region of Rajasthan. This breed has the potential to meet the nutritional as well as economic needs of the farmers living in this region. The breed is well adapted to the harsh environmental conditions and therefore, it is necessary to start a planned breeding programme in proper feeding, housing and management practices for exploiting production potential. Moreover, this breed is facing a serious threat in its genetic architecture as intermixing of this breed with other animals occurs during migrations. Hence, a breed conservation programme has to be started for overall improvement of this breed in the desert region.

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Phenotypic characterization of three strains of indigenous goats in Tanzania

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Summary

Characterization of three strains of indigenous goats found in three regions of Tanzania was undertaken on the basis of their phenotypes viz: body weight and measurements, colour pattern, ears and horns.

The three strains differed in the body weights and in the frequencies of the different coat colours. The Dodoma and Mtwara strains had similar body measurements, whereas the Kigoma strain was significantly smaller.

Resumé

Une caractérisation de trois lignées de chèvres indigènes trouvées dans trois régions de la Tanzanie a été entreprise sur la base de leurs caractères phénotypiques à savoir le poids, les dimensions du corps, la configuration de couleurs, et la forme des oreilles et des cornes.

Les trois lignées ont différencié par leur poids et dimensions corporelles ainsi que par les fréquences des différentes couleurs de la robe. Les lignées de Dodoma et de Mtwara ont eu des tailles similaires tandis que la lignée de Kigoma présentait une taille significativement plus petite.

Key words: *Dodoma goat, Mtwara goat, Kigoma goat,*

Introduction

The largest proportion of goat population in Tanzania is constituted of indigenous goat breeds which are of great genetic diversity (Rege, 1994). Though these local genetic resources play an important role in the socio-economic life of the people of Tanzania, it is unfortunate that little is known about them in terms of how many strains there are and the degree to which they are genetically adapted to diseases, parasites and nutritional stress and how these qualities have evolved. It is through characterization that this shortcoming can be overcome and much of their diversity in genetic makeup can be known (ILCA, 1992).

Animals are often characterized based on their phenotypic and/or genetic constitution traits. The commonly used phenotypic characters include coat colour, horns (shape and size), hair and/or wool, adult size in terms of liveweight and body measurements such as withers height (Meghen *et al.*, 1994).

Based on mature body weight and height at withers, Devendra and McLeroy (1982) distinguished three breed categories in the tropics, namely: large breeds with body weight between 20 and 65 kg and height at withers above 65 cm, small breeds between 19 and 37 kg and height at withers between



Figure 1. Map of Tanzania.

51 and 65 cm and dwarf breeds weighing 10 to 25 kg and below 50 cm height at withers.

Mason and Maule (1960) characterized the Tanzania goat as a small, very hardy animal with fine, short and smooth coat which may be of any colour, including brown black, brown, white, bi-coloured or multi-coloured. Nowhere in the country do specific colour patterns seem to have been classified, as all colour patterns are seen. Kyomo (1978) reported the variation of horns among Tanzanian goats in both sexes and classified them as very short (2.5 to 5.0 cm only), medium (about 15 cm) and long (about 25 cm). Wilson (1991) classified the ears of Masai goats (Small East African type) as slightly erect and rarely pricked with medium length (12-16 cm).

The aim of this study was to describe phenotypic body characteristics of three strains of indigenous goats found in three

different regions, viz; Mtwara (Southeastern region), Dodoma (Central region) and Kigoma (Northwestern region).

Materials and Methods

Ecological zones and management systems

Dodoma is situated in the central semi-arid zone of Tanzania (Figure 1), with annual rainfall ranging from 427 to 836 mm, whereas Mtwara and Kigoma lie in the southern coastal and western sub-humid zones with annual rainfall varying from 856 to 1 417 mm and 773 to 1 121 mm, respectively. The monthly mean temperatures in the respective regions of Dodoma, Mtwara and Kigoma range from 20 to 24.5°C, 24-27.5°C and 22 to



Figure 2. A Kigoma strain male goat.

25.5°C, respectively and the ranges of relative humidity are 37-56 percent, 55-76 percent and 48-78 percent, respectively.

Herded grazing on natural vegetation (grasses and shrubs) with little or no external inputs like supplementation and treatment is practiced in all three regions. Tethering is commonly practiced in Kigoma especially during the cropping season. Water shortage in the dry season is often experienced in Dodoma and Mtwara and farmers supply water to goats every one to three days. In Mtwara farmers are trying to use harvested rainwater to counteract the problem.

In Dodoma, goats are kept singly or in a mixture with cattle and/or donkeys in an open corral of a construction of thorns, whereas sheds constructed from non-baked earth bricks or mud roofed with iron sheets or grasses are used in Mtwara and Kigoma.

A survey was conducted in three regions to obtain information on body characteristics, i.e. body weight and linear body measurements attributed to the three strains of local goats. These regions were selected on the basis that Mtwara and Kigoma goats are reputed for the high twinning rate and they are well known

strains in the literature, while Dodoma goats are assumed to have special features adaptable to the semi-arid zone of Central Tanzania.

A total of 597 goats, constituted of 212, 180 and 205 goats from Kigoma (Figures 2 and 3), Dodoma (Figures 4 and 5) and Mtwara (Figures 6 and 7), respectively, had their body weights, heart girths, body trunks, body lengths and height at withers measured as described by Kyomo (1978). The age records obtained from the farmers' memory on the individual animals were classified into four categories, i.e. less than three months kids, four to six months weaners, 7-18 months growers and 19 months, adult goats. It is worth noting that when taking linear body measurements, it was ensured that goats were standing still, relaxed and were on as level a ground as possible. For the accuracy of the data, two records were taken for height at withers, body trunk and body length and the average used as a datum.

Identification and description of coat colour and hair pattern, horns and ears were done by enumerators through visual observation.



Figure 3. A Kigoma strain female goat.

Statistical analyses

Statistical analyses for various carcass and body measurements were performed separately for the four age groups used by the General Linear Models (GLM) procedure (SAS, 1988). The model for the body measurements included sex, strain/region and the interaction between them.

Results and Discussion

Body weight

There was a significant difference in adult body weights between strains (Table 1). The overall adult mean weights were 31.8, 29.2



Figure 4. Dodoma strain male goats.

Table 1. Comparison of least squares means (\pm S.E.) for body weights (kg) by strain/region and sex.

Age	Sex	Strain/Region					
		Dodoma		Mtwara		Kigoma	
		M	F	M	F	M	F
Adults	Means	34.2 \pm 1.63 (20)	29.3 \pm 1.10 (44)	28.5 \pm 2.02 (13)	29.9 \pm 0.90 (66)	22.4 \pm 2.43 (9)	25.4 \pm 0.84 (76)
	Overall	31.8 ^a \pm 0.98 (64)		29.2 ^a \pm 1.10 (79)		23.9 ^b \pm 1.28 (85)	
Growers	Means	18.3 \pm 1.01 (30)	18.0 \pm 0.99 (31)	16.4 \pm 1.24 (20)	17.8 \pm 0.96 (33)	16.4 \pm 1.21 (21)	16.3 \pm 0.88 (40)
	Overall	18.1 \pm 0.71 (61)		17.1 \pm 0.78 (53)		16.3 \pm 0.75 (61)	
Weaners	Means	11.0 \pm 1.10 (10)	10.7 \pm 0.96 (13)	13.8 \pm 1.05 (11)	11.7 \pm 1.00 (12)	12.0 \pm 1.23 (8)	7.9 \pm 1.23 (8)
	Overall	10.9 ^b \pm 0.73 (23)		12.7 ^a \pm 0.72 (23)		10.0 ^b \pm 0.87 (16)	
Kids	Means	6.3 \pm 0.67 (18)	6.1 \pm 0.75 (14)	6.6 \pm 0.63 (20)	6.1 \pm 0.51 (30)	5.4 \pm 0.60 (22)	4.6 \pm 0.53 (28)
	Overall	6.2 \pm 0.50 (32)		6.4 \pm 0.41 (50)		5.0 \pm 0.40 (50)	

1. Within row least squares means with the same superscript are not significantly ($P>0.05$) different
2. Number of observations are shown in brackets

Table 2. Least squares means (\pm S.E.) of linear body measurements of adult goats by strain/region, cm.

Variable	Strain/Region		
	Dodoma	Mtwara	Kigoma
Body length	89.4 ^a \pm 1.19 (64)	91.0 ^a \pm 1.34 (79)	77.1 ^b \pm 1.14 (85)
Body trunk	62.0 ^a \pm 0.87 (64)	62.0 ^a \pm 0.98 (79)	52.4 ^b \pm 1.14 (85)
Heart girth	75.9 ^a \pm 0.79 (64)	71.6 ^b \pm 0.89 (79)	68.3 ^c \pm 1.04 (85)
Height at withers	61.5 ^a \pm 0.76 (64)	59.2 ^a \pm 0.86 (79)	53.7 ^c \pm 0.99 (85)

1. Within row means with the same superscripts are not significantly ($P>0.05$) different.
2. Number of observations are shown in brackets.

and 23.9 kg for Dodoma, Mtwara and Kigoma goats, respectively. These figures were higher than the range of 14 to 22 kg mature liveweights of West African dwarf goats (Foulta Djallon) found by Devendra and Burns (1970) as cited by Awah *et al.* (1984), indicating that neither of the three strains fits to be classified in the 'very small breed' (dwarf) category. Nevertheless, they are

within the small breed category classified by Devendra and McLeroy (1982).

Linear body measurements

The linear body measurement seems similar for the Dodoma and Mtwara strains whereas the Kigoma goats are consistently smaller (Table 2). Previous studies (Searle *et al.*, 1989;



Figure 5. Dodoma strain female goat with her newly born male kid.

Table 3. Percentage distribution of goats' coat colours by region.

Coat colour	Dodoma	Mtwara	Kigoma
Brown	19.5	33.2	17.3
White	31.1	6.9	0.5
Black	6.7	16.3	40.1
White brown	14.4	7.9	6.9
White black	15.6	9.9	9.4
Black brown	3.3	5.9	17.3
Multicoloured	9.4	19.9	8.5

Hall, 1991) indicate that some of the linear body measurements like height at withers and body length, are more genetically determined while others (for example, heart girth), are more subject to environmental influences. The means obtained for the Kigoma strain which fall within the range were reported by Mason and Maule (1960) for SEA goats. Similar figures to those of Mtwara and Dodoma goats have been reported by Kyomo (1978) on SEA goats.

Coat colours and hair structures

Coat colour varied from one plain to bi-colours of brown, black and white (Table 3). Although multi-colours of these basic colours were also observed in the field, they constituted a small proportion of all goats. The three strains were clearly distinctive with white, brown and black being the most common coat colours found in Dodoma,



Figure 6. Mtwara strain male goats.



Figure 7. Mtawara strain female goats.

Mtwara and Kigoma, respectively. These observations agree with the findings of Mason and Maule (1960) on Tanzanian goats. On the other hand, all three strains had more or less coat hair characteristics which were predominantly smooth, short, fine and generally sweeping backwards. In addition adult males and the minority of females were bearded. Males were observed to have more pronounced ridges of hair (mane) along the length of the back which is consistent with Kyomo's (1978) findings.

Horns and ears

In all strains both sexes were horned, though a few polled goats could be found. Although no measurements were taken on horns, they varied extremely and could possibly fall within the previous classification given by Kyomo (1978). The observation revealed that horns were thicker at the base (roots) and narrowed towards the extreme tips. In most cases horns were straight and pointed backwards with the exception of some horns which curved upwards or forwards at the apex in the Dodoma strain.

In all strains ears were observed to be generally pricked erect with flexibility to move either forward or side-ways, depending on the state of the animal. A similar observation was made by Osterhoff *et al.* (1987) on goats close to the equator and Wilson (1991) on Masai goats.

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Characterization of Mehsana Buffaloes in India

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Summary

Mehsana buffalo is distributed in Mehiana, Banaskantha and Sabarkantha districts of North Gujarat in India. The animals are reared for milk production. The management practices in the breeding tract were studied. The physical, production and reproductive characters were recorded. The Dudhsagar Research and Development Association located in Mehiana district has undertaken breed improvement programmes in farmers' herds by running field progeny testing and providing other animal husbandry services like artificial insemination, health coverage, etc. This has resulted in the improvement in the reproductive performance as is evident from the decrease in the average first service period by 74 days and the average first calving interval by 103 days from 1989 to 1997. Microsatellite DNA marker analysis was carried out on 25 Mehiana buffalo DNA samples using seven markers for genetic characterization of the breed. Number of alleles at different loci ranged from four to seven and heterozygosity ranged from 0.40 to 0.92.

Resumen

La raza Mehiana de búfalos se encuentra en los distritos de Mehiana, Banaskantha y Sabarkantha en el norte de Gujarat en la India. Estos animales se crían para la producción de leche. Se han estudiado las prácticas de cría de esta raza en su entorno. Se han registrado los caracteres físicos, de producción y de reproducción. La Asociación de Investigación y Desarrollo Dudhsagar, en el distrito de Mehiana, ha empezado programas de mejora de la raza con los rebaños a través de pruebas de descendencia sobre el terreno y proporcionando otros servicios tales como la inseminación artificial, la cobertura sanitaria, etc. Todo ello ha llevado a un incremento del rendimiento reproductivo ya que se ha disminuido en media de 74 días la primera monta y el intervalo entre partos de 103 días entre 1989 y 1997. Se han llevado a cabo análisis de los marcadores ADN microsatélites con 25 búfalos Mehiana con muestras de ADN, utilizando siete marcadores para la caracterización de la raza. El número de alelos en los distintos loci iban de cuatro a siete y la heterocigosis de 0,40 a 0,92.

Key words: *Mehiana buffaloes, Buffalo genetic resources, Breed characterization.*



Figure 1. Breeding tract of Mehiana buffaloes.

Introduction

Buffaloes occupy an important place in the agricultural economy of India because of their adaptability to harsh climatic conditions, tolerance to tropical diseases and survival under poor feeding and management practices. The genetic diversity in buffaloes of the country is represented by ten recognized breeds of buffaloes besides several lesser-known breeds/strains comprising about 27 percent of the total bovine population in India (Gupta, 1997). Buffaloes contribute about 48 percent of the total milk production of the country (Gupta, 1997). The organized dairy sector in India is largely dependent on buffalo milk because of their contribution to total milk production, rich fat

and total solid content. Mehiana buffaloes are one of the best milk breeds of buffalo in India (Gupta, 1997) and are spread in the northern part of the Gujarat State (Figure 1). The name of Mehiana buffalo was derived from the town "Mehiana" in the North Gujarat State. Oliver (1938) described the breed for the first time. He pointed out that the characteristics of this breed are intermediate of two buffalo breeds namely Murrah and Surti. It was postulated that the Mehiana buffalo originated from the crossing of Murrah and Surti buffaloes. The skin colour is black. The body colour is not as dark as that of the Murrah and the horns are shorter and less curved. Mehiana buffaloes are well reputed for regularity in breeding, persistence in milk

and efficient milk production which is evident from the lactation length and short dry period (Singh, 1992).

To characterize Mehsana buffaloes in farmer herds phenotypically and genetically, a detailed project was jointly undertaken by the National Bureau of Animal Genetic Resources (NBAGR), Karnal and the Dudhsagar Research and Development Association (DURA), Mehsana to study the breed under farmers' herd conditions. The objectives of the study were to investigate the breed distribution, management practices under field conditions, breed performance and development of breed descriptor. Seven microsatellite markers were analysed in Mehsana buffalo to study the DNA sequence polymorphism in these marker loci.

Distribution of the Breed

The Mehsana buffaloes are concentrated in the Mehsana, Banaskantha and Sabarkantha districts of the northern part of Gujarat State (Figure 1). Animals true to the breed characteristics are observed in Mehsana, Patan, Sidhpur, Vijapur, Kodi, Kaley and Radhanpur areas. The areas experience extreme climates. The temperature in summer goes up to 40°C and in winter it is as low as 9-10°C. Rainfall is uncertain. Soil in these areas is sandy alluvial and porous, which in the southern parts merges into the black cotton soil.

Population Dynamics

The buffalo population in Gujarat State increased by 0.26 million to 1.83 million from 1983-84 to 1993-94. During this period the increase in the buffalo population in Gujarat State was 16.3 percent in comparison to 1.1 percent in indigenous cattle population. Livestock population in the districts where survey work was undertaken and in the whole Gujarat State are presented in table 1. All the three districts had higher livestock density than the average of the Gujarat State.

The Animal Husbandry Department, Government of Gujarat, conducted an integrated sample survey on livestock population and animal production and reported that the percentages of different buffalo breed populations in the whole Gujarat State were 42 percent Surti, 24 percent Mehsana, 24 percent Jafarabadi, 6 percent Murrah and 4 percent non-descript in the year 1993-94 (Report, 1985). In the Mehsana district lactating buffaloes of the Mehsana breed increased from 87.5 to 95.6 percent, while in the other two districts the population of the Mehsana breed declined from 81 to 45 percent in Banaskantha and 57 to 42 percent in Sabarkantha from 1983-84 to 1993-94. In Gujarat State lactating and breedable Mehsana buffaloes declined by 1.1 and 2.8 percent respectively, during this period.

Table 1. Livestock population ('000) and their density in 1992.

District	Cattle	Buffalo	Sheep	Goat	Livestock density per 1 000 hectare
Mehsana	295	630	36	189	1 409
Banaskantha	438	452	215	456	1 326
Sabarkantha	436	459	47	306	1 773
Gujarat State	6 786	5 241	2 025	4 228	1 000

Table 2. Population of total breedable and lactating Mehsana buffaloes in the native tract.

Districts	1983-84		1993-94		Trend (%)	
	Lactating	Breedable	Lactating	Breedable	Lactating	Breedable
Banaskantha	97 485	159 595	49 996	100 053	-38.5	-37.3
Mehsana	189 941	298 553	224 660	329 820	18.7	10.7
Sabarkantha	70 745	111 125	58 245	91 667	-17.6	17.9
Whole Gujarat State	440 006	689 380	435 157	670 170	-1.1	-2.8



Figure 2. Mehsana female buffalo.

Physical Characteristics of the Breed

The Mehsana buffalo is a medium-sized docile animal with a low set deep body. The forehead is wide with a slight depression in the middle sloping towards the base of the horns. The horns are generally sickle shaped and curved upwards and then bend downwards. The neck is long and well set on the shoulders. It is massive and dewlap is almost absent in males. The chest is deep with broad brisket. The legs are medium to short length with clean and broad bones. The barrel

is long and deep, with well-sprung ribs. In females, the fore quarters are light while the hind quarters are wide and heavy giving a wedge shaped appearance. The back is straight and strong with pelvic joints higher than the withers. The navel flap is very small. The tail is of medium thickness and long with black or brown switch. The skin is thin, pliable and soft and generally black. The hair is rough and scanty. The average adult body weight varies from 365 to 455 kg in females and about 500 kg in males.

The udder is well developed and well set and in good milking animals it is carried well behind. The teats are fairly thick, long and



Figure 3. Mehsana bull.

pliable. The milk vein is prominent. The photographs of a female-buffalo and bull are presented in figures 2 and 3, respectively.

Management Practices

To characterize the management practices in the breeding tract 1 097 farmers from 144 villages were contacted and information was recorded on a questionnaire developed jointly by NBAGR, Karnal and DURA, Mehsana. It was observed that 25 percent of the farmers rearing Mehsana buffaloes were landless and about 33 percent of the farmers were illiterate. The survey conducted revealed that most of the men and women spent about two hours a day in animal husbandry works like grazing, chaffing, cleaning, feeding and milking. Both male and female family members spent equal time in animal rearing activities. Eighty percent of farmers usually cleaned the udder and teats of the buffalo and 18 percent of farmers cleaned the animals completely.

Utility of the Breed

About 7.5 percent of farmers reared buffaloes for milk production and 44 percent for both milk and breeding purposes and only one percent of farmers reared buffaloes for both milk and ploughing. Farmers who kept buffaloes for breeding represented only 1.5 percent of the total surveyed. About 65 percent of farmers sold Mehsana buffaloes to businessmen who took the animals to Mumbai and Ahemadabad for milk production. These businessmen sent them for slaughtering after completion of lactation. This factor may be one of the reasons for the decrease in the Mehsana breed population in Gujarat State (Table 2).

Animal Housing

The majority of farmers (87 percent) tied their animals throughout the day and night. Forty-eight percent of farmers used open houses and 42 percent of farmers preferred both the open and closed type of sheds for their animals. In about 75 percent of cases, the farmers' and animal houses were separate

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and in the rest of the cases the animal houses were part of the farmers' own house. About 96 percent of animal houses were well ventilated, however, proper drainage facilities were available in only 23 percent of byres.

Calf Management

More than 93 percent of farmers allow female calves to suckle milk throughout the lactation period, however, the male calves were generally weaned within a week of calving. Dehorning was practiced by only 6 percent of farmers and 87 percent of farmers dewormed.

Wallowing once a day was followed by the majority of farmers. Photographs of Mehsana buffalo calf and the unique milking practice followed in the breeding tract are presented in figures 4 and 5 respectively.

Feeding

More than half (58 percent) of farmers did not take animals for grazing. Out of those who took their animals for grazing, the majority (84 percent) adopted seasonal grazing. Stall-feeding was practiced by 75 percent of farmers and both stall feeding and grazing by



Figure 4. Mehsana buffalo calf.

22 percent. Concentrate feed was provided separately by 83 percent of farmers while 17 percent of farmers provided it along with fodder. The concentrate was fed at the time of milking by 88 percent of farmers and the rest of the farmers fed concentrate at anytime. Green fodder is available mostly during the rainy season. Dry fodder includes mainly bajra (*Pennisetum typhoides*), jowar (*Sorghum vulgare*) and wheat (*Triticum aestivum*) straw.

Breeding

Out of the farmers surveyed, 98 percent were maintaining Mehsana buffaloes, one percent Murrah and one percent other breed or non-descript buffaloes. About 51 percent of farmers adopted artificial insemination (AI), 9 percent natural service (NS) and 40 percent

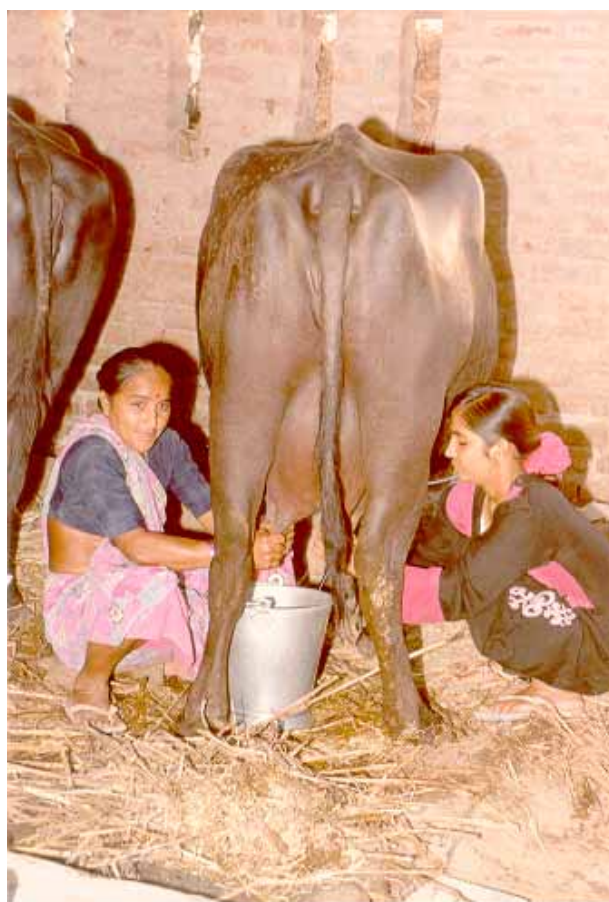


Figure 5. Unique milking practice in breeding the tract

both. Frozen semen was used in 96 percent of cases for AI. It was observed that about 75 percent of buffaloes conceived after two services. The high rate of adoption of AI with frozen semen and good conception rates was due to the service provided by DURA, Mehsana in the breeding tract.

Productive and Reproductive Performance of Mehsana Buffaloes

Production and reproductive performance of Mehsana buffaloes from 1989 to 1997 maintained at DURA, Mehsana are presented in table 3. Progeny testing in Mehsana buffaloes in field conditions has been conducted by DURA since April 1985. A total of 107 bulls in eight batches was tested. The results of five batches are available. The maximum sire indices in terms of daughters' 305-day milk yield was 2 297 kg. The performance over different years (Table 3) showed significant improvement in reproductive traits, i.e. service period and calving interval.

Genetic Characterization of Mehsana buffaloes Using Microsatellite Markers

Microsatellite DNA markers are extensively being used for animal biodiversity typing worldwide. Microsatellites or simple sequence repeats are the tandem iterations of DNA which are two to six bases in length. Due to their levels of variability, ease and reliability of scoring, neutrality with regard to selection, co-dominant inheritance and short length, microsatellite DNA markers are being widely used for genetic diversity analysis, genome mapping, QTL identifications, genetic distancing, etc. Moreover, these can be easily typed using PCR. At present no microsatellite DNA markers have been reported specifically for buffaloes. A battery of cattle microsatellite DNA markers was identified at NBAGR,

Karnal which showed polymorphism in bubaline genome (Navani *et al.*, 1999). These selected markers are being utilized for the characterization of the Mehsana buffalo breed. Blood samples were collected from unrelated animals from different villages in the breeding tract. A male cattle sample from the Haryana breed was used as a positive control. The DNA was isolated using phenol:chloroform extraction and the ethanol precipitation method (Sambrook *et al.* 1989).

PCR was carried out on 100 ng of genomic DNA in a 50 ml reaction for 25 animals. The reaction mixture consisted of 200 mM of dNTPs, *Taq* polymerase buffer, 1 unit of *Taq* DNA polymerase and 4 ng/ml of each primer. PCRs were carried out using a

PTC-200 PCR machine (MJ Research). The PCR protocol involved an initial denaturation at 95°C for two minutes, followed by 30 cycles of 92°C (one minute), 55°C (45 sec) and 72°C (one minute). A final elongation step of ten minutes was carried out at 72°C. The annealing conditions were similar to those reported for cattle (Kemp *et al.*, 1995). At the end of the reaction, 5 ml of stop dye (95 percent formamide, 0.25 percent bromophenol blue and 0.25 percent xylene cyanol) was added and 10 ml of PCR products were loaded onto a two percent agarose gel, electrophoresed and stained with ethidium bromide. The gel was visualised over UV light after ethidium bromide staining. The positive loci were loaded on

Table 3. Average year-wise production and reproductive performance of Mehsana buffaloes.

Traits	1989	1991	1993	1995	1996	1997
Age at first service (months)	22.20±0.26 (235)	23.18±0.17 (526)	24.54±0.17 (418)	25.49±0.20 (204)	24.87±0.20 (247)	24.70±0.24 (216)
Age at first conception (months)	29.1±0.53 (162)	29.0±0.34 (335)	33.1±0.27 (521)	34.2±0.35 (289)	32.2±0.38 (284)	34.3±0.36 (281)
Age at first calving (months)	36.0±0.59 (58)	40.7±0.43 (244)	42.0±0.28 (467)	44.0±0.37 (248)	44.4±0.39 (246)	42.8±0.37 (298)
First service period (days)	254±29 (47)	268±15 (171)	250±10 (351)	271±11 (222)	232±10 (259)	180±7 (272)
Overall service period (days)	254±29 (47)	265±12 (231)	243±8 (504)	220±8 (443)	215±7 (481)	173±5 (497)
First calving interval (days)	521±20 (41)	545±13 (136)	517±9 (241)	501±10 (171)	490±9 (188)	418±6 (112)
Overall calving interval (days)	521±20 (41)	545±12 (180)	521±6 (636)	499±8 (315)	477±6 (331)	420±5 (180)
First lactation length (days)	305±2 (56)	308±1 (217)	299±2 (442)	301±1 (205)	300±1 (264)	300±2 (275)
Overall lactation length (days)	304±2 (57)	307±1 (289)	300±1 (606)	303±2 (424)	300±1 (504)	297±1 (491)
First 305-day milk yield (kg)	2 093±52 (57)	1 892±23 (225)	1 914±19 (457)	1 951±23 (259)	2 004±21 (323)	1 972±23 (333)
Overall 305-day milk yield (kg)	2 096±51 (58)	1 964±23 (302)	1 988±17 (628)	2 128±20 (522)	2 153±18 (615)	2 147±20 (605)
First lactation fat %	609±0.1 (56)	6.9±0.1 (216)	6.9±0.1 (442)	7.0±0.1 (205)	7.1±0.1 (264)	7.1±0.1 (275)

Figures in the parenthesis are number of observations.

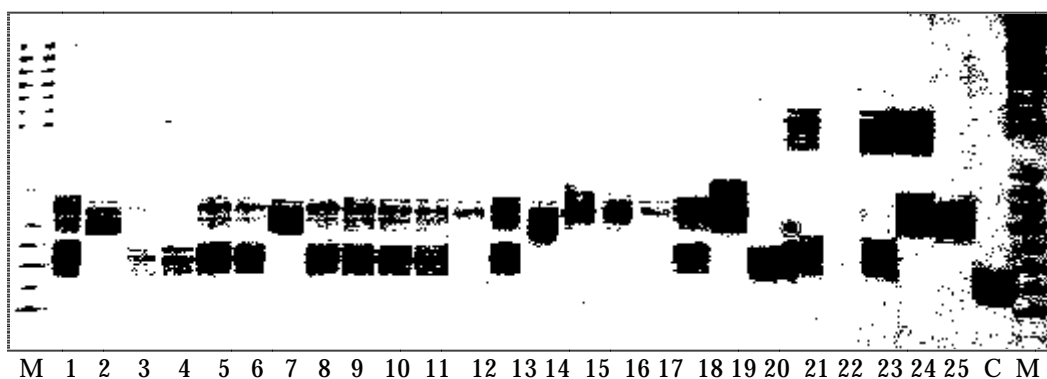


Figure 6. Silver stained representative gel of locus ILSTS052 'M'- marker, 'C'- cattle control

Table 4. Number of alleles, heterozygosity and allelic ranges of seven microsatellite loci in Mehsana buffaloes.

Sl. No.	Locus	Primers (5'-3')	No. of Alleles	Heterozygosity	Allelic Range
1	ILSTS017	F-GTCCCTAAAATCGAAATGCC R-GCATCTCTATAACCTGTTCC	6	0.92	104-124 bp
2	ILSTS019	F-AAGGGACCTCATGTAGAAGC R-ACTTTTGGACCCTGTAGTGC	4	0.40	160-170 bp
3	ILSTS025	F-GTTACCTTTATATAAGACTCCC R-AATTTCTGGCTGACTTGGACC	4	0.48	116-130 bp
4	ILSTS052	F-CTGTCCTTTAAGAACAAACC R-TGCAACTTAGGCTATTGACG	7	0.84	145-180 bp
5	ILSTS056	F-GCTACTGAGTGATGGTAAGGG R-AATATAGCCCTGGAGGATGG	6	0.64	140-172 bp
6	ILSTS058	F-GCCTTACTACCATTTCAGC R-CATCCTGACTTTGGCTGTGG	6	0.88	142-174 bp
7	ILSTS061	F-AAATTATAGGGCCATACGG R-TGGCCTACCCTACCATTTC	8	0.80	136-170 bp

6 percent denaturing polyacrylamide sequencing gels (Sequi-GT system, BioRad). pGEM DNA marker and allelic ladder of GenePrint™ STR Systems (Promega) were used as a size standard. After the run was over the gel was stained with silver nitrate using a silver staining kit (Promega). The gels were documented by drying between the sheets of cellophane papers and kept for

records. The allele numbers were counted manually. The results are presented in table 4. A representative gel picture showing a polymorphic locus (ILSTS052) is illustrated in figure 6. The results revealed that cattle microsatellite markers, to start with, may be used for molecular characterization studies in Mehsana buffaloes.

Acknowledgements

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Red Iberoamericana sobre la conservación de la biodiversidad de los animales domésticos locales para el desarrollo rural sostenible (CYTED. XII-H)

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Resumen

En este documento se presenta una red temática latinoamericana con financiación del Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (CYTED), dedicada a la conservación de los recursos genéticos de los animales domésticos, al estudio de los sistemas de explotación tradicionales, así como las repercusiones sociales y ecológicas de estos recursos, además de la evaluación de sus posibilidades en el desarrollo rural sostenible de los países implicados.

En esta red participan más de 140 investigadores de 16 equipos multidisciplinares ubicados en 9 países Latinoamericanos (México, Brasil, Bolivia, Argentina, Venezuela, Uruguay, Cuba, Portugal y España).

Se presentan los objetivos de la red y las actividades realizadas junto con las acciones planeadas para el futuro.

Summary

This document presented a thematic Iberoamerican network financed by the Iberoamerican Programme of Science and Technology for Development (CYTED) dedicated to the conservation of domestic animal genetic resources. The Network promotes the study of the traditional management systems, thus, the social and

ecological impact of these resources and the evaluation of their potential in sustainable rural development of participating countries.

One hundred and forty researchers from 16 teams of different specializations located in nine countries of the Iberian Peninsula and Latin-America (Argentina, Bolivia, Brazil, Cuba, Mexico, Portugal, Spain, Uruguay and Venezuela) participate in this Network.

This paper describes the current objectives of the Network and the realized activities together with planned activities for the future.

Key words: *Native breeds, Ecology, Social impact, Local progress.*

Introducción

En el ámbito de las naciones iberoamericanas se ha constituido desde 1984 una estructura dedicada a la cooperación y el desarrollo de estos países a través de la investigación aplicada y el progreso tecnológico, que ha sido suscrita por 21 estados de habla hispana y portuguesa de ambas orillas del Atlántico, los cuales aportan al programa una financiación desde sus instrumentos nacionales para la cooperación internacional y una contribución voluntaria para la financiación de acciones concretas desarrolladas en los diversos países (seminarios, congresos, experiencias conjuntas, etc.), sumando a todo esto una contribución por parte de España de al menos

el 50% del total del presupuesto, que en 1998 se elevó a un total de casi 4,5 millones de Dólares USA.

El Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (Programa CYTED) consta de diecisiete subprogramas dedicados a las más diversas áreas. Estos subprogramas financian tres tipos de acciones internacionales:

- Redes temáticas de trabajo.
- Proyectos precompetitivos de I+D.
- Proyectos Iberoeca de I+D con participación de empresas.

Dentro del subprograma XII, titulado "Diversidad Biológica" y coordinado por el Dr. Gonzalo Halffter (Instituto de Ecología, Xalapa, México), se ha constituido en 1999 la Red Iberoamericana sobre la conservación de la biodiversidad de los animales domésticos locales para el desarrollo rural sostenible (XII-H). Esta red dedica sus esfuerzos a cuatro puntos fundamentales:

1. El estudio de los recursos genéticos de los animales domésticos nativos y criollos de las naciones involucradas.
2. El conocimiento de los sistemas de explotación tradicionales y el análisis de puntos críticos susceptibles de mejora de estos sistemas asegurando su esencia.
3. La evaluación del impacto social de estos recursos en los pueblos que los explotan.
4. La evaluación del impacto ecológico de estos recursos en las áreas donde son explotados.
5. Investigar las posibilidades de optimización de las relaciones hombre-animal-ambiente definidas, para el desarrollo rural sostenible.

Integrantes de la Red

En la actualidad se encuentran involucrados en la red en torno a 140 investigadores, distribuidos en 16 equipos de investigación de 9 países (Tabla 1).

Este grupo es multidisciplinar, disponiendo de especialistas en genética animal y conservación, en reproducción asistida, en sociología y estudios campesinos, en zootecnia general, en caracterización racial,

en ecología y también en economía agraria. Esto nos está permitiendo abordar el contenido de la red desde diversas ópticas que nos dan una imagen multidimensional de los problemas, muy necesaria a la hora de llegar a conclusiones prácticas en temas tan complejos como el desarrollo rural en áreas extremadamente deprimidas.

Objetivos y Actividades de la Red

Coordinación e intercambio de experiencias

Nuestro primer objetivo es crear un foro de discusión periódica, en el que los integrantes de la red podamos intercambiar nuestros conocimientos y experiencias, además de exponer los avances conseguidos. Esto lo hemos planteado a través de nuestras reuniones anuales de coordinación, la primera de las cuales se celebró en el mes de diciembre de 1999 en el Instituto Tecnológico Agropecuario N° 2, Conkal, en la ciudad mexicana de Mérida en el estado de Yucatán. La segunda reunión correspondiente al año 2000 se celebrará en el mes de noviembre en la Embrapa Pantanal (Centro de Pesquisa Agropecuaria del Pantanal - CPAP), en la ciudad de Corumbá, estado de Mato Grosso del Sur, en el Pantanal brasileño.

Conservación "In Situ" y "Ex Situ" de los recursos genéticos animales

En la actualidad son muy numerosas las técnicas existentes para la conservación de la diversidad genética animal, estos métodos, según la FAO (1999), se pueden clasificar en "in situ", cuando el resultado es la conservación de las poblaciones en su mismo ambiente, aplicando tan solo medidas coadyuvantes para recuperar la competitividad de las mismas, o los métodos "ex situ", en los que la conservación se consigue a través de la aplicación de medidas artificiales que mantienen al recurso genético lejos de su ambiente habitual, en este caso nos

Tabla1. Integrantes de la Red Iberoamericana sobre la conservación de la biodiversidad de los animales locales para el desarrollo sostenible (XII-H).

Centro	Coordinador	País
Univ. Autónoma Nacional de México (UNAM)	Dra. A. Shuneman	México
Univ. Autónoma Nacional de México (UNAM)	Dr. A. Medrano	México
Univ. Autónoma de Puebla	Dr. S. Hernández	México
Univ. Autónoma de Chiapas	Dr. R. Pérez-Grovas	México
Centro de Inv. y Graduados Agropec. Conkal. Yucatán	Dr. A. Sierra	México
Universidad Federal de Pelotas	Dr. R. Cardellino	Brasil
Embrapa Pantanal, Corumbá, MS.	Dr. J.R.B.Serenio	Brasil
Embrapa Cenargen, Brasilia, DF.	Dr. A.S.Mariante	Brasil
Universidad Autónoma de Santa Cruz de la Sierra	Dr. J.L. Vaca	Bolivia
Academia Nacional de Ciencias de Bolivia	Dr. A. Cardoso	Bolivia
Universidad de la República. Montevideo	Dr. G. Fernández	Uruguay
Universidad de Lomas de Zamora.	Dr. F. Rumiano	Argentina
Centro de inv. Agropecuaria del Baixo Alentejo	Dr.C.P.Matos	Portugal
Unid. de Veterinaria. Depto. de Genética. Univ. de Córdoba	Dra.M.E. Camacho	España
Universidad Nacional Francisco de Miranda", Estado Falcón	Dr. F.Pariacote	Venezuela
Universidad de Granma	Dr. F. Velázquez	Cuba

encontramos con medidas mas drásticas como la criocongelación de gametos y cigotos, y las menos drásticas como son los zoos.

Nuestra intención es profundizar en estos campos de trabajo a través de la celebración de talleres específicos, como el celebrado paralelamente en nuestra reunión de Mérida. En este caso la presentación realizada por el Dr. Medrano sirvió de base para una profunda discusión sobre la creación de bancos de germoplasma. Esta acción se ve complementada por la conformación de equipos específicos con los miembros de la red especializados en esta materia, lo que constituye un foro específico de discusión y de intercambio de técnicas y experiencias. Nuestra intención es madurar las estructuras creadas dentro de la red en este campo para solicitar un proyecto internacional de investigación y desarrollo.

Caracterización primaria, morfológica, productiva y genética de los recursos genéticos animales

Uno de los principales problemas al que nos enfrentamos dentro de nuestros planteamientos es la indefinición de las razas iberoamericanas, ya que tras la "sombrilla" del término criollo nos solemos encontrar una gran diversidad genética en la forma de múltiples razas y poblaciones que aún hoy no han sido caracterizadas de acuerdo a criterios científicos modernos.

Por esa razón, hemos considerado de importancia estratégica en nuestro trabajo el unificar criterios en cuanto a los protocolos aplicados para la caracterización genética, morfológica y productiva de nuestras razas (Delgado y col. 1999).

El procedimiento de trabajo planteado en este aspecto es similar al descrito en el punto anterior. a en nuestra reunión de Mérida celebramos un taller específico coordinado por el Dr. Hernández, en el que se abordó sobre una ponencia del mismo, un intenso debate sobre los procedimientos a seguir y los protocolos a aplicar. Como resultado del taller quedo conformado un equipo de especialistas encargados de profundizar en esta materia y transferir sus avances al resto de componentes de la red.

Así mismo, hemos planteado durante el año 2000 el desarrollar un modelo de encuesta que será aplicado de una manera común por los equipos participantes. Esta información se almacenará en una base de datos que estará a disposición de los interesados de dentro y fuera de la red en nuestra pagina Web actualmente en construcción.

También es nuestra intención consolidar el intercambio de información y el equipo de trabajo hasta llegar a la solicitud de un proyecto internacional de investigación y desarrollo en esta materia.

Tipificación y mejora de los sistemas de producción animal tradicionales

Como paso preliminar en nuestro trabajo sobre este aspecto, los equipos participantes definirán los sistemas de producción tradicionales de sus países con el máximo rigor y profundidad, para poder realizar sobre ellos un diagnóstico de puntos críticos en los que se pudiera actuar realizando una mejora y optimización sin alterar su esencia. A continuación nuestro trabajo será similar al descrito en puntos anteriores, con la celebración de talleres específicos, la conformación de equipos de especialistas, y el intercambio de técnicas y experiencias, para finalizar con la solicitud de fondos para la investigación en esta materia.

En este aspecto nos hemos trazado la elaboración de informes periódicos nacionales e internacionales que se divulgarán a las distintas personas e instituciones con

competencias en la materia, para que sirvan de base para la planificación de posibles acciones para el desarrollo rural.

Evaluación de impactos sociales y ambientales de la producción animal tradicional

Nuestras acciones en este punto ya han comenzado en nuestra reunión de Mérida, ya que allí celebramos un primer taller específico coordinado por el Dr. Pérez-Grovas, en el cual tras su brillante ponencia comenzamos a discutir sobre el desarrollo de protocolos comunes de evaluación de impactos sociales y ecológicos, para realizar el diagnóstico de las interacciones Recurso Genético-Ser humano-Medio ambiente.

En estos aspectos también se actuó sobre la conformación de equipos de especialistas, el fortalecimiento del intercambio de experiencias y se planteó la búsqueda de recursos para la investigación y el desarrollo de este objetivo.

Fortalecimiento del papel de Iberoamérica en los foros internacionales de conservación

Existe la creencia entre los científicos y técnicos dedicados a la conservación que la riqueza en recursos genéticos animales en el ámbito iberoamericana es escasa. Este grave error emana de la inexistencia de trabajos rigurosos dedicados a la caracterización racial de las poblaciones iberoamericanas, esto hace que se conozca como criollo de un determinado país a numeroso colectivo de razas adaptadas a los más diversos ecosistemas y circunstancias, mostrando por tanto claras diferencias entre grupos. Este fenómeno hace que los gobiernos y los entes internacionales como la FAO mantengan unos criterios erróneos sobre la necesidad de actuación en pro de la conservación de los recursos animales iberoamericanos.

Este es el motivo por el cual nos trazamos como un objetivo prioritario el dar a conocer los avances de la red en los foros

internacionales especializados en estas materias, a través de nuestra participación en los puntos focales nacionales y regionales del Programa Global de la FAO para la Conservación y Utilización de los Recursos Genéticos Animales. Pero usando también, los vehículos de las publicaciones en libros y revistas como la que nos ocupa, así como la presentación de comunicaciones y ponencias en congresos relevantes.

Formación continuada y transferencia de resultados a los sistemas productivos y las políticas de los países iberoamericanos

Algo muy importante y que no vamos a descuidar es la transmisión de nuestros logros y avances a la comunidad científica iberoamericana, para ello hemos acordado la celebración de un curso internacional intensivo anual para posgraduados de nuestro contexto cultural y científico, centrado en el contenido de la red. Este curso que se celebrará en la Universidad de Córdoba (España) y será avalado como título propio de la mencionada institución.

Ya está propuesto el primer curso que con una duración de 100 horas se iniciará en el mes de septiembre del año 2000, con el título "Primer curso internacional sobre la

conservación y utilización de las razas de animales domésticos locales en sistemas de explotación tradicionales", el cual se compone de cuatro módulos, el primero de ellos dedicado a la definición de los recursos genéticos, el segundo se centrará en los sistemas de explotación, el tercero sobre la tecnología de la conservación y el cuarto sobre el desarrollo rural sostenible.

Una herramienta fundamental en el proceso de divulgación de nuestros resultados es la disposición de una página web específica, la cual ya está a disposición de los usuarios desde el mes de Julio del año 2000 (www.uco.es/investiga/grupos/cyted), o la más reducida www.uco.es/grupos/cyted.

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Reports of Selected Meetings

This is a new section. The Editors felt that it could be of interest to readers to publish on *ad hoc* basis the reports received on selected meetings. This section is thus in no way exhaustive and only depends on the reports received on relevant meetings.

FAO-AnGR National Coordinators Workshop, Rome, 31 August – 2 September 2000

FAO, with generous financial support from the Government of France, coordinated an orientation workshop for National Coordinators in Rome, from 31 August to 2 September 2000, to review and examine the overall process for developing the first *Report on the State of the World's Animal Genetic Resources (SoW-AnGR)*, and to discuss in-country requirements and activities related to the preparation of Country Reports, a crucial step in the SoW-AnGR Process. Approximately 60 participants, including National Coordinators from all regions and other country experts, along with FAO staff and supporting consultants, attended the orientation workshop.

Workshop participants firmly supported the preparation Country Reports and the first *SoW-AnGR*, and confirmed their willingness to be involved. They stressed the need for Country Reports to be an official government

report and the need for an effective National Focal Point, Consultative Committee and Country Network to enable preparation of quality Country Reports by 2001.

Workshop participants felt that Country Reports should be strategic documents based on a sound assessment of where each country is in terms of the management of animal genetic resources (AnGR), where it needed to be, and how best to get to where it needed to be. There was acknowledgement that answering these questions would be difficult, but that answering them was essential to gain a full understanding of the state of each countries AnGR, and the state of capacity to management them now, and in future.

Workshop participants concluded that the process for developing the Country Report must to consultative, empower stakeholders, and increase awareness of the roles and values of AnGR.

Intergovernmental Working Group on AnGR (CGRFA/FAO), Second Session, Rome 4 - 6 September 2000

The Second Session of the Intergovernmental Technical Working Group on AnGR for Food and Agriculture was held in Rome, Italy, from 4 to 6 September 2000. The Working Group considered progress in developing the Global Strategy for the Management of Farm Animal Genetic Resources, and the preparatory process of the SoW-AnGR.

The Working Group agreed that the first *SoW-AnGR* is the main priority. Based on Country Reports, *the SoW-AnGR* will provide a firm, comprehensive information base for use in upgrading decision-making on use, development and conservation of AnGR, enable better understanding of AnGR, and strengthen country capacity for their management, while providing a solid foundation for further priority actions.

The Working Group stressed the need for strong National Focal Points, to facilitate networking and the preparation of Country

Reports, and the need to enhance efforts to establish Regional Focal Points and other networks.

The Working Group indicated the need to continue AnGR as a priority area in the FAO Programme of Work and Budget, and should be a high priority for donor support.

The Working Group considered the policy implications of the rapid developments in the animal biotechnologies for AnGR management, and recommended priorities for advancing the Global Strategy including, enhancing efforts to prepare national strategies for AnGR; that FAO investigate guidelines for best practices, to more effectively plan livestock breeding programmes using local and, when appropriate, exotic germplasm and enhance characterization efforts, and that they identify options for establishing a country driven early warning and emergency response mechanism for the AnGR most at risk.

ICAR-FAO Buffalo Workshop on “Animal Recording for Improved Breeding and Management Strategies of Buffalo” Bled, Slovenia, 16 - 17 May 2000

B. Moioli

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During the 32nd Meeting of the International Committee for Animal Recording (ICAR, 13-19 May 2000) a Joint FAO-ICAR International Workshop on “Animal Recording for Improved Breeding and Management Strategies of Buffaloes” was organized. The objectives were the examination of recording in some buffalo raising countries and the promotion of collaboration among these countries. Experts from 17 countries plus FAO and ICAR participated in the Workshop.

The Workshop was organized in four sessions.

Session 1. Presentation of the Seven Most Relevant Cases of On-Field Buffalo Recording

Seven country case studies were presented from Bulgaria, Egypt, India, Iran, Italy, Nepal and Pakistan.

The major features of these case studies were:

1. the objective of milk recording involves both improved farm management and selection decisions in four cases (Bulgaria, Egypt, Iran and Italy). Selection of breeding animals at national or regional level is the only purpose of milk recording in three cases (India, Nepal and Pakistan);
2. milk recording and selection activity are performed and controlled directly by the Government through its own established structures and staff in three cases (Iran,

Nepal and Pakistan); in three cases (Egypt, India and Italy) it is performed through the cooperative efforts of several institutions, including farmers' cooperatives and it is performed directly by the Government, but it is now becoming responsibility of farmers' associations in Bulgaria.

Session 2. Justification and Components of a Functional Milk Recording Scheme

Benefits to farmers as discussed in this session are listed below from the most important to least important:

1. Improved animals are available from the selection which is made possible only by the recording activity.
2. Results of the milk recording activity (individual milk yield, fat yield, production and reproduction level of the herd, etc.) allow the farmers to better manage their herds.
3. Farmers can sell their animals as breeding stock at a better price if they can prove their genetic potential.
4. Farmers receive technical advice on feeding, health, reproductive and husbandry practices, through regular visits from the recording staff.
5. Artificial insemination is offered to the farmers participating in the recording activity (mainly important for the smallholders who cannot afford to raise their own bulls).

6. Farmers receive technical advice on fertility and other herd aspects, through the regular visits of technicians.
7. In some cases farmers receive incentives in the form of free or subsidised feed concentrates and medicines.

Who pays the cost of recording activities when they exist? Between 80 and 100 percent of the recording costs are paid by governments in most cases (80 percent). In Bulgaria the Government covers only 30 percent of the costs. Only in India (Gujarat State) is the Government not involved at all. The organizers/supervisors of the recording are a cooperative of milk producers and the recording costs are automatically retained by the cooperative from the price of purchased milk.

The Session also discussed the major constraints in implementing milk recording with the following results:

1. Farmers do not fully comprehend why they should be visited regularly by external people who measure the productivity of their animals. They are suspicious of strangers accessing their farms and do not like other farmers knowing how productive their herd is.
2. The establishment of a recording system requires the identification of the recorded animals (as well as their pedigree). Identification is expensive both for the devices to be applied and for the cost of the staff required for application.
3. In countries where the illiteracy rate is high (Bangladesh and Pakistan), it is impossible to rely on even partial cooperation of the farmers in the recording operations, therefore, more staff are needed.
4. In some countries, smallholders are scattered in the countryside, far away from each other (Bangladesh and Nepal). The recording staff spends a lot of time and money driving miles and miles to record only a few animals.
5. In Thailand and Viet Nam buffalo milk is not given adequate importance by the market, hence, little importance is given to milk recording.

Participants concluded that to overcome the constraints, the Government must step in to assist farmers and form cooperatives among farmers based on sound information.

Session 3. Initiation and Implementation of a Functional Milk Recording Scheme in Countries Where It Does Not Yet Exist. Identification of Opportunities and Constraints

Participants concluded that the initiation of recording schemes can be promoted by the Government, farmers' cooperatives and research institutions. In all cases it is necessary to increase awareness among all people involved in the benefits of recording. It was also suggested to start with medium-size herds first and to collect low-cost but useful information (conceptions, pregnancies and milk production). Recording can also be initiated within the framework of an artificial insemination or progeny-testing programme.

Session 4. Identification of the Necessary Components for Establishing and Maintaining a Programme for the Genetic Improvement of Dairy Buffalo

To implement and maintain a successful breeding programme, the participants recommended/concluded that:

1. The breeding objectives should be clearly stated. If the breeding objectives are the improvement of milk yield, the performance recording of milk yield as well as the method for calculating the lactation must be standardised.
2. A single organization or institution is needed to supervise the recording activities and to secure data processing. Such an

organization must rely on the availability of computer facilities and expertise in computing and genetic evaluation methods. It must also rely on availability of financial support either from the Government or other sources (farmers, foreign agencies, international development projects, etc.).

3. Artificial insemination is fundamental for distribution to farmers of the semen from the selected young bulls being evaluated and that from proven bulls. The organization must therefore establish a clear working programme with the AI centre.
4. In the case where a field programme does not exist or cannot be established in the short-term, a breeding programme might

be organized within nucleus herds, where all stages of the genetic improvement strategy can be more easily performed. In this case, research institutions can be good promoters of the breeding programme because they can offer scientific/technical expertise at all levels. It is recommended, however, that research institutions help to sensitize the policy-makers to the importance for the economy of the country of promoting and maintaining an effective genetic improvement scheme.

The complete details of the Workshop are published in Moioli, B. *et al.* 2000. ICAR Technical Series Number 4, Rome.
<<http://www.icar.org/publicat.htm>>

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Selected publications

In this section only relevant publications brought to the attention of the Editors are reviewed.

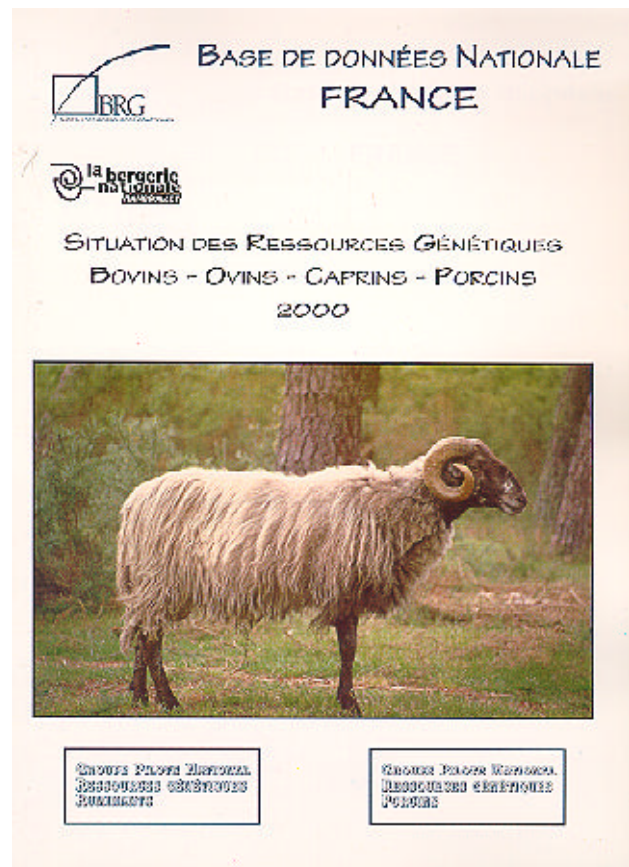
Base de données nationale France. Situation des ressources génétiques. Bovins-Ovins-Caprins-Porcins 2000

Conception et réalisation: Mylène Durand-Tardif et Dominique Planchenault
Bureau des Ressources Génétiques
In French. ISBN: 2-908447-17-7
pp. 230

Following the 1998-1999 edition (see AGRI 27, page 69), the National Bureau of the Genetic Resources published the Year 2000 Edition, containing an up-dated version of the French database of animal genetic resources.

The situation of cattle, sheep, goat, and pig breeds is described in several chapters each of them containing the name of the breeds, regional distribution, origin and present situation, reproduction characteristics, phenotypic characterisation. Estimations of the total number of the breeds are also given, together with the number of male and female animals, and their genetic characteristics. The principal utilisation of each breed and their specific aptitudes are also listed.

This book contains the same information of the French electronic database developed through the collaboration of many partners. It is characterised by the extreme synthesis in presenting the present situation of the French animal genetic resources and the lack of some photos does not compromise the very clear description of each breed.



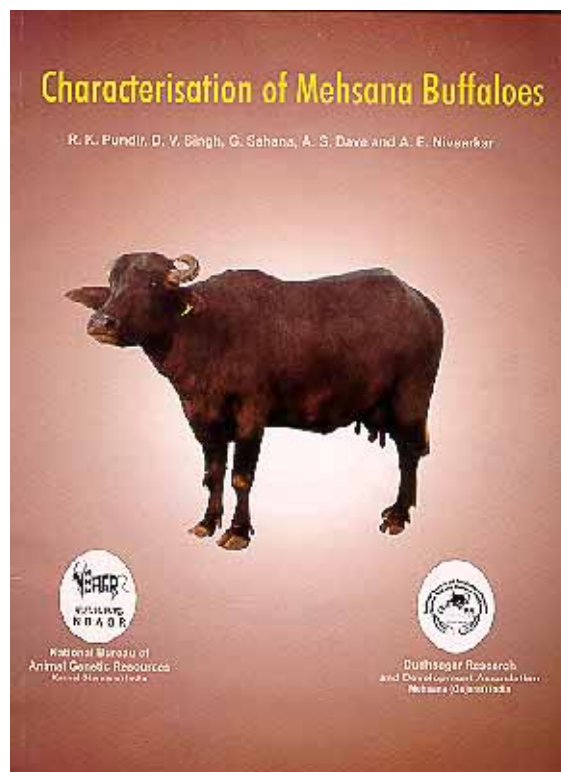
Characterization of Mehsana Buffaloes NBAGR Research Bulletin No. 8

R.K. Pundir, D.V. Singh, G. Sahana, A.S. Dave & A.E. Nivsarkar
National Bureau of Animal Genetic Resources, P.O. Box 129,
Karnal 132 001, Haryana, India
E-mail: pundirrk@nbagr.hry.nic.in
pp. 71

Mehsana is one of the well-defined breeds of river buffalo distributed in the northern part of Gujarat State in India. This breed is docile and reputed as persistent milker, regular breeder and also for its economic efficiency. The breed resembles to the Murrah breed of buffalo, in respect of various body characteristics, performance traits like such as yield, fat percentage, and a distinctive phenotype. Mehsana buffaloes are lighter in body weight than Murrah buffaloes. Body colour is not as dark as of the Murrah, horns are shorter and less curved in comparison with the Murrah.

A concerted effort was made in this bulletin to compile the literature on the Mehsana buffalo. After a brief sum-up of the origin of this buffalo, the bulletin gives details of the breeding tract of Mehsana buffalo and its population dynamics along with other livestock of the region. Physical characteristics, body weight, production, reproductive performance and genetic parameters were reviewed and presented in tabular form. Average age at first calving, dry period, service period and calving interval were 1 302 days, 170 days, 160 days and 474 days respectively. Average lactation length, lactation milk yield and fat percentage were 304 days, 1 822 kg and 6.83 respectively. No significant differences were observed in the milk compositions of Mehsana, Jaffarabadi, Murrah and other non-defined buffaloes. Semen attributes of bulls of this breed were dealt in detail. The cytogenetic parameters were also reviewed along with the karyotype and ideogram for both male and female animals. Photographs of adult male, female, heifer, calf buffaloes and important management and feeding practices are given.

The breeding policy followed for genetic improvement in the breed home tract is discussed. The list of selected bulls and their index for milk yield were also presented. The reasons for the decline in population in some regions are discussed. The recommendations are given for necessary action required for the conservation and sustainable improvement of the breed in its habitat. The bibliography contains an exhaustive list of publication on the Mehsana buffalo.



Landrace breeds: South Africa's indigenous and locally developed farm animals

C. Alberts (Ed.)

Farm Animal Conservation Trust (FACT) Private Bag X2 Irene 0062,
Gauteng, South Africa

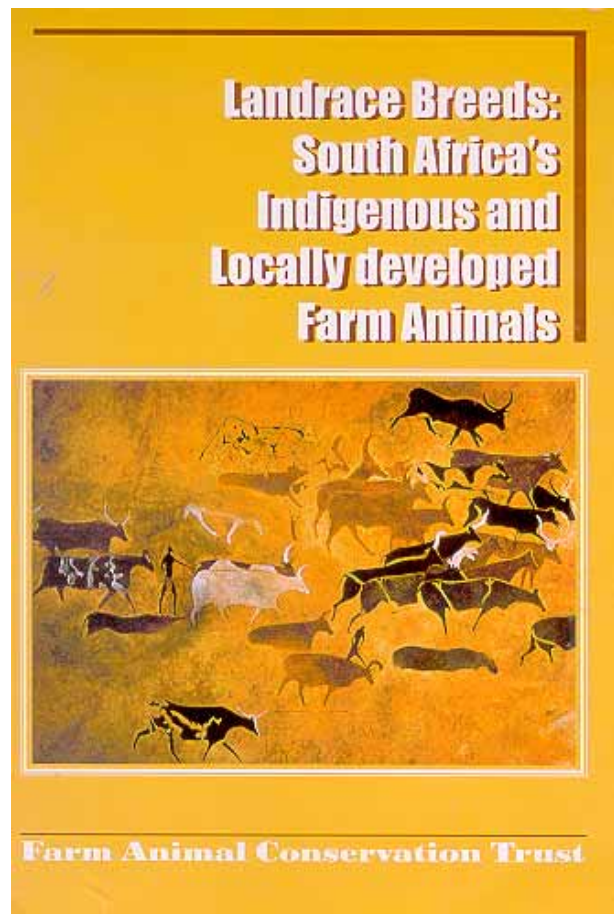
Tel: +2712 672 9030; Fax: +2712 6651503; E-mail: Akotze@iapi1.agric.za

ISBN: 0-620-25493-9

pp. 112

The Farm Animal Conservation Trust (FACT) of South Africa has published a book on South Africa's indigenous and locally developed breeds to create an awareness of these valuable resources and to facilitate conservation through sustainable commercial use.

The book provides much needed information on the breeds as well as related services such as the breed societies, breeding and trading consultants, import and export agents and semen and embryo collection services. Each breed page has a clear color picture as well as basic information on the origin, general description, qualities, production environment, and performance data (where available). A contact address, telephone, fax and email (where available) have been included for those who need more information - or who would like to buy animals of the breed concerned. By combining a wide range of linked information in one book, FACT has created a combined reference and marketing catalogue. Prospective buyers worldwide will be able to get information on animals, semen and embryos - and will also be able to contact import and export agents and other related services. The book is an ideal reference for students at agricultural schools, colleges and universities who require general information on the breeds and for the general public who would like to know more about this often forgotten resource. The book is available from FACT.



Genetic resistance to animal diseases Revue Scientifique et technique

M. Müller & G. Brem (Eds)

Office International des Épizooties (OIE), 12 rue de Prony, Paris 75017, France

Tel. +33-(01)-44151888; Fax: +33-(01)-42670987; e-mail: oie@oie.int

ISBN 92-9044-466-5. 391 pp. US\$ 45

This special issue of *Revue scientifique et technique* de l'Office International des Epizooties (OIE) is a particularly welcome review of the present situation in the domain of genetic resistance to animal diseases.

The book is made up of five sections, covering (i) general mechanisms of defence, (ii) genetic resistance to various infectious agents, (iii) conventional breeding programmes, (iv) marker-assisted selection and identification of resistance traits, and, finally, (v) more futuristic approaches such as targeted disruption of gene function and transgenesis.

The most important section is devoted to mechanisms of defence, which occupy a quarter of the book. The two chapters on constitutional and adaptive immunity set the general landscape, dominated by complexity and diversity of the mechanisms involved.

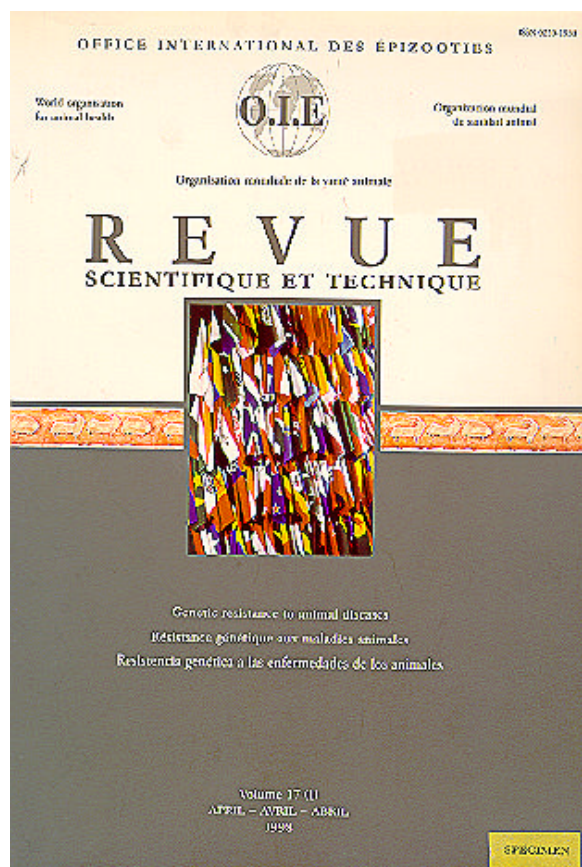
Four chapters are devoted to the major histocompatibility complex (MHC) in various livestock, fish and poultry species. The section on genetic resistance covers parasites, bacteria, viruses and prions.

Improvement of disease resistance by breeding is addressed in the two sections on conventional breeding and genomics, the latter including a chapter on the cataloguing of inherited disorders.

The last two chapters deal with transgenic technology, considering its two opposite aspects, either deletive (knockout) or additive (gene transfer). This technology has proven to be a very powerful tool for analysing gene functions. The potential also exists in large animals for removing susceptibility genes, or for adding beneficial ones, such as genes encoding for immunoglobins specific of given pathogens. The last sentence of the book, however, reminds us of the many obstacles still on the road.

The whole book offers a very comprehensive and up-to-date overview of the present knowledge on genetic resistances in farm animals, each chapter being followed by an extensive bibliography. The book is well organized and successfully meets the challenge of avoiding major overlaps between its 27 chapters.

Overall, the material presented and the general orientation towards future developments to be expected in the field of genetic resistance make this book a highly valuable tool for students, researchers, teachers and the animal industry.



Tradition and innovation in the Mediterranean pig production Options Méditerranéennes no. 41

J.A. Afonso de Almeida & J.L. Tirapicos Nunes (Eds)

Proc. of the 4th International Symposium held in Evora, Portugal, 26-28 November 1998

CIHEAM, Apartado 202, 50080 Zaragoza, Spain

Tel.: +34-976-716000; fax: +34-976-716001; <http://www.iamz.ciheam.org>

ISSN: 1016-121-X ISBN: 2-85352-213-X

pp. 330. Price: FF 350

Pig production based on local genetic material plays an important role in Mediterranean agriculture, supplying raw material mainly transformed into high quality products for specialised markets.

The background of this meeting lays on 3 former Symposia (respectively organised in Ajaccio, France, 1988; Badajoz, Spain, 1992 and Benevento, Italy, 1995) where researchers and technicians evidenced an increasing scientific knowledge and interest on the autochthonous Mediterranean pig breeds. In this Symposium the latest information on herd health, breeding and genetic conservation, nutritional needs and natural feed resources utilisation, management practices, quality of the meat and typical transformed products have been discussed among the participants during six sessions and the final round table of the breeders' associations.

Paper presented in this 4th Symposium emphasised the different production systems, their sustainability and relevant contribution to the development of local regions by utilising natural and local resources to produce ecologically valuable high quality products.



Base de données nationale France. Situation des ressources génétiques. Poules. Edition 2000

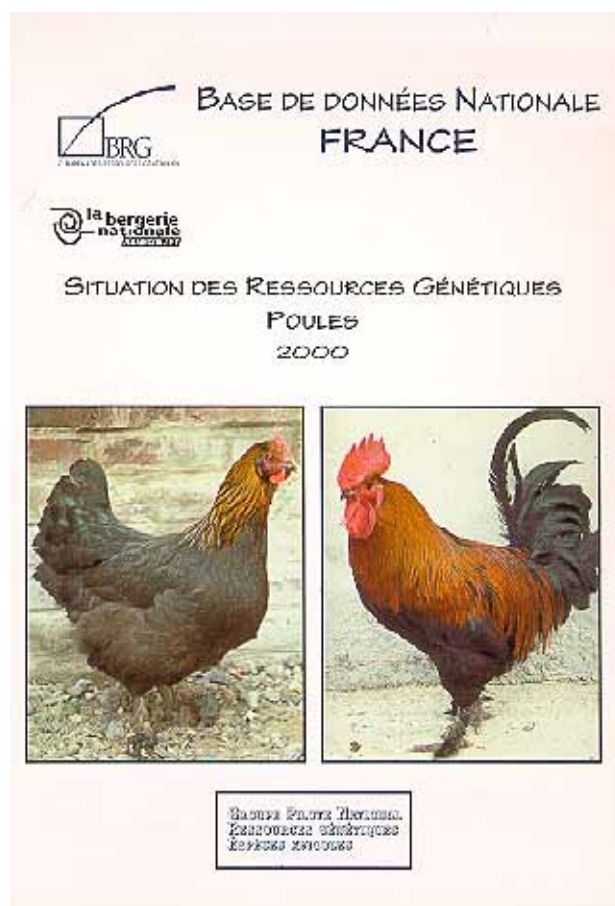
Conception et réalisation: Mylène Durand-Tardif et Dominique Planchenault
Bureau des Ressources Génétiques

In French. ISBN: 2-908447-16-9

pp. 90

This latest realisation on the French genetic resources series contains the presentation of the present situation of the national poultry breeds. The same structure of the former already reviewed book (see AGRI 27, pag. 69 and AGRI 28, page 75) is maintained. Developed in five steps, the data base describes morphological and genetic characteristics of each breed. The utilisation and main parameters are well described together with the regional distribution, origins, egg description, attitudes and reproduction performances.

Basically characterised with an essential exposition of the topics, this book unifies the knowledge about French poultry genetic resources, thus making available all the important information to both breeders and scientists of France and other countries.



Formaggi d'alpeggio: il pascolo, l'animale, la razza, il prodotto (Alpine cheeses: pastures, animals, breeds, product)

F. Pilla & P. Martin (Eds)

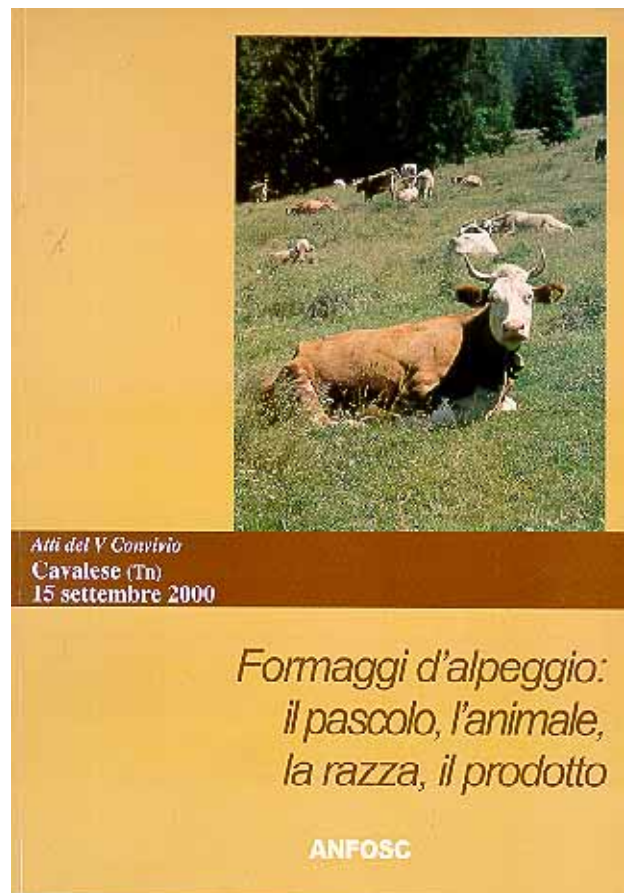
Proc. of the Meeting held in Cavalese, Italy on 15 Sep. 2000
ANFOOSC-ONLUS, Viale del Basento 108, 85100 Potenza, Italy

E-mail: anfosc@memex.it; www.anfosc.com

In Italian. pp. 240

The economic relevance of the alpine breeds together with the importance of their quality products were particularly underlined during the Meeting held in Cavalese, Italy on 15 September 2000.

Some 15 papers and posters stressed the commercial importance of the conservation of the alpine ruminants, considering their ability in transforming local pastures into incomes for the local population. In fact, only well adapted breeds can survive the difficult environmental conditions characterised by cold and snowy winters, typical of the Alpine climate. Examples of well adapted breeds were reported (e.g. *Valgerola* goat) that made possible the continuous presence and sustenance of mountain populations in the region. Animal welfare was presented as a basic condition to reach good final products and the role of old traditional technology was exposed as basic guidelines to be respected. Technology aspects of transformed products were compared in order to improve organoleptic factors of cheeses produced with the milk of various cattle, sheep and goat breeds, typical of the region.



Sheep and goat nutrition: Intake, digestion, quality of products and rangelands

Series Cahiers OM /Vol. 52

Proc. of the Meeting held in Grignon, France on 3-5 September 1998

CIHEAM Zaragoza, CIHEAM, Apartado 202, 50080 Zaragoza, Spain

Tel.: +34-976-716000; fax: +34-976-716001; <http://www.iamz.ciheam.org>

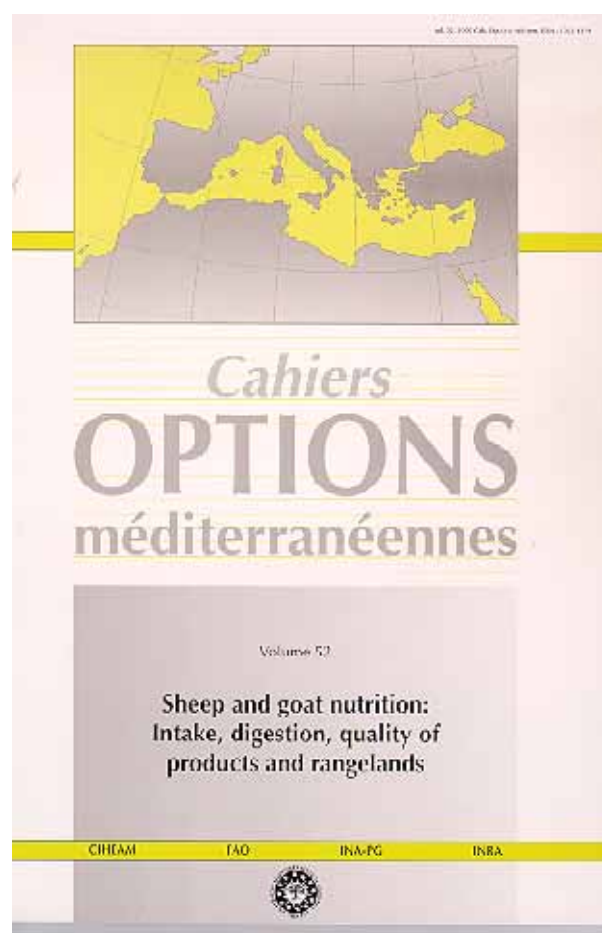
ISSN: 1022-1379

pp. 200 Price: 200 FF

This meeting was structured in three scientific sessions:

1. *Intake, digestion and metabolism.* A general report has proved how the type of forage, could influence feeding behaviour and intake in small ruminants and in particular motivate ingestion and feed choices, which has consequences on intake quantity and performance. Various communications have shown that animals try to optimise their intake through their feed choices in a meadow, and have indicated the importance of secondary meals to predict the digestibility of organic matter.
2. *Effect of nutrition on milk, meat and fibre quality.* Three important papers reviewed the effect of nutrition on ewe milk composition, on lamb meat quality and the effect of nitrogen nutrition on the production and quality of goat hair. In fact nutritional factors act very similarly on the composition of ewe and goat milk. Furthermore, live weight and dairy diet composition are the major factors on which fatty acid composition of adipose depositions and consequently their ability to curd at slaughtering depend. Besides, the papers have revealed the interest of protected methionine to increase the growth of Angora or Cashmere hair in the case of sulphur amino-acid deficit. The communications of this session have demonstrated the interest of adding lipids of various natures to improve the nutritional or organoleptic quality of milk, but in reality, the technological conditions of cheese manufacturing generally have more pronounced effects on cheese quality than the type of diet.

3. *Utilisation of grasslands and rangelands in harsh environments.* Several papers, including the general report, have highlighted the interest of providing polyethylene to offset the negative effects of tannins in the digestion of poor quality rangeland plants, which is one of the limiting factors for livestock development in arid zones. On the other hand, stubble is an interesting component of Mediterranean feed systems for small ruminants. Furthermore, it appears that on rangelands, goats' feed choice is more nutritive than that of sheep.



Chokla. Famous carpet breed of sheep

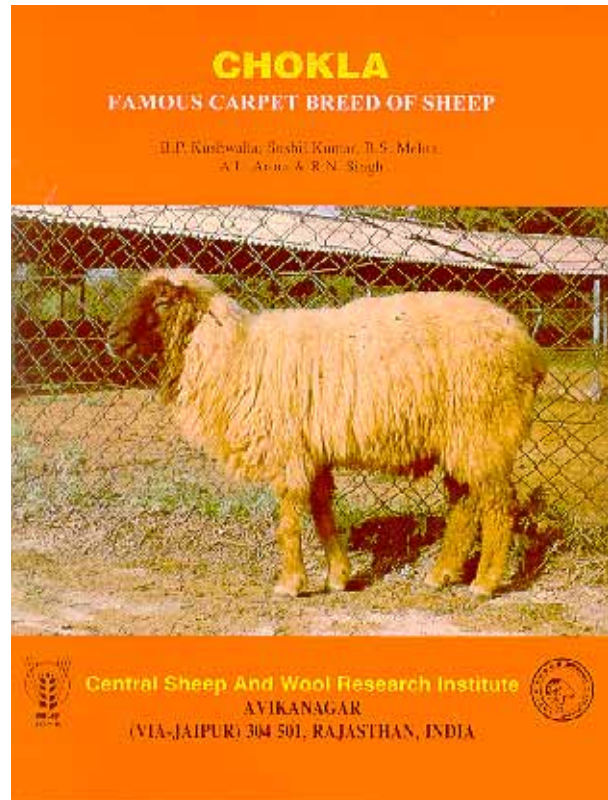
CSWRI Research Bulletin, September 1999

B.P. Kushwaha, Sushil Kumar, B.S. Metha, A.L. Arora & R.N. Singh
Central Sheep and Wool Research Institute, Avikanagar
(Via-Jaipur) 304 501, Rajasthan, India

Chokla sheep are a renowned carpet wool producing breed. Animals of this breed are found in Churu, Jhunjhunu, Sikar and Nagaur districts of Rajasthan. These districts are in an arid region and agricultural production is very low. The economy of this region is mainly dependent on livestock, specially sheep rearing. Chokla sheep are hardy and well adapted to the arid and semi-arid environments in which they have been reared for centuries. Migration is a common practice in this region and the Chokla sheep are best suited for migration.

The population size of the breed is declining due to natural reasons and to large scale crossbreeding programmes for converting Chokla toward wool production. The fact that the interest of the farmers is changing towards keeping heavy breeds of sheep rather than Chokla, is also one of the reasons for the reduction of the Chokla population size. An attempt has been made in this study to unify all the information on Chokla sheep in order to help in the evaluation of characteristics and formulation of future strategies for this breed.

The natural habitat, population size, geographic distribution and physical and reproductive traits have been analysed; a bibliographic presentation of the biochemical polymorphic traits, carried out in different years by various authors, is also reported. A list of selected papers concludes this clear and to the point presentation about the Chokla breed of sheep.



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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 indentation. 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

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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

Prof. Galal left FAO on the 1st February 2000 for Cairo (Ain Shams University, Faculty of Agriculture, Animal Production Dept.).

There is no change in the editorial responsibility of AGRI.

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

agri-bulletin@fao.org

Thanks for the collaboration

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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 recommandations 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 descriptions 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 majeure partie des terres consacrées à l'élevage, à la production totale des aliments et l'agriculture provenant 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 événements nationaux, régionaux et internationaux; ainsi que les conclusions et recommandations par rapport aux objectifs de ces principaux événements. Les auteurs sont priés d'envoyer ce genre de matériel aux éditeurs.

Guide pour les auteurs

Présentation du manuscrit

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 manuscrits 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 manuscrit

Sur la première page du manuscrit 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'écrit sur la partie supérieure de la page 1 du manuscrit en majuscules. Le titre en entier du manuscrit 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 exemple 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'écrit 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'écrit 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. Exemple 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 exemple 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 exemple "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

Le Prof. Galal a quitté la FAO le 1er février 2000 pour aller au Caire (Ain Shams University, Faculty of Agriculture, Animal Production Dept.). Aucun changement n'a eu lieu en ce qui concerne la responsabilité éditoriale pour AGRI.

Pour tout envoi de manuscrits ou correspondance 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 sitio: <<<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 31/2") 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 título 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 número 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 sitio 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

El Prof. Galal dejó la FAO el 1 de febrero del 2000 para ir al Cairo (Ain Shams University, Faculty of Agriculture, Animal Production Dept.).

No ha habido ningún cambio en cuanto a la responsabilidad editorial de AGRI.

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

agri-bulletin@fao.org

Gracias por su colaboración

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