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ANIMAL GENETIC RESOURCES INFORMATION

BULLETIN D'INFORMATION SUR LE RESSOURCES GÉNÉTIQUES ANIMALES

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

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

UNEP

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

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Editorial

Sustainable Livestock Development: Inputs and Outputs -2

To realise and maintain food security, many countries must achieve continued increases over time in agricultural **production**, because human numbers are still increasing and often also because a level of food poverty currently prevails. Further, virtually all countries must now also increase **productivity** as the resultant pressure on the supply of inputs such as water, available land, animal feed etc intensifies. In addition, the management of such inputs to ensure continuity of supply over time reduces the risk of production failure due particularly to periodic and often irregular major rainfall deficits. We term the active manipulation of the processes of production and productivity , *through the deployment of more inputs in the system* , whilst at least restraining risk of system failure over time, sustainable intensification.

Of course instead of addressing production (output) and productivity (output per unit of input) we could deal only with the two primary variables, *i.e. inputs and outputs.* Indeed during most of this century, with lesser pressure on input resource availability, agriculturists - crop and livestock farmers, researchers, trainers, consultants etc - primarily considered the system output side of the productivity function. Commonly only the main output*(s)* from each type of plant and animal was considered, e.g. units of milk, or meat or fibre, or eggs. Although **multi-purpose production** prevailed in most circumstances, frequently only the main output which was consumed directly was considered in production development. So, for instance, outputs such as draught for cultivation, transport, etc, manure for fuel and fertiliser, the employment generating contribution, and the major asset value of animals utilised by farmers for risk management, often also comprise important contributions by them to farming communities. Of course, sustainable intensification of a biological system cannot be maintained by only addressing some of the important outputs or by neglecting the inputs. More formally, whilst important variables are excluded from a functional relationship describing a production situation even the relative emphases accorded those variables will be incorrect, and badly so in some cases.

A further important aspect of agricultural production which has contributed to the development of social diversity of human communities is **product quality**. The nature of the environment has shaped the production system and the living habits of people, their housing, clothing, and particularly their food and customs. Further, and depending on the quality of fresh food products, different secondary products such as cheeses, yoghurts, preserved meats, fabrics, etc are made and differentiation of communities in cuisines has been the result. As the developed countries in particular enter the information age, increased market segregation even within communities is occurring with demand increasing simultaneously for both greater variety and more consistent products. This range of demands within and amongst communities suggests that whilst food and agricultural product quality considerations may well be of minor importance to communities in poverty they cannot be neglected in planning for sustainable intensification of production at the country, regional and global levels.

Sustainable intensification of production may, *thus*, be achievable at all input-output levels and not simply in the highly industrialised (high input) production systems. The challenge is to ensure that the technologies etc employed to achieve the intensification process are appropriate to the production system.

The Editors

Développement durable en élevage: ressources et productions - 2

Pour atteindre et conserver la sécurité alimentaire, la plupart des pays doivent réaliser des augmentations continues dans le temps en matière de **production** agricole, étant donnée que le nombre d'habitants est en augmentation et que souvent aussi le niveau de pauvreté alimentaire est courant. En outre, tous les pays doivent maintenant augmenter la **productivité** comme résultat de la pression intense exercée sur les ressources telles que l'eau, la disponibilité de terre, l'alimentation animale etc. D'autre part, une gestion de ces ressources qui puisse permettre d'assurer la continuité des apports dans le temps diminue le risque d'échec de la production qui est dû surtout au déficit provoqué par les périodiques et souvent irrégulières pluviométries. Nous califions ainsi la manipulation active des processus de production et de productivité - *à travers le déploi de plus de ressources dans le système* - tandis que le risque d'un échec du système dans le temps diminue par le biais d'une intensification durable.

Nous pourrions, bien sûr, au lieu de nous référer à la production et à la productivité (production par unité de ressource) traiter seulement les deux variables primaires, c'est-à-dire, *les ressources et les productions*. De fait, presque tout au long de ce siècle, qui a subi moins de pression sur les ressources disponibles, les agronomes, vus comme éleveurs et agriculteurs, chercheurs, enseignants, consultants etc., ont considéré en premier lieu la partie du système de production qui correspond à la fonction de productivité. Très souvent seulement les principales productions de chaque type de plante ou d'animal ont été prises en considération, par example les unités de lait, de viande ou de fibre, des oeufs. Bien que la **production à buts multiples** soit souvent la plus importante, fréquement seules les productions qui sont consommées directement viennent prises en considération dans le cadre du développement. De ce fait, les productions telles que la traction animale dans l'agriculture, le transport etc., le fumier pour l'utilisation comme carburant et fertilisant, la génération d'emploi, ainsi que la principale valeur, les animaux utilisés par les éleveurs pour la gestion du risque, souvent contiennent des contributions importantes pour la communauté agricole. Bien sûr l'intensification durable d'un système biologique ne peut pas être soutenue seulement par la sélection de certaines parmi les productions plus importantes ou par l'exclusion des ressources. Plus concrètement nous pouvons dire que, tandis que des variables importantes sont exclues d'une relation fonctionnelle qui décrit une situation de production, l'importance relative accordée à ces variables sera incorrecte, voir négative dans certains cas.

Un autre facteur important de la production agricole qui a contribué au développement de la diversité sociale des communautés humaines est la **qualité du produit**. La nature de l'environnement a déterminé le système de production et les habitudes des peuples, leurs maisons, leurs habits, et, en particulier, leur nourriture et habitudes alimentaires. En outre, et selon la qualité des aliments frais, certains produits secondaires se sont développés, tels que le fromage, le yogurt, les viandes en conserve, les tissus etc., donnant lieu ainsi à une plus grande différentiation entre les communautés du point de vue de la gratronomie. Etant donné que, surtout les pays développés, entrent maintenant dans l'ère de l'information, on observe une augmentation dans la ségrégation des marchés même à l'intérieur d'une communauté, avec, simultanément, une augmentation de la demande de meilleures variétés et de produits plus consistents. Cette partie des demandes à l'intérieur et entre les communautés fait penser que les considérations sur la qualité des aliments et des produits agricoles peuvent être de

moindre importance pour les communautés plus pauvres, mais ne doivent pas être négligées lors de la planification d'une intensification durable de la production au niveau d'un pays, d'une région ou même au niveau mondial.

L'intensification durable de la production doit donc être atteinte à tous les niveaux de ressource-production et non seulement dans les systèmes de production hautement industrialisés (haute production). Le défi consiste à assurer que les technologies employées pour atteindre le processus d'intensification soient appropriées au système de production.

Les Editeurs

Desarrollo ganadero sostenible: recursos y producción- 2

Para conseguir y mantener la seguridad alimentaria la mayoría de los países debe llevar a cabo contínuos incrementos en la **producción** agrícola, ya que el número de la población humana sigue creciendo y, a menudo, prevalece un escaso nivel alimentario. Por otro lado, todos los países deben ahora incrementar también la **productividad** como resultado de la intensa presión ejercida sobre los recursos tales como el agua, el terreno disponible, la alimentación animal etc. Además, la gestión de estos recursos que permita asegurar una continuidad del suministro a lo largo del tiempo, disminuye el riesgo de un fracaso en la producción, debido en particular a las lluvias periódicas y a menudo escasas. Calificamos la manipulación activa de los procesos de producción y de productividad - *a través del despliegue de mayores recursos en el sistema* - mientras se restringe el riesgo de un fracaso del sistema en el tiempo mediante una intensificación sostenible.

Por supuesto en vez de referirnos a la producción y a la productividad (producción por unidad de recurso) podríamos tratar solamente con las dos variables primarias, es decir, *los recursos y la producción*. De hecho, durante gran parte de este siglo, debido a una menor presión sobre los recursos disponibles, los agrónomos, entendidos como ganaderos y agricultores, investigadores, enseñantes, consultores, etc., consideraban en primer lugar la parte del sistema de producción referida a la función de productividad. A menudo se tomaban en consideración sólo las principales producciones de cada tipo de planta o animal, por ejemplo, unidades de leche, o de carne, o de fibra, o de huevos. A pesar de que **la producción con varios propósitos** prevaleció en la mayoría de los casos, a menudo sólo la producción principal consumida venía considerada para el desarrollo. Por todo ello, las producciones tales como la tracción animal en la agricultura, el transporte etc., el estiércol para carburante y fertilizante, el empleo ajeno, y el principal valor, los animales utilizados por los ganaderos para la gestión del riesgo, a menudo también aportan importantes contribuciones para la comunidad agrícola. Por supuesto, la intensificación sostenible de un sistema biológico no puede mantenerse sólo seleccionando algunas de las producciones más importantes o dejando de lado los recursos. Más concretamente, mientras algunas variables importantes queden excluidas de la relación funcional que describe una situación de producción, incluso el énfasis relativo concedido a aquellas variables será incorrecto y en algunos casos incluso negativo.

Otro factor importante de la producción agrícola que ha contribuido al desarrollo de la diversidad social en las comunidades humanas es **la calidad del producto**. La naturaleza del ambiente ha determinado el sistema de producción y las costumbres de vida de la gente, sus casas, vestidos, y, en particular, su alimentación y hábitos. Además, y dependiendo de la calidad de los productos frescos alimentarios, han surgido distintos productos secundarios tales como los quesos, yogurt, carnes en conserva, tejidos etc., y el resultado ha sido una diferenciación en los tipos de cocina de cada comunidad. Dado que, en particular los países desarrollados, han entrado en la era de la información, se ha producido una mayor segregación del mercado, incluso dentro de las comunidades, con al mismo tiempo un incremento de la demanda tanto de mejores variedades como de productos más consistentes. Este tipo de demandas dentro y entre comunidades sugiere que, mientras la alimentación y la calidad del producto agrícola pueden muy bien ser de menor importancia para las comunidades más pobres, no puede ser dejado de lado en la planificación de una intensificación sostenible

de la producción a nivel de un país, una región o incluso mundial.

La intensificación sostenible de la producción puede, *por tanto*, ser alcanzada a todos los niveles de recursos-producción y no solamente en los casos de alta industrialización de los sistemas de producción (alta producción). El desafío consiste en asegurar que las tecnologías empleadas para alcanzar el proceso de intensificación sean apropiadas al sistema de producción.

Los Editores

The Betizu Cattle of the Basque country

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Summary

The Betizu feral cattle breed is considered as one of the most endangered and ancient in Europe. It is native to the Basque Country (Euskadi). A small number survives in Bizkaia, Gipuzkoa (Basque Autonomous Community), the Navarre and the Atlantic Pyrenees Department of France (Lapurdi). This paper describes the origin, habitat, zootechnical characteristics, aptitudes and attributes of this breed. At present, conservation projects have been initiated in order to preserve the remaining populations.

Resumen

La raza Betizu que está considerada como una de las poblaciones bovinas más antiguas de Europa, se encuentra en grave peligro de extinción. Originaria de Euskal Herria (País Vasco), quedan contados animales en Bizkaia, Gipuzkoa (Comunidad Autónoma Vasca), Navarra y Lapurdi (Departamento de Pirineos Atlánticos de Francia). En este artículo describimos el origen, hábitat, características zootécnicas, aptitudes y cualidades de esta raza. En la actualidad se han iniciado proyectos de conservación para preservar esta población.

Key words: *Betizu Cattle, Basque Country, Conservation, Utilization*

Introduction

The word Betizu, arises from the Basque language where *behi* means cattle (cow) and *izua* wild, in reference to the wild characteristics of these cattle which tend to hide in forested areas (Gómez, 1996). Etymologically, it means wild (Barandiarán, 1972) or elusive cow. Other synonyms traditionally used by farmers during past decades are "*herri ganadua*" (Echevarría, 1975), "*herri behiak*" (Staffe, 1926), "*behi auzoa*", "*etxeko behiak*" (Seiliez, 1975), "*abel gorriak*" or "*kata bizarrak*". In some publications erroneous terms such as "*betizuak*", "*betitzu*" or "*betiso*" (Darrigade, 1979) have been transcribed.

Origin, Population Numbers and Distribution

Much discussion has been held and full agreement has not been reached about the origin of this breed (García Dory, 1986). The most accepted thesis indicates that the Betizu constitutes a residual group of the ancient cattle known as Basque or Pyrenean breeds (Plazaola, 1992 and Asociación de Amigos de la Betizu, 1995). Most of them underwent an improvement process while another group became wilder. Some other theories relate it to the aurochs, from various fossil and drawing testimonies of wild cattle in different archaeological excavations. Most researchers seem to agree on the relationship between these feral cattle and the first human inhabitants of the Pyrenees. These cattle can

Figure 1. The Basque and Navarre Communities, and the Department of the Atlantic Pyrenees.

be described as a group of animals, small in size, very rustic and well adapted to wild conditions.

Nearly 160 individuals survive as pure-breds, grouped in four nuclei, one more or less wild group, based in the Bizkaia area (Figure 1) with 10 head (9 females and 1 male) in Dima and a group of around 15 individuals on the Gorbea mountain, the second, with 30 head (20 females and 10 males) in the Ibardin and Mondarrain areas (Lapurdi) in the Atlantic Pyrenees Department, the third, belonging to the Navarre Regional Government, inhabits an area in the Finca of Sastoia in Urraul Alto and includes 75 animals, descendant from a group that was taken from the Goizueta mountains in 1973 (ITGV, 1996) and the fourth is a group of 30 individuals in Gipuzkoa.

They live in totally free and wild conditions without any human intervention, feeding on the vegetation around them. They graze in herds that have rarely been domesticated or taken into a cowshed.

Characteristics of the Breed

Animals are small in size with wither height around 130 cm for males and 120 cm for females. The average weight for males is around 400 kg and 300 kg for females. The fore quarters (shoulders, withers and neck) are more developed than the hind part with smaller reduced hindquarters and buttocks (Figure 2). This difference is more notable in males. The colour at birth is dappled yellow

which develops with growth into tawny varying from blonde to red depending on sex and season. There is no pigmentation in the mucous membrane and hoofs. Animals have a big head, narrow face and muzzle and a plain forehead (figure 3). The horns are pearly white at the base and the end and the tip is coloured with crescent shapes. The small eyes, short neck and the remarkable dewlap are also characteristics of the breed. Other characteristics are notable withers, a straight dorsal line rising slightly towards the hindquarters (in many cases the dorsal-lumber line has a "saddle shape"), little body development, small udders, without any pigment, covered with long hair and a highly inserted tail

The natural reproductive cycle is associated with seasons. Cows calve approximately in March, every two years and average age at first calving is 3 years, cows giving 5 or 6 young during their life. The bullock stays with the mother for the first 15 months. The animals are suited to walking using the tips of the hoofs. Life span is 14-15 years. There are two traditional uses that humans have given to this breed;, traditional hunting that is often helped by the use of the "Encartaciones" area, hunting with dogs and bullfighting.

Research Priorities

The Betizu, together with other Basque domestic endangered breeds are in danger of extinction. However the Agricultural Department of the Bizkaia, Araba and Gipuzkoa province council and the Basque Government are supporting a research project to conserve these genetic resources. In 1996 the Department of the Bizkaia province council carried out field work to evaluate the photozoometric index of animals in this province.

I*n situ* and *ex situ* conservation plans have been initiated including the conservation of semen, ova and embryos. The first phase was started in 1989 through the collaboration

Figure 2. Betizu bull

between a farmer and an animal genetics enterprise (Rekagorri, 1991). A total of 215 doses of frozen semen were obtained by electroejaculation. In 1996, five bulls were selected from the 3 pure herds for semen collection. For 1997, ten 2-year-old heifers have been selected and are being prepared for ova collection. With this genetic material, embryos will be obtained to produce bullocks to repopulate the breed and distribute to interested farmers. These can also be introduced into some of the Basque Natural Parks areas where these breeds used to live in ancient times.

This breed has been included in a funded programme to promote methods of agricultural production compatible with the requirements of the environment and the conservation of natural areas together with the conservation of local breeds. This programme is in accordance with the EEC regulation number 2.078/92 of 30th of June of 1992 and the Bizkaia Province Council Act number 18/1996 of 27 February 1996.

Conclusions

Apart from its historical and cultural value, the Betizu breed can be used as an unbeatable "mountain gardener", making use of marginal zones and mountainsides with poor pasture which would otherwise turn into a thicket vegetation. Their distinctive rusticity adaptation to the environment, ability to use fodder with low feeding value and good maternal ability, are all fundamental requirements for extensive systems. Due to scientific, cultural, historical and possibly economic reasons the conservation of this breed is considered to be of great importance, not only to conserve the genetic biodiversity necessary for the equilibrium of the ecosystem but also to enrich the gene pool with elements that someday could be exploited.

Figure 3. Betizu cow

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The Florina (Pellagonia) sheep breed

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Summary

The Florina (or Pellagonia) sheep, which have descended from ancient indigenous Greek populations, are on the way to extinction. A small number of animals are found in the region of West Macedonia. The breed belongs to the semi fat-tailed Ruda wool type sheep, is well adapted to harsh mountain conditions and shows resistance to diseases. Recorded farms are kept at the Agricultural Research Station of Koila in Kozani, at the T.E.I. farm of Florina, at the Animal Husbandry Institute of Gianitsa and at the Agricultural Research Station of Komotini. The average commercialised milk production is 96±38.6 kg during a lactation period of 156 days and the average litter size is 1.4±0.52.

Résumé

La race ovine Florina (Pellagonia), à l'origine de races rustiques, est menacée d'extinction. Un petit nombre d'animaux se trouvent dans la région Ouest de la Macédoine. Cette race est bien adaptée aux conditions climatiques rudes et elle est résistante aux maladies. Des troupeaux contrôllés se trouvent dans la Station de Recherche d'Agronomie à Koila, Kozani, au T.E.I. à Florina, à l'Institut de l'élevage à Gianitsa et à la Station de Recherche d'Agronomie à Komotini.
La production laitière moyenne est de 96±38.6 kg et la taille de portée de 1.4±0.52.

Key words*: Characteristics, Florina, Pellargonia, Greece, Zackel*

Introduction

The majority of the sheep population in Greece belongs to the Zackel type, which is found all over the country and is characterised by the long tail and coarse wool. A second group includes breeds of the Ruda type, which have finer and more uniform wool and are found mainly in Macedonia, Thrace and on some Aegean islands. There is a third category of sheep of the so-called semi fat-tailed type, found on the East Aegean islands. Today's evolution and distribution of the different sheep types and breeds are the result of developments and changes that have taken place over the last thirty years. Uncontrolled cross-breeding and the unplanned extension of artificial insemination have played a major role in the disappearance of certain smaller breeds and the diminishing number of the pure-bred mountain populations. The Florina breed belongs to the Ruda type and is one of the native breeds, which is at the risk of extinction (Hatziminaoglu *et al*., 1985).

Location and Numbers

The sheep of Pellagonia or Florina descend from the ancient indigenous sheep and are probably the result of the crossing of lowland with mountain breeds (FAO, 1995).

This breed was raised traditionally, in the region of Monastiri of Skopia, where pure-bred animals are no longer found. From 1950, the breed has been found in West Macedonia and particularly in the county of

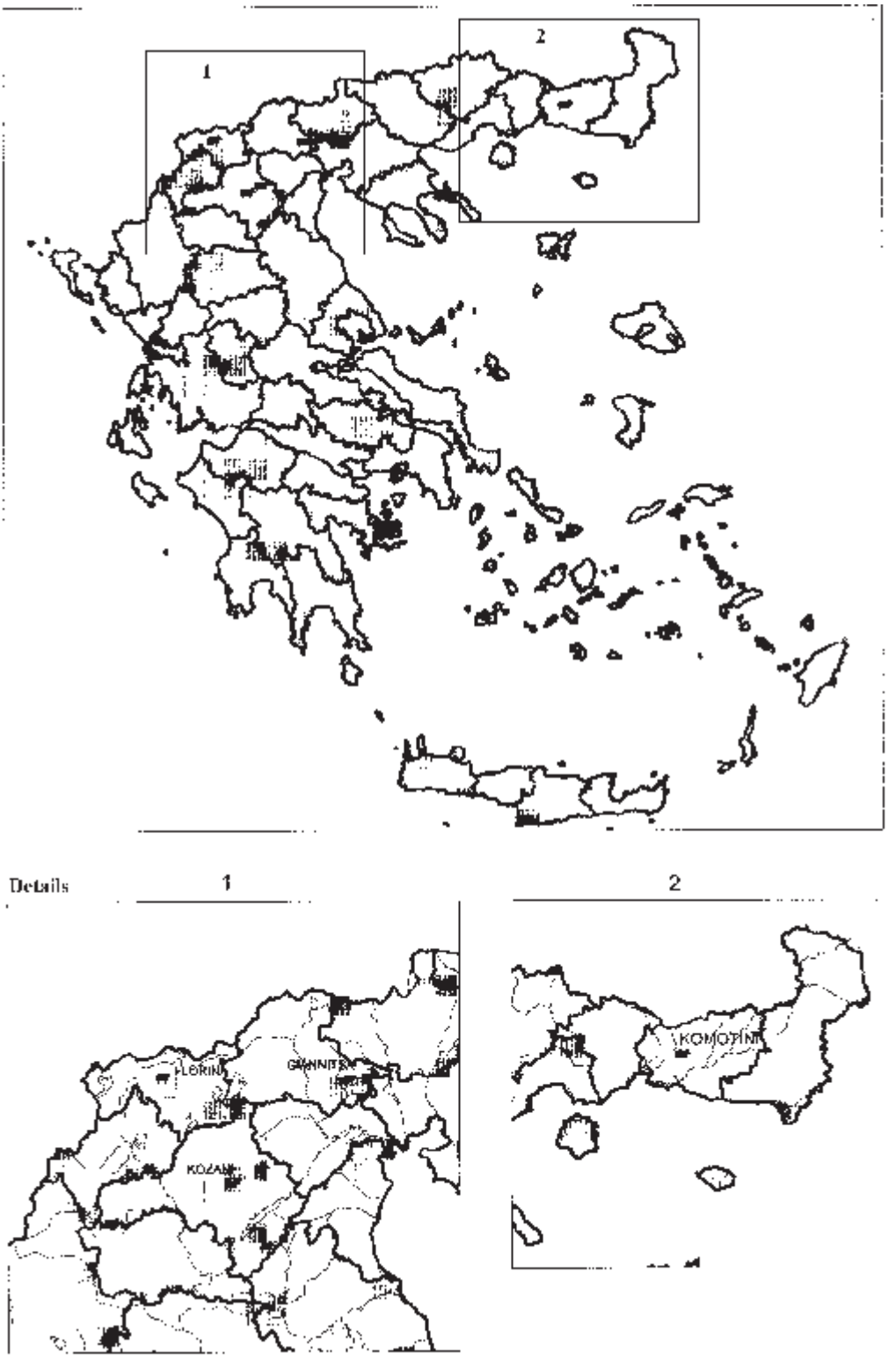

Figure 1. Distribution of Florina sheep breed in Greece.

Florina, where a small number of animals are still kept today. A small number of animals are also raised in the nearby county of Kozani. Recorded farms are found in the Agricultural Research Station of Koila at Kozani, on the T.E.I. farm of Florina, in the Animal Husbandry Institute of Gianitsa and in the Agricultural Research Station of Komotini (figure 1). In table 1 the numbers of ewes and rams recorded are given.

Breed Characteristics and Husbandry Information

The Florina sheep belong to the semi fat-tailed Ruda wool type sheep. The typical colour is white with a characteristic black ring around the eyes and black spots on the nose and legs. The body is long with a straight dorsal line, strong legs and large udder. The head is big with drooping ears. The height of the ewes is about 70 cm with a live weight of 55-60 kg and rams measure 80 cm and weigh 80-85 kg. The ewes are polled, while the rams have spiral horns (respectively figures 2 and 3).

Main characteristics of Florina sheep are reported in table 2.

The sheep are hardy and well adapted to harsh mountain conditions. The low quality pastures of autumn and early spring can be exploited, due to their low feeding requirements. Furthermore these sheep show resistance to diseases.

Table 1. Location and numbers of the Florina (Pellagonia) sheep[1]

Location	Males	Females
Agricultural Research Station of Koila	15	165
Agricultural Research Station of Komotini	16	120
T.E.I. of Florina	15	35
Animal Husbandry Institute of Gianitsa	25	100
Kozani country	5	58
Total	*76*	*478*

[1]October 1997

Table 2. Characteristics of the Florina (Pellagonia) sheep

	Males		Females	
Body weight (kg)	80		55	
Height at wither (cm)	80		70	
Birth weight (kg)	3.9	±0.04[1] (n=262)	3.7	±0.03[1] (n=288)
Weaning weight (kg)	12.9	±0.14[1] (n=262)	11.9	±0.13[1] (n=288)
Average daily gain till weaning (g)	215	±3[1] (n=262)	196	±3[1] (n=288)
Litter size			1.4	±0.32[2] (n=1741)
Milk production (kg)			96	±38.6322 (n=1741)
Lactation length (days)			159	±22.33[2] (n=1741)

Source: Agricultural Research Station of Koila, Kozani. Data collected during 1982 -1990.
[1]Standard Error; [2]Standard Deviation
Standard Error and Standard Deviation for mature body weight and height not available

Figure 2. Florina ewe at her second lambing; triplets.

Ewes are early maturing and can be bred at the age of 8 months (Triantafillidis *et al*., 1994). The breeding season begins in July and lasts until the end of October. The distribution of the parturitions peeks in January, while first lambings are more widely distributed in the months of January, February and March. Ewes with twin lambings are common, with some litters of 3 and 4 lambs. The suckling period lasts 42 days, after which weaned lambs are selected according to the dam's milk production and litter size. The birth weight of male lambs is 3.85±0.04 and of females 3.65±0.03, the weaning weights being 12.9±0.14 and 11.93±0.13 respectively. The average daily gain was 215±3 gr for the male lambs and 196±3 for the females (Alexandridis *et al*., 1989; Triantafillidis *et al*., 1992). A Florina flock is shown in figure 4.

The Florina sheep is used mainly as a dairy and secondly as a meat breed. The carcass of the lambs is of good quality and is preferred by the consumers due to its low fat content.

From the analysis of the data collected at the Agricultural Research Station of Koila, from 1982 till 1990, the average commercialised milk yield was 96±38.6 kg in 159±22.3 days (table 3). Forty percent of the ewes produce over 95 kg milk. The average litter size was 1.4±0.52 (Pappa-Michailidou *et al*., 1997; Triantafillids *et al*., 1997). Estimates of heritability for commercial milk yield and litter size was 0.21±0.11 and 0.10±0.07, respectively. Figure 5 shows the distribution of commercialised milk yield.

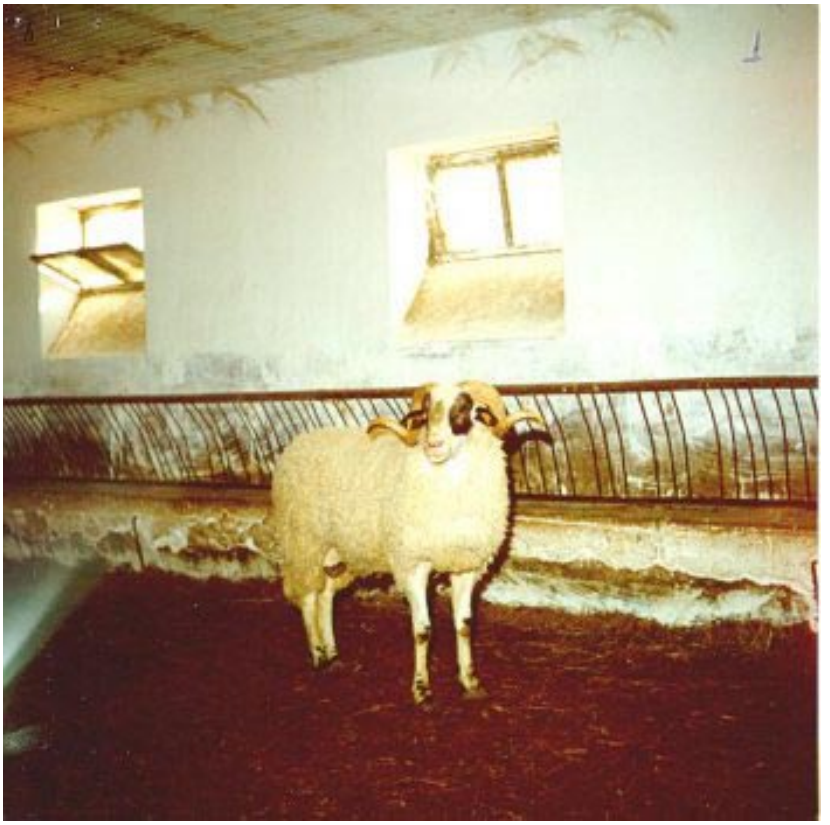

Figure 3. Two-year-old Florina ram.

Table 3. Averages of milk yield and litter size by parity.

Parity	Commercialised milk (kg±Standard Deviation)	Litter size (±Standard Deviation)
1st	81±41.4	1.2±0.39
2nd	95±35.6	1.3±0.49
3rd	103±33.1	1.5±0.53
4th	106±37.4	1.6±0.54

Source: Agricultural Research Station of Koila, Kozani.
Data collected during 1982 -1990.

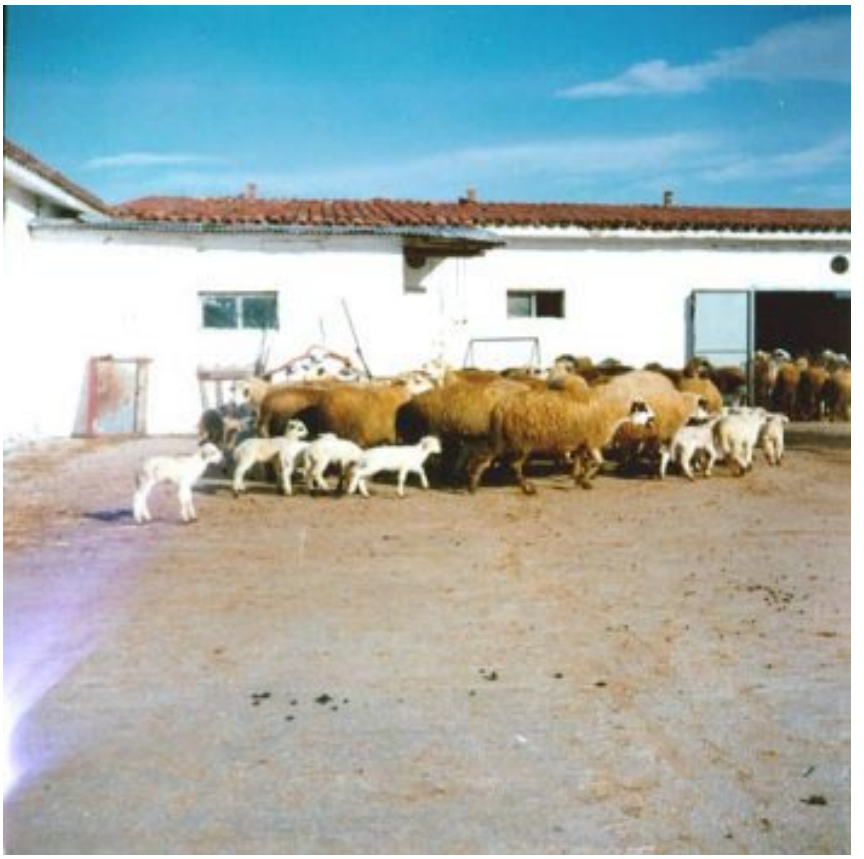

Figure 4. A Florina flock.

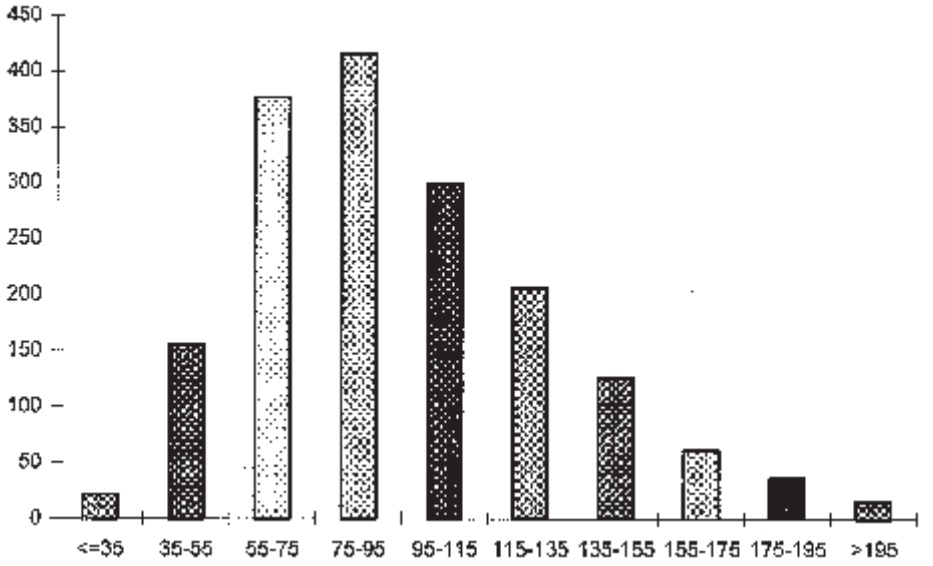

Figure 5. Distribution of commercialised milk yield.

Conclusions

The breed is competitive with other indigenous breeds for litter size. It produces a good quality carcass and taking into consideration the adaptability of the breed in the mountain conditions, selection programmes for the conservation of the breed and its genetic improvement are under consideration.

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Characteristics of Bonpala sheep

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Summary

Bonpala is a dual purpose sheep breed found in Sikkim, Western Bhutan and Eastern Nepal. A sample survey was conducted in east Sikkim to record characteristics of Bonpala sheep. Information was recorded on morphological characteristics, management practices and body measurements. Bonpala sheep have mixed colours ranging from all white, white and black or all black. Measurements were recorded of body length, height, heart girth, paunch girth, rump width, pin width, face length, face width, ear length, tail length, horn length and horn circumference.

Resumen

La raza ovina Bonpala es una raza a doble propósito que se encuentra en la zona de Sikkim, al oeste de Bhutan y al este del Nepal. Se llevó a cabo una encuesta en el este de Sikkim para registrar las características de la oveja Bonpala. Los datos tomados se referían a las características morfológicas, las prácticas de manejo y las medidas corporales. La oveja Bonpala presenta un manto de colores mixtos que van del blanco al blanco y negro o al negro. Se tomaron medidas sobre la longitud corporal, altura y circunferencia de diversas partes del cuerpo, así como la longitud y circunferencia de los cuernos.

Key words: *Bhutan, Nepal, Sikkim, Bonpala, Gharpala*

Introduction

Bonpala is a typical migratory dual purpose sheep breed found in Sikkim and its neighbouring western part of Bhutan and eastern region of Nepal (figure 1) (Acharya, 1982). Another strain of sheep i.e. Gharpala is found in this region. These sheep are small in size and are home reared. Bonpala is large in size, migratory and grazes at different altitudes. Local people call it Banpala. In fact, these strains derive their names from the mode of rearing i.e. Ban: forest; Ghar: home and Pala: rearing. Bonpala sheep produce hairy wool while Gharpala provide fairly good meat. These sheep are reared mostly by the traditional shepherd tribe called *Gurung*. Sheep are reared mainly on grazing. Even the home reared are also grazed on nearby areas. Hardly any concentrate is fed to them. Southern Sikkim has lot of pastures for grazing and the climate is conducive to sheep rearing.

Sikkim is a small state situated in the eastern Himalayas between 27.5° and 28° north latitude and between 88.4° and 88.58° east longitude. It comprises an area of 7 300 km^2. It is entirely hilly with altitudes ranging from 300 m to 8 500 m above sea level. Precipitation is above 160 cm in summer and 10-20 cm in winter.

Materials and Methods

Sikkim had about 16 268 sheep in 1992 (Census Report, 1992) registering an increase of about 49% over the population in 1987. This population included mainly the Tibetan, Bonpala and Gharpala breeds. The population

Figure 1. Distribution of Bonpala sheep.

of different breeds is not known but Acharya and Arora (1978) reported that about 60% of total sheep population are of Bonpala type. Though indigenous sheep breeds have been defined by quite a few workers, literature on Bonpala sheep is very limited (Katiyar *et al.*, 1981; Acharya, 1982). Information was collected on morphological characteristics, body measurements, management practices and performance under field conditions for describing this breed. A sample survey was conducted in the Padamchen and Lingtam blocks of East Sikkim bordering Bhutan to record information on characteristics of the same breed.

Results and Discussion

Morphological characteristics

These sheep have generally mixed colours of white and black. Complete white or black animals are also found. Face, neck, knees, legs and hooves are generally black in colour. Muzzle is white or pink in colour. Areas behind neck and lower side of the body are white in colour. Nose is typically Roman type. Katiyar *et al.* (1981) also reported Roman nose in Bonpala which was more prominent in males. Both sexes are horned. Horns are directed slightly upward before running backward, downward, and then twist forward and outward. Horns are thick and long in rams and thin and small in ewes. Ears are short and tubular. Tail is short. Belly and legs are generally devoid of wool (figure 2 and 3).

Body measurements

Length, height, heart girth and paunch girth averaged 63.33±1.08, 69.67±2.23, 82.44±1.87 and 90.33±1.45 cm, respectively in ewes and 72.5±0.50, 74.0±2.0, 85.0 and 96.0±2.0 cm respectively in rams. Males had a longer (30.0±4.0 cm) and wider (31.0 cm) face compared to that of females (23.66±0.65 and 23.44±0.71 cm). Horn dimensions differed markedly between both sexes. Horn length and circumference averaged 11.40±1.12 and 9.0±1.38 cm in ewes and 37.0 and 25.0±1.9 cm in rams (table 1). Similar measurements for length, height, girth, head length, ears, horns and tail length were also reported by Katiyar *et al*. (1981) and Acharya (1982) in Bonpala sheep.

Performance

Flock owners were interviewed to collect information on the performance of Bonpala sheep. Wool is coarse and hairy and is around 1/2 kg per shearing with two shearings in a year in March/April before migration and in

Figure 2. Adult ram

Figure 3. Adult ewe

October/November after returning from the high ranges. Acharya (1982) reported average fibre diameter, fibre length and modulation percentage as 66±25, 9.63±0.47 cm and 95±1.4% respectively. Age at puberty is around 6 months and first lambing around 10-11 months. Lambing interval is around 1 year.

Acknowledgements

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The Chokla Sheep in India

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Summary

There are approximately 41 million sheep in India, 0.51 million of which are made up by the Chokla population. This breed is generally found around Churu, Jhunjhunu, Sikar and bordering areas of the Bikaner, Jaipur and Nagaur districts of Rajasthan. The animals have a light to medium-sized body, a small head and are reddish brown or dark tan in colour as far as the middle of the neck, with a white body. The skin is pink. The ears are small to medium in length and tubular in shape. The Chokla sheep are hardy and well adapted to arid and semi-arid tropical environments and are suited for the region where migration is a common practice. The Chokla is a comparatively fine-wool producing type among the Indian sheep. The wool produced by Chokla animals is heterogeneous in quality and generally mixed with coarser fleece of other sheep for their utilisation as carpet wool.

Resumen

Existen aproximadamente 41 millones de ovinos en India, 0,51 millones de los cuales pertenecen a la raza Chokla. Esta raza se encuentra generalmente alrededor de Churu, Jhunjhunu, Sikar y en la zonas fronterizas de los distritos del Rajasthan de Bikaner, Jaipur y Nagaur. Los animales poseen un tamaño corporal bajo-medio, una cabeza pequeña y son de color marrón-rojizo o oscuro hasta mitad del cuello y con el cuerpo blanco. La piel es rosa. Las orejas son de longitud pequeña o media y en forma de tubo. La raza Chokla es robusta, está bien adaptada a los medios áridos y semiáridos tropicales y resulta adecuada para las regiones donde se practica normalmente la migración. La raza Chokla se halla entre las razas indias ovinas buenas productoras de lana fina. La lana producida por los animales Chokla es heterogénea en cuanto a calidad y viene normalmente mezclada con lana gruesa de otras ovejas para la confección de alfombras de lana.

***Key Words:** Chokla, Sheep, Carpet wool, Production performance*

Introduction

Chokla sheep are comparatively a finer carpet-wool producing type among the Indian sheep. Wool produced by Chokla sheep is heterogeneous in quality, and is generally mixed with coarser fleece of other sheep for carpet wool. The bulk of the wool produced by Chokla sheep is, therefore, used for manufacturing carpets, blankets and suchlike. This breed is generally found around Churu, Jhunjunu, Sikar and bordering areas of the Bikaner, Jaipur and Nagaur districts of Rajasthan. Animals true to the breed type are found in the Sikar and Churu districts. Sheep farmers in the region generally name this breed “Rato munda”, meaning the sheep with dark brown or tan face. Chokla is also known as Shekhawati\Chapper in the main breeding tract. These sheep are reared by the Khatika, Jat and Meena people. Each farmer rears about 100 sheep on average, kept in roofless pens fenced with thorny hedges. They graze in the outskirts of the villages, sometimes on stubble in the fields of harvested autumn\spring crops.

Population and Distribution

Of the approximately 41 million sheep in India, 33 % are found in Rajasthan (Anonymous, 1993), the major sheep rearing state in India. Chokla sheep are found around Churu, Jhunjhunu, Sikar and bordering areas of the Bikaner, Jaipur and Nagaur districts of Rajasthan which have an annual rainfall of 20 to 40 cm. Animals true to the breed type are found in the Sikar and Churu districts of Rajasthan. According to the 1972 and 1977 censuses, the Chokla population was 0.53 and 0.51 million, respectively. The latest sheep population figures of this breed are not available, but it is apparent that numbers are declining due to natural reasons to large scale crossbreeding programmes for converting Chokla to apparel-wool production. Nor are farmers obtaining better prices for the quality wool produced by the Chokla sheep in comparison to coarser wool, hence they are opting to keep the heavy breeds so that their lambs can be sold to the butcher at an early age for a better price.

The average flock size is 115 head, including 13 adult males, 73 adult females and 29 lambs (Acharya, 1982).

Appearance and Size

Arora *et al* (1975), Acharya (1982) and Mason (1988) gave good descriptions of Chokla sheep. The animals are light to medium size, with a square and compact body, and a small head, reddish brown or dark tan in colour extending up to the middle of the neck with a white body (figure 1 and 2) and pink skin. Both sexes are polled. The tail is thin and the coat is dense and relatively fine, covering the entire body including the belly and the greater part of the legs. The animals have fairly developed quarters, with small udders and teats in ewes. The body measurements viz. length, height, distance between eyes, length of the ear and tail of different age groups as reported by Arora *et al* (1975) are given in table 1.

Adaptability, Behaviour and Temperament

Chokla animals are hardy and well adapted to the arid and semi-arid environments where they have been reared for centuries. The studies on adaptation of this breed to heat stress (Singh and Acharya, 1977; Singh *et al*,

Table 1. Body measurements in Chokla ewes at different ages (Arora et al*. 1975).*

Parameter (cm)	milk teeth (n=46)	2 teeth (n=133)	4 teeth (n=93)	6 teeth (n=16)
Length	60.3±0.39	61.1±0.22	61.5±0.40	72.0±0.84
Height	62.4±0.36	61.8±0.24	61.8±0.27	62.5±0.46
Heart girth	66.8±0.43	67.9±0.26	68.0±0.43	68.3±0.62
Paunch girth	68.3±0.60	69.8±0.37	69.7±0.36	69.5±0.95
Head	23.8±0.12	24.1±0.09	24.1±0.08	24.3±0.23
Eye	15.6±0.12	15.6±0.14	15.5±0.08	15.7±0.23
Ear	8.1±0.05	8.0±0.14	7.3±0.13	7.5±0.33
Tail	24.2±0.34	24.6±0.19	24.6±0.22	24.6±0.05

Figure 1. Chokla ram

1980; Gupta and Acharya, 1987) revealed that the feed and water intake was maximum in Chokla animals as compared to the Merino and crossbred when the animals were exposed to the sun for 8 to 15 hours, with temperatures ranging from 13°C to 42°C. Higher feed intake by Chokla during the heat stress period indicated its ability to eat under high ambient temperatures. More and Sahni (1973) reported that watering of Chokla sheep at intervals of 72 hours did not pose any physical or managemental difficulty. Maximum water economy was ensured through provision of water at intervals of 96 h. However it is not safe to deprive the pregnant sheep from water beyond 72 h. During the rainy season there was no need to water the sheep.

The Chokla animals are the best suited for the region where migration is a common practice. These sheep, having traditionally been reared in small flocks in close association with man, are gentle and docile but do not react well to strange animals i.e., dogs and cats, and are thus susceptible to predation. The ewes generally show poor maternal behaviour. Their milk production is comparatively low (above 0.5 kg per day) but enough to feed a single lamb adequately.

Epidemiological studies (Sharma *et al.*, 1986) showed that Chokla animals are more resistant to sheep pox than the Nali.

Production Characteristics

There is not much variation in performance of production characters among Chokla sheep in their native tract. This may be because the climatic conditions in their native tract is similar and that the husbandry practices adopted thereon have been similar. A flock of Chokla sheep was maintained as a contemporary for comparison with its crossbreds at the Central Sheep and Wool Research Institute (CSWRI), Avikanagar, under the All India Co-ordinated Research Project (AICRP) on Sheep Breeding. Data spread from 1977 to 1994 were subjected to least squares analysis for body weight at different ages taking sex, season and year as

factors. A summary of the results obtained is reported in table 2. The effect of sex, season, and year were all significant for the whole body weight except 12 month-weight where season had a non significant effect. The average birth, weaning, six and twelve-month body weights were 2.79, 12.9, 17.4 and 22.0 kg, respectively. Birth weight ranged between 2.26 kg (Arora *et al*. 1975) to 2.87 kg (Anonymous, 1994), weaning weight between 10.3 (Arora *et al*. 1975) to 13.4 kg (Anonymous, 1994) while adult body weight ranged from 20.6 (Malik *et al*. 1971) to 21.5 kg (Anonymous, 1994).

Least squares means of male and female body weights at different ages, as reported by Singh *et al*., 1996, are presented in table 3. Body weights increased with age up to 4-5 years. Following this age body weights were maintained or fluctuated. Adult body weights in females were lower than the males ($P<0.01$).

Average pre-weaning (0-3 months) daily weight gain was 112 g, while post weaning (3-6 months) gain was 53 g (table 4).

Animals were sheared twice a year i.e. spring and autumn. Average greasy fleece weight for the first six months of age and the second six months of age was 0.978 kg and 0.820 kg, respectively (table 5). Average adult six monthly and adult annual greasy fleece weights were 1.041 kg and 2.130 kg, respectively. In the field, it is a common practice to shear the animals three times a

Table 2. Least squares means of body weight in kg.

Parameter	No.	Male	No.	Female	No	Pooled
Birth wt.	568	2.9±0.02	587	2.7±0.02	1155	2.8±0.02
Weaning wt.	478	13.3±0.14	502	12.6±0.14	980	12.9±0.12
6 month wt.	381	18.5±0.20	426	16.3±0.20	807	17.4±0.17
12 month wt.	240	24.2±0.30	337	19.8±0.29	557	22.0±0.26

Table 3. Least squares means of body weight at different ages in kg.

Age (year)	No.	Male	No.	Female
1-2	567	27.5±0.24	986	24.4±0.12
2-3	211	34.2±0.42	668	25.1±0.15
3-4	152	37.1±0.50	540	27.4±0.16
4-5	126	38.7±0.35	1246	29.1±0.13
5-6	347	36.4±0.38	1128	28.0±0.13
6-7	95	39.9±0.65	770	28.3±0.16

Source: Singh et.al., 1996.

Table 4. Least squares means of average daily body weight gain.

Parameter	No.	Male	No.	Female	No.	Pooled
Pre-weaning (0-3 month)	478	115±1.00	502	108±1.00	980	112±1.00
Post-weaning (3-6 month)	373	60±2.00	414	46±2.00	787	53±2.00

Table 5. Least squares means of greasy fleece weight in kg.

Age	No.	Male	No.	Female	No.	Pooled
1st 6 month	351	0.930±0.014	397	1.027±0.014	748	0.978±0.010
2nd 6 month	206	0.892±0.024	321	0.748±0.020	527	0.820±0.018
Adult 6 month	--	--	--	--	--	1.041

year hence the wool yield is slightly higher but with shorter staples.

The average fibre diameter, medullation and staple length of six monthly growth were 28.2 μ, 24.00 % and 4.7 cm, respectively.

Chokla ewes are very poor milkers and generally not milked (Acharya, 1982). The average milk yield recorded indirectly by the lamb suckling technique (3 to 4 times a day and twice weekly) ranged from 0.546 to 0.552 kg per day in the autumn season (Uppal *et al.*, 1971). The Chokla also has a poor mothering ability particularly in the first lambing. This usually results in higher lamb mortality (Singh *et al.*, 1973). Maximum milk yield was found in the fourth lactation.

Figure 2. Chokla ewe

Reproduction and Breeding

It is customary among the farmers to keep breeding rams in the flock at all times, and exert no control over mating. This system requires at least 3-4 rams for every 100 ewes. In Government/commercial farms controlled mating is practised.

In the farmer's flock, age at first mating was estimated at 15 and 18 months in males and females, respectively (Acharya, 1982). Studies under AICRP on Sheep Breeding reported 742±17 days as age at first breeding in ewes and 970±18 days as age at first lambing under restricted breeding. Higher age at first service and age at first lambing reported in AICRP results were high because of the restricted breeding practices. In the farmer's field, age at first service, as reported by the farmers during the visit of the first author, varied between 365 to 450 days.

In figure 3 a Chokla ewe with her lamb are shown.

The Chokla sheep are known to breed throughout the year although the majority of them breed during July-August, immediately after the onset of the monsoon season when plenty of natural grazing is available (Acharya and Patnayak, 1974). Litter size is single (Acharya, 1982).

Honmode (1970) and Sahni & Pant (1978) reported 152 days average gestation length in Chokla animals. Involution of the uterus in Chokla ewes was estimated at 26 days and ranged from 16-30 days post partum (Bhaik & Kohli, 1980).

Figure 4 shows a Chokla flock.

Breeding Structure

This breed is found in a very limited area and the population is also small. There is no breeders association for this breed in the country. In the native tract of Chokla, farmers used to exchange breeding rams from one flock to another at their level. The State

Figure 3. Chokla ewe with lamb

Government of Rajasthan was also distributing rams to the farmers under a ram rearing scheme. In this scheme male lambs at the age of three months were purchased and reared in the Government farm up to breeding age and then distributed in the field.

Attempts for Improvement

From 1990-91, A network project on sheep improvement was started with the objective of undertaking the survey, evaluation and improvement of indigenous sheep breeds. Under this scheme, a project on Chokla sheep entitled "Evaluation and improvement of Chokla sheep for carpet wool" was initiated in CSWRI from 1992. The objective of the project was to increase the wool production through selective breeding. Breeding rams are selected using selection indices based on greasy fleece weight and body weight at six months of age. The project is in progress. Surplus breeding rams are being distributed to the farmers through the State Government of Rajasthan. Average adult six monthly greasy fleece yield (GFY) in ewes is 1.09 kg and in rams 1.46 kg. Average annual GFY (pooled GFY of both the seasons) in adult ewes is around 2.0 kg. In rams/males, which are less in number, GFY is around 3.0 kg. in a year.

Earlier, this breed was used for crossbreeding with exotic sheep (Rambouillet and Russian Merino) to develop apparel type sheep. The new breed Avivastra with 50 % exotic inheritance and Bharat Merino with 75 % exotic inheritance had been developed at CSWRI.

Figure 4. Chokla flock

Acknowledgements

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Conservation of an equine feral breed: the Asturcón Pony

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Summary

The Asturcón Pony was on the verge of disappearing during the decade of the 1970. The creation of A.C.P.R.A (Breeders Association of Asturcón Ponies) and the measures undertaken by this association have made possible the present population of 400 of these animals and future perspectives for them to be bred at large for agrotourism and children's training in horseback riding and other equestrian sports. In spite of the fact that the recovery of the breed is being carried out with few individuals, our results show a high genetic variability. Analysing the allelic frequencies of blood polymorphism, we have obtained an average heterozygosity of 0.3649±0.1070 akin to that of other ponies such as the Dartmoor (0.3396±0.1060), Shetland (0.3158±0.1246 or the Connemara (0.3797±0.1000) and even superior to breeds such as the P.S.I. (0.2857±0.1194) and the Arabian (0.2299±0.0969).

Resumen

El poney Asturcón es una raza que estuvo a punto de desaparecer en la década de los 70. La creación de A.C.P.R.A. (Asociación de criadores de Poneys de Raza Asturcón) y las medidas acometidas por esta asociación, han hecho que en la actualidad se cuente con unos 400 ejemplares y unas buenas perspectivas de futuro como animal criado en libertad y dedicado al agroturismo y la iniciación de los niños en los deportes ecuestres. A pesar de que la recuperación de la raza se está llevando a cabo a partir de muy pocos ejemplares, nuestros resultados muestran una elevada variabilidad genética ya que analizando las frecuencias alélicas del polimorfismo sanguineo, hemos obtenido una heterocigosidad media de 0,3649±0,1070 semejante a la de otros ponies como el Dartmoor (0,3396±0,1060), Shetland (0,3158±0,1246) o el Connemara (0,3797±0,1000) e incluso superior a razas como el P.S.I. (0,2857±0,1194) y el Árabe (0,2299±0,0969).

Keywords: *Genetic profile, Genetic variability conservation, Autochthonous breeds, Handling, Behaviour and environment.*

Introduction

In the last 100 years a great number of horse breeders associations have been created dedicated to their protection and improvement through the characterisation of their peculiarities and the opening of their corresponding studbooks that endorse genealogy and ownership for a given breed group. This is the case of the creation of the Regional Breeders Association of the Asturcón breed in 1981, later substituted by the Breeders Association of the Asturcón Pony (ACPRA) in 1986, which looks to the recovery, safeguard and expansion of this old horse breed that was on the point of disappearing during the 70s[1].

To guarantee conservation plans and modern breed improvement, some identification mechanisms and control of efficient filiation are indispensable. The study

of genetic markers of an individual allows us to know a part of their paternity and to assure their filiation. The statistical analysis of the data at breed level may be used to define the designated genetic profile.

The objective of this work is to carry out an initial prospecting on the different alleles of blood groups and biochemical polymorphisms of the blood present in this breed, as well as to undertake a comparative study, starting with data obtained from international bibliography of their genetic profile with that corresponding to other populations.

Origin and Historical Evolution of the Asturcón Pony

The Asturcón belongs to the Celtic ponies group, which includes the Icelandic pony, the Shetland and Highland Scots, the Irish Connemara, Fell, New Forest, Exmoor and Dartmoor from Great Britain, the Pottoka and Spanish Faco, and the Garrano from Portugal (Alvarez and Alvarez, 1987).

In the Cantabrian area, before the arrival of the Celts, a people with agricultural and ranching knowledge, called the Túmulos, existed although it is unknown whether they had really tamed the horse. The oldest discovered equine fossil in Asturias was located at Mestas de Con (Cangas Onis) and it belongs to the geological era of the Superior Villafranquiense (Cromeniense) and to the cultural period of the Acheliense (García Dory, 1980). During the time of Celtic dominance there was in the North and in the West of the peninsula a short, stocky horse, good for hauling, but not very good for war. Its head was small, and orthoidal, with short ears, strong croup, abundant hair and dark coat. It was frequently shod and clearly originated from the Tarpán horse, but had already been denominated Asturcón by Itálico in the III century (Valderrábano, 1970).

The first archaeological remains found that make reference to the taming of the Asturcón horse, are posterior to the Celtic invasion, during the IX to the V centuries (B.C.). The

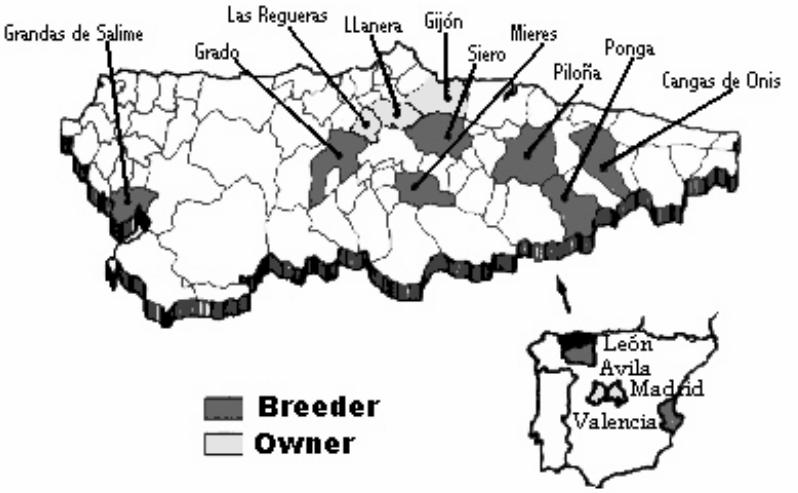


Figure 1. Main geographical areas where the Asturcón pony is currently used.

Figure 2. The Asturcón herds consist of 15 to 30 mares that remain together under the control of one stallion.

Celts were warriors that brought with them tame horses habituated to war. The taming and selection of these autochthonous horses, as well as the cross-breeding with imported breeds and the natural isolation of Asturias, gave rise to the formation of this breed.

These horses may have come from the *Equus gracilis* of *Ewart* from Central Europe, that gave rise to the Celtic pony, which in the Cantabrian peaks evolved into the present-day Galician, Asturcón, and Vasco-navarro ponies employed in transport, in war and in religious sacrifices (Anonymous, 1991).

Several thousand horses were used for auxiliary troops throughout the Roman empire, mainly destined to Germania, Britannia, Africa and to the East.

In the book "The History of British Native Pony" by Anthony Dent and Daphne Godall (1962), the Asturcones are extensively referred to and described minutely, affirming that they contributed to the creation of the Irish horse during the middle Ages.

Starting in the XVI century a stage of decadence for the autochthonous equine Spanish breeds begins. In the Corregidors of Oviedo´s Royal Order, dated in Valladolid June 9 of 1562, the importation of large Central European horses was promoted and the castration of one year old autochthonous ponies is promulgated to stop their reproduction.

In the wars from the XVII to the XIX centuries (Succession, Demanda, Independence, Carlist) a great number of horses with defined qualities was required. However, the Asturcón pony was not considered as the most valuable in military confrontations, and therefore, new massive imports were carried out.

Nevertheless, up to 1940, in Asturias the herds or "corros" of Asturcones which presented little influence from other breeds was still very abundant, particularly in the Western area. It is calculated that there were

about 3 300 individuals roaming, to which we should add those used for agricultural labour (due to their strength and short stature they were very often used in the farming of fruit trees).

Due to the later new forests in traditional grass zones, the mechanisation of the field labour and the abandonment by the youth, this breed nearly became extinct, with only about 30 or 40 pure animals remaining at the end of the 70s'.

In the 80s' strong concern for their recuperation arose and the Regional Breeders Association of the Asturcón Pony was created in 1981 and later substituted in 1986 for the Association for the Asturcón Breed (ACPRA). Its mission is to control the Studbook in order to recuperate, and preserve the breed using the few specimens still conserving the typical attributes.

Present distribution of Asturcón pony is shown in figure 1

Among the measures undertaken by the Association we should mention:

- Opening of the Studbook.
- Elimination of animals not adjusting to breed standard.
- Valuation and selection of stallions.
- Study of the inbreeding.
- Sanitary control of all herds.
- Prohibition of the sale of reproductive animals to non associated breeders.
- Since 1994 the formation of a DNA bank has begun.

Figure 3. In the face of danger, the group adopts a circular formation in which the young are placed on the inside.

Behaviour of the Asturcón, its Environment and Conditions of Development

The Asturcón herds live in groups of 15 to 30 mares that remain together under the control of one stallion, in charge of the guidance and protection of the group (Figure 2). In the face of danger, such as the proximity of wolf packs, the group adopts the formation of the typical "corro", a circle in which the young are placed on the inside and the mares on the outside with heads and forequarters outward, while the sire tries to repel the possible attack (Figure 3). The male defender of the herd against other horses is however also in charge of permitting the entrance of other animals such as cows or sheep.

Traditionally it has been the western area of Asturias that presented more suitable conditions for the maintenance of the roving Asturcón (Fig. 1). This area, which hosts the mountains of Bovia, San Isidro, Illano, San Marín de Oscos, Vegadeo, Gargalois, Franfaraón, the Puerto del Palo, the Panchón and the Tineo, is characterised by soft mountainsides and abundant pasture practically all year round. Numerous mares existed in these zones up to 1940.

Another less important nucleus was the central east area by the coast, in the Mountain ranges of the Winds, the Pumar, and the Sueve. In these the Asturcón was raised in altitudes of between 1250 and 1400 metres. The frequent snowfalls made the Asturcones descend in search of food to inhabited areas, competing with cows, sheep and goats.

At the moment two types of management are known:

- One traditional, in which the Asturcón herd stays all year round in the mountains, coming down to the grasslands only in times of extreme climatic conditions (Figure 8). This breed lives in the mountains of Pedroriu and the Sueve.
- The second form of management began to develop when the association of ACPRA breeders was founded. It consists of breeders, with a small number of animals without rights to the communal grasses, who maintain the Asturcón ponies all year on their own grasslands (Figure 9).

Breed Standard and Genetic Profile of the Asturcón Pony

Breed standard

The Asturcón Pony presents some unique anatomical features, such as the short prominence of the occipital bone with regard to other non Celtic breeds, or the existence of canines in the inferior mandible in 90% of females, which gives us an idea of the breed´s archaism (Alvarez and Alvarez, 1987).

It is considered a ellipometric, subconcave horse, varying from longitudinal to sublongitudinal (Figure 6).

General aspect: strong, with admissible general conformation, and in pony-type proportions.

Coat: black, in different shades or dark bay or brown, with only the presence of a small star (Figure 7).

Wither height: in free breeding conditions it hardly surpasses 1.30 m. ranging between 1.20 and 1.35 m. according to the system of breeding. Animals over 1.48 m high are not inscribed in the Genealogical Animal Book (A.C.P.R.A., Record Regulation in the studbook).

Head: middle or small size, very defined and with straight to subconcave profile. The forelock is very thick, falling over the eyes mainly in males . Small ears, high set. Big eyes, black and expressive. Wide and extensive nostrils.

Neck: average length, strong, moderately fine in the females. Abundant and long manes.

Trunk: well arched ribs.

Chest: wide and moderate musculature, with a notable depth.

Back and loin: muscular and very tight. Slightly saddled back. Short flanks and kidneys.

Shoulder and withers: long shoulders, not very inclined. Noticeable withers and moderately light.
Forelegs: thin but strong, without large muscular masses, tendons are the same as the forelegs and ergots are short. Small black hoofs.
Croup: inclined, sometimes sunken. Of proportionate length and double width. Very thick tail that reaches the floor and sprouting at the height of the sacrum.
Hindlegs: short and very stocky. Marked clean hocks. Chestnut very small or null.

Genetic profile of the breed

In order to determine the genetic profile of the Asturcón horse, we have analysed an aleatory sample taken from 34 ponies inscribed in the Genealogical Book. The small number of horses studied allows little more than preliminary considerations.

The allele frequencies of the antigen factors of the erythrocyte membrane and of the biochemical polymorphism systems are shown in table 1. The existence of the allele *Dcfgkm*, is indicated, considered so far as a marker of PRE breed. No antigen factor of the *Q system* of blood groups is detected.

The comparison of the results obtained in this breed has been carried out with allele frequencies from another 6 equine breeds from international bibliography: three breeds of European ponies such as the Dartmoor, Shetland and Connemara (Kaminski 1979), the Pure Spanish Breed Horse (Rodríguez-Gallardo *et al*, 1992), Arabian (Ouragh *et al*, 1994) and English Thoroughbred (Bowling *et al*., 1975). The great coincidence in the drawing of the profiles can be appreciated, with the exception of punctual differences such as the case of the *Transferrin TF-F1* and the *Glucose phosphate isomerase GPI-F* and *GPI-S* (Figure 4).

In figure 5, the gene frequencies for these same systems are represented in comparison to the Asturcón pony, the Pure Spanish Breed (P.R.E.), the Arabian and Thoroughbred English (P.S.I.) horses, appreciating the breed individuality of the Asturian horse. Likewise the characteristic profile of the *GPI system* is also highlighted.

In table 2 the Nei genetic distance (Nei, 1972, 1976) and the average heterozygosity (Lacadena, 1981) is shown among the seven breeds using five systems of biochemical polymorphisms, while table 3 shows the Nei genetic distance and the average heterozygosity to seventeen loci in four breeds; the Asturcón, Pure Spanish Breed, Arabian and P.S.I., being a reference of those obtained with only five loci, and confirming that the distances and heterozygosities are proportional.

In spite of the fact that the Asturcón population is very small and recuperated from very few specimens, it presents a high variability, since, using 17 loci, the median of the heterozygosities (*Jx*) possesses a value superior to that corresponding to the P.S.I. and Arabian horses and practically equal to that of the PRE horse (Table 3).

As for the values obtained of Nei genetic distance (Table 2 and 3), we observed that the Asturcón Pony has a high genetic similarity firstly, with the P.R.E. and immediately after with the Shetland and Dartmoor Ponies. This could corroborate the hypothesis that this breed had its origin in the trunk of the Celtic Central European pony and that later on there was a great isolation and breed differentiation where there were less and less frequent cross-breedings. This is not the case with the P.R.E. breed, which, because of its geographical proximity, could easily have been used several times to enhance this pony's breed.

Current Situation and Future Perspectives

A utilisation of the pony as a recreational animal has not existed traditionally in Spain and this has also contributed decisively to the precarious situation in which the Asturcón is found along with the rest of the

Table 1. Allele frequencies obtained in the analysed sample.

Systems of Blood Groups			Electrophoretics Systems	
System A			*System A1B*	
	A^{adf}	0.4074	K	0.7500
	A^{adg}	0.0253	S	0.2500
	A^{b}	0.0789		
	$A^{(-)}$	0.4883	*System ALB*	
			A	0.5875
System C			B	0.4125
	C^{a}	0.3675		
	$C^{(-)}$	0.6325	*System ES*	
			G	0.2125
System D			I	0.7875
	D^{bcmq}	0.0500		
	$D^{cegimnq}$	0.0375	*System GC*	
	D^{cfgkm}	0.0375	F	0.9750
	D^{cgmp}	0.0625	S	0.0250
	D^{cgmq}	0.0875		
	D^{deloq}	0.4625	*System GPI*	
	D^{dfkl}	0.1750	F	0.2875
	D^{dghmq}	0.0500	I	0.7125
	D^{dkl}	0.0375		
			System HBA	
System K			BI	0.8250
	K^{a}	0.0382	BII	0.1750
	$K^{(-)}$	0.9618		
			System PGD	
System P			F	1.0000
	P^{a}	0.4137		
	P^{b}	0.0250	*System PGM*	
	$P^{(-)}$	0.5612	F	0.1000
			S	0.9000
System Q				
	$Q^{(-)}$	1.0000	*System PI*	
			G	0.0375
System U			I	0.0125
	U^{a}	0.4299	L	0.2625
	$U^{(-)}$	0.5701	N	0.2500
			S	0.2875
			T	0.1375
			U	0.0125
			System TF	
			D	0.3250
			F_2	0.2000
			H	0.1125
			O	0.0750
			R	0.2875

Figure 4. Comparative graphic of frequencies of five systems of biochemical polymorphisms of four breeds of European ponies.

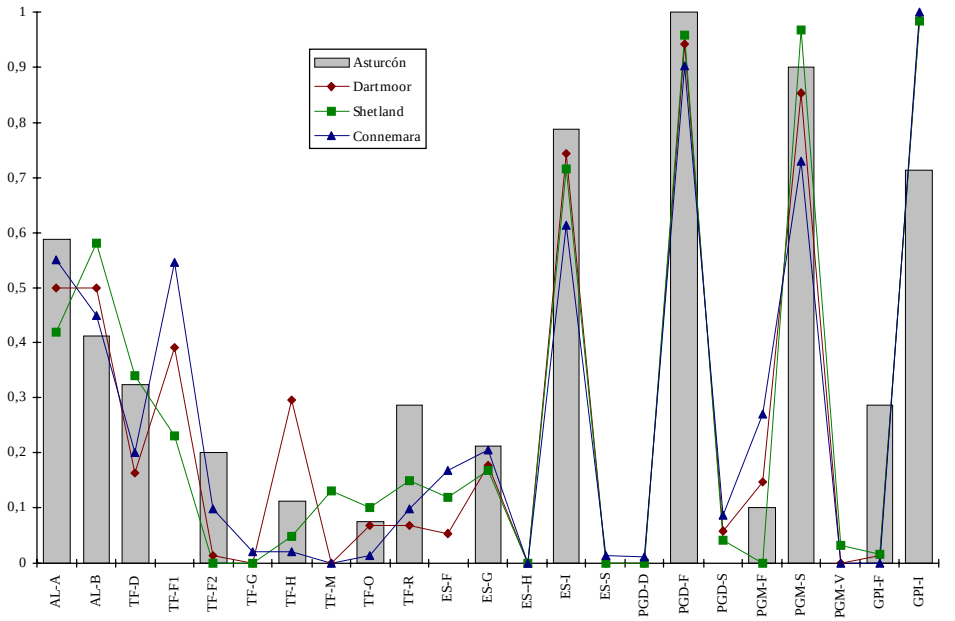
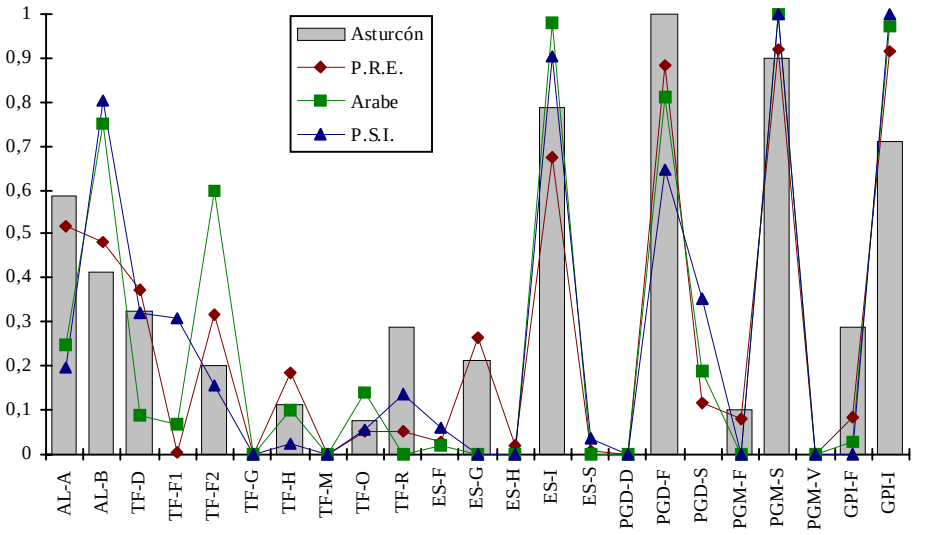


Figure 5. Comparative graphic of frequencies of five systems of biochemical polymorphisms of four equine breeds.



autochthonous ponies of the Iberian Peninsula. The traditional uses during the development of the Asturcón as a war horse and for traction in agriculture do not justify their conservation. Therefore the uses for which this breed presents advantages over the foreign horse should be promoted.

Between the measures undertaken by the ACPRA for the promotion of this breed we can point out:

- The periodic publication of pamphlets financed by various public as well private (Savings-bank of Asturias, Education Councils,, Culture, Sports and Youth of the Principality of Asturias, Patronage of Tourism...etc.) institutions with the aim of spreading the knowledge of this breed to breeders and riding fans.

Table 2. Genetic Distance D (up) and average heterozygosity Jx (diagonal) with their respective standard errors for the seven breeds at five loci.

Race	Asturcón	Dartmoor	Shetland	Connemara	PRE	Arabian	P.S.I.
Asturcón	0.3649± 0.1070	0.0582± 0.0488	0.0434± 0.0290	0.0879± 0.0606	0.0233± 0.0205	0.0968± 0.0486	0.1158± 0.0487
Dartmoor		0.3396± 0.1060	0.0222± 0.0237	0.0208± 0.0201	0.0418± 0.0021	0.0924± 0.0697	0.0708± 0.0351
Shetland			0.3158± 0.1246	0.0407± 0.0294	0.0312± 0.0316	0.0807± 0.0672	0.0481± 0.0288
Connemara				0.3797± 0.1000	0.0685± 0.0632	0.1294± 0.0773	0.0927± 0.0359
PRE					0.3680± 0.0959	0.0575± 0.0314	0.0763± 0.0378
Arabian						0.2299± 0.0969	0.0450± 0.0446
P.S.I.							0.2857± 0.1194

Table 3. Genetic Distance D (up) and average heterozygosity Jx (diagonal) with their respective standard errors for the 4 breeds at 17 loci.

Races	Asturcón	PRE	Arabian	P.S.I.
Asturcón	0.3936± 0.0577	0.1157± 0.0663	0.1630± 0.05953	0.2062± 0.0657
PRE		0.4039± 0.0629	0.0804± 0.0294	0.1484± 0.0623
Arabian			0.3340± 0.06314	0.0733± 0.0315
P.S.I.				0.3299± 0.06403

Table 4. Evolution of the number of associated breeders and of the animals registered in the Genealogical Book of the Race.

	1981	1983	1985	1990	1992	1993	1994
No. of breeders	3	5	6	16	26	36	40
No. of reproductive animals	21	38	68	168	241	284	343
No of castrated animals (Section C)	-	-	3	25	26	28	48
Total number of animals	21	38	71	193	267	312	391

(from ACPRA)

- The promotion of their use in various Spanish Pony Clubs. ACPRA is trying to guide the breeding of this pony toward children's horseback riding and equestrian sports, given their great resistance, their safety for riding and their magnificent temperament.
- Periodical demonstrations, morphological and sports contests.
- The favouring of scientific investigation of this breed (Ethnology, Biochemistry, Genetics etc.).
- The presentation of the animals to all livestock fairs that the economic means of the Association have permitted.

One of the main priorities of this association is to reach a sufficient ranch

Figure 6. The Asturcón Pony is considered a ellipometric, subconcave horse, varying from longitudinal to sublongitudinal.

Figure 7. The Asturcon coat is different shades of black, dark bay or brown.

population for the recovery of the breed, maintaining as much of their genetic variability as possible. Table 4 shows the evolution of the number of breeders and of animals registered in the Association since 1981. It emphasises the extreme gravity of the initial situation of this breed, and the slow but sure evolution in the number of breeders (from 3 in 1981 to 46 at the present time) and of registered animals (from 21 in 1981 to 391 around the end of 94). Therefore, at the end of 1994 the number of Asturcones registered in Asturias was 391 animals, divided between two main groups, one in the Principality of Asturias, located in the Cayón Mountains (town of Piloña) and the other in the Mountains of "The Pedroriu" (town of Grado) privately owned. In the Sueve, only 20 animals were found, the remainder being widely disseminated all over the region of Asturias, though individuals can be found in other points of Spanish geography such as León, Zamora, Cuenca, Cáceres, Alicante, Madrid, Castellón and Seville (Figure 1). The distribution by ages and sexes appears in table 5, the population of males representing 41.6% of the total compared to 58.4% of the females. Of 45 head unable to reproduce, 7 are devoted to agricultural tasks and 33 dedicated to children's horseback riding or equestrian tourism.

The expansion that this breed is currently experiencing, not only responds to the initiative of the national government for the conservation of the genetic patrimony, but is also due to the fact that its capacities satisfy some of the equestrian demands of society today. Its recognised nobility and quiet character makes it a saddle pony ideal for children to enter the world of horses and to initiate them in equestrian sports. The Pony Clubs of Madrid, Seville and Valencia are good proof of this. It has also had a great acceptance in educational activities such as Nature Classrooms. Finally, in rural tourism programmes, which are so popular nowadays, the Asturcones assume an added tourist attraction for the area.

Nor can we forget the importance of the genetic reserve that this autochthonous breed represents, with the advantage of its development on open ranges and on high

Figure 8. Traditional management system in which the Asturcón herd stays all year round in the mountains.

Figure 9. Second management system of the Asturcón pony. It consists of using breeders who keep the Asturcón ponies all year on their own grasslands.

Table 5. Distribution of the Asturcón population around the end of 1994 for ages and sex.

	Males	Females	Total
Reproductive animals	65	118	183
2 year old progeny	17	20	37
1 year old progeny	21	25	46
Weaned progeny	44	33	77
Castrated	45	3	48
Total	192	199	391

(from ACPRA)

mountain meadows, otherwise useless for agriculture. The Asturian ranching structure is currently undergoing a serious reconversion process, where milk production is being restricted to flat and fertile zones, while remaining grasslands and pastures are being abandoned due to the low profitability obtained by the traditional systems of bovine development and to the advanced age of the livestock farmers. In this way, the recovery of this breed may be used to support a pastoral economy that permits a demographic balance in these depressed zones, contributing in turn to the maintenance of the ecosystem in which it is developed (Alvarez and Alvarez, 1989).

Some of the short term objectives of this association are to reach a figure of 500 registered head and before the end of the century, have enough annual births to maintain a population of 1 000 mares (Technical Report of ACPRA, July 1995). This would mean that this breed, instead of being "in danger of imminent extinction", could be catalogued as "threatened" and "on the way to recovery".

In order to achieve these objectives institutional help will be needed. At the end of 1994 the European Commission agreed to finance through the European Agricultural Guidance and Guarantee Fund, a five year Spanish Programme on agro-environmental measures. The main proceeding lines of this programme are to promote ecological agriculture, to preserve autochthonous breeds in danger of extinction and to maintain traditional extensive management systems (Decision of the Commission of the European Communities, 19 January 1995). The financial assistance to conservation effort of 55 autochthonous breeds in danger of extinction amounted to more than 2 000 million PTAs ($ 16 000 000). The Asturcón is among these, together with another 7 Spanish equine autochthonous breeds.

Most recently, the Agriculture and Livestock farming Council of the Autonomous Community of Castilla and León, regulated the application of this assistance in this community (Official Bulletin of the Community of Castilla and León, number 127, Order of the Agriculture and Livestock farming Council of 28 June 1995). In this way assistance is being regulated to farmers committed to encouraging the conservation of genetic diversity, by raising animals of the autochthonous breeds of this Community (represented by the Asturcón and the Losino), with the set ammount of the assistance which can be obtained to maintain, to increase and improve the census and to register these animals in the Genealogical Book of the breed.

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The Criollo Horse in Uruguay

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Summary

The Criollo horse bred in Uruguay is a direct descendant of the Andalusian horses that were brought to America by the Spanish conquerors. It is not an isolated population. Ever since its coming into existence it has been related to the other populations of the southern countries of South America (Chile, Argentina and Uruguay). It is adapted to the most divergent regions of the continent, evolving through natural selection into a versatile breed, suited in particular for farm work because of its endurance, courage and capacity for recuperation.

At the beginning of this century, its existence was endangered because of the tendency of crossing with European breeds. Around this time, breeder organisations appeared in various countries and with them the standardisation of the Criollo horse as a breed. From this moment on, its growth was well maintained and constant, and today it is also being bred in Germany and Italy.

Resumen

El caballo Criollo criado en Uruguay es un descendiente directo de los caballos andaluces llevados a América por los conquistadores españoles. No es una población aislada, está emparentada, desde su formación, con las poblaciones de los demás países del Cono Sur Sudamericano (Chile, Argentina y Uruguay). Se fue adaptando a las más diversas regiones del continente, formándose por selección natural una raza de gran versatilidad, destacándose especialmente en las faenas de campo por su resistencia, valor y capacidad de recuperación.

A comienzo de siglo, con la tendencia a los cruces con razas europeas, se vio amenazada su existencia y en ese momento comienza a surgir en los diferente países las agrupaciones de criadores y su estandardización como raza. Desde este momento su crecimento es sostenido y costante. Actualmente también se cria en otros países como Alemania e Italia.

Key words*: Criollo horse, Animal genetic resources, Characteristics, Uruguay.*

Origin of the Criollo Horse

The American horse came into the New World through the island "La Española" (presently Santo Domingo) during the second voyage of Columbus in 1493. The island became a breeding centre, supplying the horses that were used for expeditions and conquests that followed. The breeding zone passed on to the continent 15 to 20 years after (del Río, 1990), and was later replaced by breeding centres in Colombia and Panama. Later still, in 1532, Pizarro took horses to Charcas (Peru), which became an important centre of horse production. From here, horses spread to Chile and Tucuman (Argentina). Around the same time Don Pedro Mendoza (in 1535) and Alvar Nuñez Cabeza de Vaca (in 1541) introduced horses directly from Spain to the Rio de la Plata region (Argentina and Uruguay), and to Paraguay respectively (Cabrera, 1945).

Horses were brought to the Southern countries of South America, from Peru, and also directly from Spain (Cabrera, 1945 and Tocagni, 1985). The base population for the

horse presently called Criollo did not descend from these two blood lines alone, because new blood (also of Spanish origin) was permanently introduced in the constant crossing of horses in the continent. Many horses were abandoned or lost in expeditions and battles, establishing themselves in the wild. These wild or untamed horses were also called "baguales" and could be seen in massive herds. In the year 1600, governor Diego Valdés wrote to Felipe III, referring to these "baguales": "*They outnumber the amounts that, according to tradition, were present in those pasture lands of the province that were used by the Persian kings, and of which it is said that there were one hundred and fifty thousand horses. And here, if we would say that Your Highness possesses one and a half million, we would be underestimating the number*".

The crossing and later fusing of these tame (owned by the colonists) and wild herds, originated the population today called Criollo. This population was often subject to cross-breeding as a consequence of the rapid movements of the Indian and Gaucho mounts that followed the conquests and the colonial period. The Indians also had a great influence on the spreading of horses, exchanging them between different tribes and with the white men. In one of his works on the Criollo horse, Dr. Angel Cabrera confirms that this moving around of herds for three centuries resulted in an almost complete natural selection. This severe natural selection already played its part during the very long and hard journeys of those times, when a great percentage of the horses died before even reaching America. The ones which did survive had to endure rough environmental conditions and permanent danger. Thus, for all these years, only the stallions that were dominant because of their physical condition, could bring forth mares that were suited for reproduction under these circumstances. All these qualities presently make up the genetic heritage of the breed.

Figure 1. Three years-old male during Montevideo exposition, Uruguay.

Crossbreeding and Recuperation of the Criollo Horse

At the end of the last century and at the beginning of the present, other horse breeds were imported. At this time, the Criollo horse was indiscriminately crossed with mainly English breeds. Some breeders refused this cross-breeding and kept their animals pure. In order to maintain this "breed purity", there was an exchange of studs between the breeders who followed this genetic lineage. In Uruguay, ranchers broadened their spectrum when they thought it was convenient, exchanging products with Brazilian and Argentinean breeders (Anonymous, 1945).

After many years of crossbreeding the ranchers started noticing the lack of working horses for the herding of cattle. As a consequence, they returned to the origins of the breed through the herds that had been kept pure. Chile was the first country in this matter to ensure the preservation of its horses and to start with an official register. After a failed attempt in 1893, the register was successfully expressed in concrete terms in 1910 (Cabrera, 1945).

In Argentina, before the initiation of the official registers, Dr. Emilio Solanet kept his own registers of Criollo horses (Solanet, 1943, 1980). The majority of these horses was obtained from indigenous tribes (Dowdall, 1979). In a similar way, ranchers from Uruguay and the south of Brazil were exchanging studs, seeking the purity of their herds, before opening official registers (Anonymous, 1945). A movement in favour of the recuperation of the breed originated. Genealogical registers were opened, starting from the purest herds kept by those breeders who had refused cross-breeding. Every country that is presently a member of the Interamerican Federation for the Criollo Horse, started with the recovery of the breed by means of a system of inspection in order to incorporate the animal in the official registers (Table 1).

Every country upheld a similar inspection system in order to achieve a correct identification of the Criollo horses. In this way, all the "base" animals are incorporated and branded. These "base" animals are considered Criollo because of their type, shape and measurements, not to mention being of a known descent. A system of "preparatory register" is created, where every animal derived from two "base" animals is listed as "preparatory II", Leading to "preparatory III", until the definitive registered animal is derived from two prep. III. Animals derived from two definitives need not be submitted to inspection.

The objective of this inspection system is to control the production in such a way that at least 5 control generations, are always needed before a definitive registration is achieved, and a most thorough purification is made possible, so the carriers of inappropriate genes can be detected. The Tobian coat is accepted in some countries (Uruguay, Brazil and Paraguay) but not in others (Argentina and Chile), because subsequently it was considered that this coat had been introduced through horses from the north of Brazil, maybe of Dutch origin, which were brought to the Rio de la Plata by Tobias (Dowdall, 1979). The suspicion of a later incorporation of this colour, is due to the fact that it is not described in any chronicle of the expeditions of the conquests, but the entire range of the presently existing coats does exist in writings of the 16th century (Cabrera, 1945).

Table 1. Year of opening of Registers and Breeder Associations in some South-American countries.

Country	Opening of Registers	Breeder Association
Chile	1910	1946
Argentina	1918	1923
Uruguay	1929	1941
Brazil	1931	1932
Paraguay	-----	1977

Figure 2. Typical head of the Criollo race.

Nowadays, animals with a preliminary register still exist, partly due to the longevity of the breed, and partly to the short reopening of the registers in countries where more base animals were incorporated. The last reopening occurred in Argentina in the fifties (Dowdall, 1979). In Uruguay, the last reopening occurred in the forties (Anonymous, 1945). The animals submitted to inspection can be classified as accepted, postponed or eliminated from the registers:

- *Accepted*: conform to the breed biotype and biometrics characteristics.
- *Postponed*: because of development failure and/or bad condition impeding a good morphological evaluation, or because of excessive development for its age. Submission to inspection can be repeated three times, and if not accepted the third time, the animal is eliminated from the registers.
- *Eliminated*: not conforming to the breed biotype and/or biometrics characteristics.

The southern South American countries

have worked together for many years. They established a common breed standard in 1941 and founded the Interamerican Federation for the Criollo Horse (FICC) on 18th of July 1972, as well as organising expositions and international contests (Figure 1). The present members are Argentina, Brazil, Paraguay and Uruguay. Chile has not been a member since September 1996.

The Criollo Horse at Present

At present, all countries have kept their registers closed for many years. The present stage is one of evolution, where functional perfection and morphology, to respond the highest physical demands, are pursued. Nowadays, the same morphology, created by nature during more than 300 years, gives the Criollo horse its characteristic biotype, which makes it the most suited riding horse for farm and ranching work (Ibarra, 1945 and Gallinal, 1948).

This evolutionary stage is marked by an increasingly fluent integration between the member countries of the FICC, with a tendency to standardise the selection criteria and functional trials. This selection methodology in which morphology and functionality are united is called "integral selection" and the most complete trial is the Golden Bridle, presented in Brazil, but preliminary trials for the finals in Brazil, are nowadays also being held in Uruguay. The advantage of these trials is that the animals are being judged on their morphology and functional abilities in a very complete way. The disadvantage is that not all of them are evaluated under all of these trials because it is not considered a stallion evaluation.

Concerning breed selection, a population

Figure 3. Mares during resistance competition. "Marcha funcional".

improvement programme still does not exist. Its implementation would by no means be easy because the total breed population is the one existing in the member states of the FICC. In Uruguay alone, there are 2 774 inscriptions per year, representing 72.8 % of the total of all breeds. Brazil has a total population of 93 528 animals and every year 10 000 are registered. Updated numbers could not be obtained from the other member countries of the FICC.

Presently there is an intensive control of the population, thanks to the inspections, but estimations are that within 15 years all the Criollos in Uruguay will be definitive, so that inspections will no longer be necessary and control over the population will be lost. The future situation obviously requires the implementation of an Improvement Programme.

The Criollo horse is mainly fit for farm and ranching work, since stockbreeding in the countries is totally extensive. In this system the horse plays a fundamental part in the herding and handling of the cattle and also in the transport between the "haciendas". So, the objective of the improvement of the breed is very clear.

The importance of the physical qualities of the Criollo horse, fundamental for the ranchers, was considered by the breeders associations as a fundamental point, together with its morphological qualification, in the perspective of their selection and improvement programme.

The functionality trails have an ever-increasing relevance, and the most important ones can be classified into three groups:

1. *Functional or resistance course*: these are run over a course of 750 km divided into 14 stages. The robustness, resistance to exhaustion and capacity for recuperation are manifested. This trial is very popular in Uruguay, where it is being proposed as a functional trial (Figure 3 and 7).

Figure 4. Pair of mares pair during "paleteadas" competition.

Figure 5. "Jalones" competition.

2. *Rein trial or rein course*: the objective is to test the agility, co-ordination, temperament, docility, natural worker instinct and innate ability to exert diverse marching patterns (Figure 5, 6 and 8). There are different trials in this group:
   a) Common rein trial.
   b) Course with vertical stakes of approx. 3 m height, with a different name according to the country.
   c) Criollos of America: trial with barrels.
   d) "Paleteadas en juntas" or the ability of a ridden horse with another to draft a steer into a barn or a pen (Figure 4).
   e) Tail catching: the calf has to be rolled over by catching its tail.
3. *Golden Bridle*: at present the most complete trial, in which the competitors are judged by their morphology. Later on, for several days there are rein and mobility trials with cattle in corrals and in the open field. The final takes place in Esteio (Brazil). Prado (Uruguay) is one of the classification locations.

The breeders associations from the different countries are aware that these trials are fundamental for selection, since morphological qualities without the corresponding functional abilities are not sufficient for the breeding of the breed.

The trials are becoming increasingly important, consolidating and assuring constant growth, and revalorisation of the cultural inheritance of the Criollo horse.

Figure 6. Figure trial during "Freno de Oro" competition.

Figure 7. Physical condition after covering 750 km. In 14 days. "Marcha funcional".

Standard of the American Criollo breed

In the Extraordinary General Assembly of the 4th Interamerican Reunion of Criollo Horse Breeders, convened in 1959, the Criollo Breed Standards were updated, although every country maintains its own profile within the limits of the following standards (Anonymous, 1959):

- Eumetric, mesomorph, with straight or subconvex profile.
- *Type*: pronounced musculation and modelled in strength, but also agile and swift in its movements.
- *Temperament*: active and docile.
- *Height*: ideal at 1.44 m, with fluctuations between 1.38 and 1.55 m, but heights not exceeding 1.48 m are advisable (mares 2 cm less). The breeders associations from different countries can, within these limits, impose their own maximum and minimum limits, according to their interests.
- *Thorax circumference*: ideal at 1.78 m (mares 2 cm less).
- *Cannon circumference*: ideal at 0.19 m (mares 1 cm less). The fluctuations of this measurement must follow those of the stature.
- *Coat colour*: with the exception of "pintado", all colours are accepted.
- *Head*: altogether short, broad base, fine crown and broad front (proportionally big crown and little face). Little ears are best, intelligent and expressive eyes, and dilated nostrils (Figure 2).

Figure 8. Corral trial during "Freno de Oro" competition.

- *Neck*: of intermediate length, well united in its two extremes, slightly convex in its superior line and almost straight in its inferior line. Abundant manes.
- *Withers*: muscled and not very pronounced.
- *Back*: broad and with proportioned extension to complement a broad thorax.
- *Loins*: short, broad, muscular, well joined to the back and the croup. Altogether there must be perfect harmony between the different parts.
- *Croup*: of intermediate length and width, very muscular, well developed.
- *Tail*: with an insertion that follows the superior line of the croup. Short and thick root of tail with abundant hairs.
- *Chest*: broad and muscular.
- *Trunk*: very well developed, ribs well arched, deep and empty stomach.
- *Hip*: short and full.
- *Shoulder*: properly inclined, with the elbow well separated from the thorax, and both very muscular.
- *Foreleg*: perpendicular, long and very muscular, becoming more refined near the knees.
- *Knees*: broad, strong, of intermediate length and bright.
- *Hindquarters*: thigh is muscular, buttock must be long. Gaskin, broad and muscular. Hock joint very pronounced.
- *Bulb of heel*: broad, strong and muscular, well standed. They must also be parallel with the medium level of the body. The anterior angle of the bulb of the heel will be slightly open.
- *Cannon*: short, strong and well defined.
- *Pastern*: rounded, medium length, wide, and slightly inclined.
- *Hoof*: its volume is proportionate to the body, hard, solid, and well trod. They are usually black.

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Le Zébu Gobra: caractères ethniques et performances zootechniques

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Résumé

Dans cette étude, les auteurs font le point sur les principaux résultats obtenus chez le zébu Gobra. La croissance est de 280 g/j dans les conditions d'élevage du C.R.Z de Dahra. Elle peut atteindre cependant 736 g chez des mâles recevant dès la naissance une alimentation équilibrée et 1 080 g dans des unités d'embouche. Les caractéristiques de carcasse sont bonnes et comparables à celles de la plupart des races à viande spécialisées. L'âge à la 1ère mise-bas (1 365,6±24 j) et l'intervalle entre mise-bas (15,5 mois) sont élevés mais sont susceptibles de diminuer lorsque les conditions d'élevage sont améliorées.

Summary

This paper reviews the main results obtained in zebu Gobra cattle. Under the breeding conditions of C.R.Z. of Dahra, the average daily growth is 280 g but can reach 736 g in well fed males and 1 080 g in feed lots. Carcass traits are also good and compare favourably with those of specialized meat breeds. Age at first calving (1 365.6±24 days) and intervals between calvings (15.5 months) are high but can be reduced by improving breeding conditions.

Key words: *Reproduction, Production, Physical characteristics*

Introduction

Malgré les efforts consentis à ce jour dans le secteur de l'élevage, l'Afrique continue de faire face à une insuffisance en protéines d'origine animale. L'une des causes principales de ce déficit alimentaire est la faible productivité du cheptel. En effet, les pays du Sud disposent de 70% du cheptel bovin et de buffles du monde mais ne produisent que 29% de la viande et 23% du lait (Janhke *et al*. 1988). Pour accroître la productivité du cheptel, très tôt des programmes d'importation de race exotique ont été mis en place. Mais face au manque de rusticité de la plupart des races introduites, les races locales se positionnent de plus en plus comme des alternatives durables vers l'autosuffisance alimentaire. C'est ainsi que, par exemple, sur l'échiquier régional, la grande rusticité de la race taurine Ndama est de plus en plus reconnue, ce qui explique le grand engouement que suscite la race (Shaw et Hoste, 1991).

Au Sénégal se rencontre le zébu Peul ou zébu Gobra décrit par différents auteurs comme l'une des meilleures races de boucherie d'Afrique de l'Ouest (Doutressole, 1947; Ndiaye et Balam, 1977). Pour cette raison sans doute, l'IEMVT (Institut d'Elevage et de Médecine Vétérinaire des Pays tropicaux) relayé ensuite par l'ISRA (Institut Sénégalais de Recherche Agronomique) se sont très tôt attelés à une meilleure connaissance de la race. Toutefois, les résultats obtenus chez le zébu Gobra restent disparates puisque la seule étude bibliographique existant sur cette race ne

traite que de ses caractères ethniques (Ndiaye et Balam, 1977).

Cette étude vise à faire le point sur les performances de reproduction et de croissance du Zébu Peul du Sénégal.

Le Berceau et l'Aire de Répartition

D'après Doutressole (1947), le zébu Gobra vit à l'Ouest du Sénégal, dans les provinces du Baol, du Djoloff et du Cayor et au Nord, dans la province du Sine Saloum et le long du fleuve Sénégal. On le trouve également en Mauritanie (Epstein, 1971) et dans le Sahel Malien qu'il aurait atteint à la suite des guerres de El hadji Oumar (Ndiaye et Balam, 1977). Son aire de répartition, qui est comprise entre le 12° et le 16° longitude Ouest et le 13,5° et le 16,6° latitude Nord, est caractérisée par une faible pluviométrie (340 mm entre Juillet et Septembre) et une température moyenne annuelle de 28°C.

Au Sénégal, trois variétés de Zébu Gobra sont décrites: les variétés Djoloff, Baol et Dagana (Doutressole, 1947). A cela s'ajoute dans le bassin arachidier et en haute Casamance une population métisse plus ou moins stabilisée issue du croisement entre le Gobra et la race taurine Ndama appelée Djakoré.

Caractères Ethniques

C'est un animal sub-convexiligne, eumétrique et médioligne. Chez l'animal adulte, la hauteur au garrot varie de 1,35 m à 1,40 m

Figure 1. Zébu Gobra à robe blanche

chez le mâle et de 1,25 à 1,35 m chez la femelle. Le poids est compris entre 300 et 400 kg chez le mâle et entre 250 et 350 kg chez la femelle. Toutefois, chez la variété Djoloff qui est la plus grande, la hauteur au garrot peut atteindre 1,54 m.

La tête est fine et longue, le front bombé, les yeux gros, le chignon saillant, le chanfrein rectiligne et les oreilles longues et dressées. Les cornes qui peuvent atteindre jusqu'à 80 cm de longueur sont portées en lyre haute. Elles sont plus développées chez les mâles que chez les femelles. Le fanon est large et plissé surtout près des membres antérieurs. La bosse, thoraco-cervicale est bien développée chez le mâle alors qu'elle est petite chez la femelle. La poitrine et les reins sont étroits, le bassin large, les fesses sont garnies et globuleuses chez les animaux préparés pour la boucherie. La queue qui dépasse la pointe du jarret de quelques cm est terminée par un toupillon important. La robe est généralement blanche (Figure 1) mais quelquefois blanc rayée de noir (Figures 2 et 3), rouge-pie et froment.

Les Paramètres de Reproduction

L'âge au premier vêlage

Selon Fayolle (1974) cité par Mime (1981), en milieu traditionnel l'âge à la première mise bas est compris entre 4 et 5 ans. Au Centre de Recherche Zootechnique (C.R.Z.) de Dahra, dans des conditions semi extensives d'élevage, les femelles sont mises à la reproduction vers l'âge de 24-27 mois, qui correspond au moment où elles atteignent 75-80% de leur maturité (Abassa, 1987). Dans cette station, l'âge au 1er vêlage est de 1365,6±24 j, soit 44,8 mois (Denis et Thiongane, 1973). Ceci traduit une absence de précocité sexuelle de la vache Gobra qui serait due aux conditions d'élevage en général et à l'alimentation en particulier. En effet, Denis et Valenza (1970) ont montré qu'on pouvait ramener l'âge au premier vêlage à 31 mois en soumettant les animaux dès la naissance à une supplémentation appropriée.

L'intervalle entre vêlages

Il comprend la durée de gestation et l'intervalle entre la parturition et la nouvelle fécondation appelée période de service. L'intervalle entre vêlages est de 15,5 mois chez la vache Gobra (Denis, 1971) ce qui correspond à 2 naissances en un peu plus de 3 ans. La durée de gestation étant peu variable dans cette race (293±2 j) (Denis et Thiongane, 1973), c'est donc la période de service qui rend compte de la variation observée. Ce délai dans la fécondation serait dû à la présence permanente des taureaux dans les troupeaux, au déficit alimentaire et à l'allaitement prolongé des produits (Denis, 1971). C'est ainsi qu'une amélioration d'un mois de l'intervalle entre mise-bas a été obtenue lorsque les conditions d'alimentation ont été améliorées (Denis et Thiongane, 1973).

La fécondité

La fécondité, c'est à dire le nombre de naissances annuelles ramené au nombre de femelles en âge de se reproduire, est de l'ordre de 53-55% en milieu traditionnel (Meyer, 1981). Elle est fortement tributaire des conditions de milieu puisque dans la zone d'encadrement de la SODESP (Société de Développement de l'Elevage dans la Zone Sylvopastorale), elle a pu être portée à 67%. Chez la vache extériorisée, Denis (1971) a rapporté un taux de fécondité de 86%. Cette forte influence des conditions d'élevage sur la fécondité explique sans doute les fortes variations saisonnières observées. En effet, comme le montre la figure 4, plus de 50% des naissances ont lieu entre Mars et Août, ce qui situe la période de fécondité favorable entre Juin et Novembre (Denis et Thiongane, 1975). Mais pour Cuq *et al*. (1974), près du 2/3 des fécondations ont lieu entre Septembre et Novembre, qui est la période au cours de laquelle le disponible fourrager atteint son maximum et les vaches leur meilleure forme (Denis et Valenza, 1970).

Figure 2. Zébu Gobra à robe blanche et noire

Les Paramètres de Production

La croissance et les caractéristiques de carcasse

La croissance

Le Gain Moyen Quotidien (GMQ) est de 280 g de la naissance à 36 mois d'âge (Sow *et al.*, 1988). Ainsi le poids passe de 25,5 kg à la naissance à 328,5 kg à 3 ans (Figure 5). En réalité, la croissance est bonne avant sevrage (429 g) et ne se détériore qu'après (249 g). De plus, chez les animaux ayant reçu dès leur naissance un régime tenant compte de leurs besoins, des GMQ de 736g et de 546 g ont été relevés respectivement chez les mâles et les femelles. C'est en particulier en embouche que les excellentes aptitudes bouchères du Zébu Gobra sont révélées. En effet, chez des zébus soumis à une ration à base de coques d'arachide melassées ou de paille de riz, complémentée avec différents sous produits agricoles, des GMQ de 586 à 1080 g ont été obtenus; les meilleurs résultats ayant été observés chez les mâles entiers de 3-5 ans.

Les différentes parties du corps du Zébu Gobra n'ont pas la même vitesse de croissance. Celle-ci se fait essentiellement en longueur et en profondeur, comme le montre l'augmentation régulière des ratio LSI/PT et LSI/HG, d'une part, et PT/HG, d'autre part (Tableau 1).

Les caractéristiques de carcasse

Le tableau 2 présente les caractéristiques de carcasse de zébu Gobra. Chez les animaux tout venants âgés de 3-5 ans, le poids de la carcasse est de 128,7 kg pour un rendement d'abattage de 56,7%. Le poids de la carcasse atteint 373 kg et le rendement d'abattage 66,5% chez les animaux extériorisés d'âge

Tableau 1. Evolution en fonction de l'âge de quelques mensurations chez le Zébu Gobra

	Age			
	Naissance	6 mois	1an	36 mois
Périmètre thoracique (PT, cm)	68,6	109,4	124,4	163,4
Hauteur au garrot (HG, cm)	66,1	92,6	101,4	121,2
Longueur scapulo-ischiale (LSI, cm)	54,1	88,5	108,7	142,6
LSI/PT	0,79	0,81	0,87	0,87
PT/HG	1,04	1,18	1,23	1,35
LSI/HG	0,82	0,96	1,07	1,18

Tableau 2. Caractéristiques de carcasse chez le Zébu gobra.

	Zebu Gobra[1]		Charolaise[2]
	Taurillons tout venant (3-5 ans)	Taurillons extériorisés (54 mois)	
Poids d'abattage (kg)	254	605,5	654
Poids de la carcasse froide (kg)	128,7	373	392
Rendement vrai (%)	56,7	66,5	68
Longueur de la carcasse (cm)	107,8	133,3	132
Epaisseur de la cuisse (cm)	19,4	29,7	32
% muscle	-	63,3	73
% os	-	15,67	15
% gras	-	19,98	13

Sources: [1]Mime P. 1981; [2]Missohou A. 1991

analogue. Ce bon rendement, de même que les autres caractéristiques de carcasse (longueur de la carcasse, épaisseur de la cuisse) sont particulièrement proches de ceux rapportés en race Charolaise (Tableau 2), race à viande par excellence, et confirment les aptitudes bouchères remarquables du Zébu Gobra. Les pourcentages de muscle et de gras sont moins bons que ceux de la race Charolaise mais ils sont comparables voire meilleurs à ceux rapportés par Cole *et al*. (1964) (Cités par Valenza *et al.*, 1971) chez d'autres races à viande spécialisées.

La production laitière

La production laitière du Zébu Gobra est très faible. Estimée de façon directe par pesée du veau avant et après la tétée, la quantité de lait produite sur 11 mois de lactation dans un troupeau tout venant est de 675 l (environ 2 l\j) (Thiongane et Denis, 1969). En milieu traditionnel Diaw (1974) utilisant la même technique d'estimation a obtenu 1,3 l/j sur 6 mois de suivi.

Figure 3. Taureau Gobra "blanc rayé de noir"

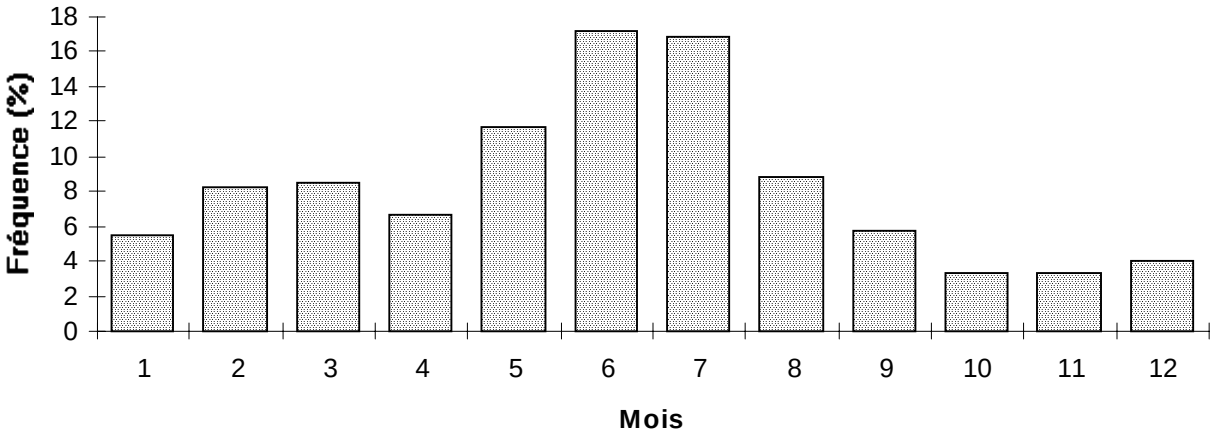

Figure 4. Répartition des naissances de zébus Gobra. Source: Denis et Thiongane, 1975.

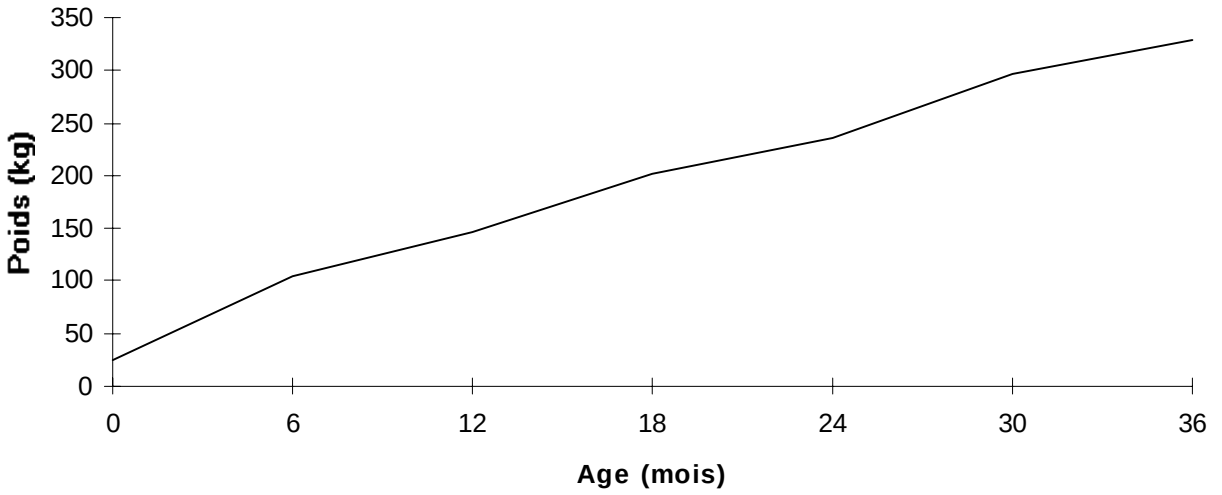

Figure 5. Croissance pondérale chez le zébu Gobra. Source: SOW et al.*, 1988.*

Conclusion

Le Zébu Gobra possède des potentialités bouchères remarquables dont l'extériorisation est cependant limitée par des conditions de milieu défavorables. Une amélioration des conditions d'élevage, en particulier une supplémentation stratégique pendant les périodes de soudure, doit permettre d'accroître sa productivité numérique et pondérale. Ce faisant, on se dote de moyens de faire face aux lourds déficits en viande qui menacent le continent noir à l'horizon de l'an 2000.

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Characteristics of indigenous chickens of Malawi

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Summary

Indigenous chickens (IC) are the commonest type of chickens raised in Malawi, especially in the rural areas. The management system is primarily of the free range type which is characterised by lack of supplementary feeding, minimal housing and little or no animal health services. This in turn results in low bird production in terms of egg and meat production when compared to modern breeds. Cross breeding the IC with improved breeds such as the Black Australorp is one avenue through which productivity of the indigenous chickens may be improved. The advantages of the indigenous Malawi chicken and issues for their conservation and genetic improvement are discussed.

Resumen

Los pollos autóctonos (IC) pertenecen al tipo de pollo más común que se cría en Malawi, sobre todo en las zonas rurales. El sistema de gestión principal se basa en la cría libre, sistema caracterizado por la falta de alimentación complementaria, un mínimo bajo cubierta y la poca o ninguna asistencia sanitaria. Todo esto tiene como resultado un bajo rendimiento en términos de huevos y producción de carne, en comparación con las razas modernas. El cruzamiento de IC con razas mejoradas, tales como la Black Australorp, sería un modo de aumentar la productividad de los pollos indígenas. Se presentan en el artículo las ventajas de la raza indígena de pollo Malawi y las posibilidades existentes para su conservación y mejora genética.

Key words: *Management system, Breeding, Improvement programme, Poultry diseases and health, Conservation*

Introduction

Indigenous chickens (IC) (*Gallus gallus domesticus*) form the largest proportion of chickens raised in Malawi. They are primarily raised in the rural areas or remote villages of most developing countries hence the name "village chickens". The IC have been reported to belong to a third class poultry industry by Spradbro (1993). Despite such a description, IC are also present in urban and periurban areas of Malawi and most developing countries. The actual number of IC available in Malawi cannot be mentioned with any degree of certainty due to lack of detailed livestock census. However, it is estimated that more than eight million ICs exist in Malawi (Safalaoh, 1992). Gondwe (1994) observed that almost 90% of farmers interviewed in Extension Planning Areas 11 and 12 of Lilongwe Agricultural Development Division own chickens of which the IC is the predominant breed.

Types and Common Characteristics of Indigenous Chickens

Indigenous chickens found in Malawi are of a non-descript type but three major categories are visibly present: *abathwa* (the dwarf type-DIC), *mmeta khosi* (the naked neck-NIC) and *mawanga* (spotted type-SIC). Common feather colours are waxy black, white, reddish brown, grey or spotted or a mixture of these. With the introduction of the Black Australorp (BA) to improve the productivity of the local chicken, cross breeds also exist and it is sometimes difficult to separate the two. Each of the three types of IC has its own specific attributes. The DIC is preferred for its prolificacy in egg laying while the SIC is renowned for being meatier. On the other hand, it is a common belief, especially in the rural areas of Malawi, that the NIC is more resistant to poultry diseases than the other IC types and imported breeds.

Resistance to ectoparasites such as lice has also been reported elsewhere (Ani *et al.*, 1989). The survival of the NIC in high temperature conditions is also highly acclaimed. Such resistance to heat stress is probably attributed to the reduced integument of the NIC where the zones separating the pterylae or apteria and areas surrounding the breast and thigh are entirely or partially devoid of down or feathers. Differences in bird characteristics and performance of indigenous chickens have also been reported in other countries (Oh, 1987).

Other positive attributes of IC are the yellow colour of the egg yolk, probably due to xanthophylls obtained through scavenging and foraging on green grass. Although Phoya and Whelehan (1982) reported that chicken meat is second to beef in terms of preference in Malawi, the taste of IC meat is preferred to that of modern broilers. This may be due to high contents of inosinic acid (Fujimura *et al.*, 1994).

Realising that the IC has an array of advantages and it is kept by almost every household, the need to preserve and conserve the IC genes through creation of a genome bank as done in other countries (Chen *et al.*, 1994, Valencia *et al.*, 1990) cannot be overemphasised.

Generally, productivity of the IC leaves a lot to be desired. They are characterised by slow growth rates, small body size, low egg production and low hatchability (Malawi Government, 1972; Mjojo, 1983). Egg size\weight is usually below 40 g (Malawi Government 1972; Safalaoh *et al.*, 1995) while total production is usually less than 120 eggs per annum. Other parameters such as egg length and diameter, albumen height and diameter and yolk height have also been reported to be lower in IC than other modern breeds in other countries (Yeasmin *et al.*, 1992). Market weights of more than 1 kg are attained at more than twenty weeks of age (Safalaoh *et al.*, 1996). Korean native chicken have been reported to have market weights of about 1.6 kg at sixteen weeks of age (Bay-Petersen, 1991) and 1.9 kg at 20 weeks of age (Kang *et al.*, 1993). As shown in table 1 and from other literature (Adebanjo and Oluyemi, 1981), age has a profound effect on meat yields of IC. Not many studies have been conducted to characterise the IC of Malawi. As such, there is a paucity of information in literature. Some characteristics of IC of Malawi are presented in table 1

Uses and/or advantages

Most IC are raised in the rural areas where the poor undernourished masses reside. Meat and eggs from IC therefore offer a good source of animal protein to most rural people. Johnston (1990) mentioned the ability to provide or generate protein in quantities that are convenient for local sale or for domestic consumption as one of the fundamental virtues of IC.

The smallness of carcasses precludes the need for refrigeration as is the case with goats or cattle meat. Chickens, particularly those white in colour, have been used for many years for medicinal or therapeutic purposes by traditional healers (*singangas*). This is also true for other countries (Oh, 1987). Sale of IC

to individuals or restaurants also brings extra income to the family. Provision of manure and use as gifts during traditional ceremonies such as weddings are other positive attributes. The advantage which is usually forgotten is that the IC provides a valuable service by keeping the surroundings clean through scavenging on insects, weeds and wastes that lie on the ground.

The returns to cost ratio in IC are also higher than in other breeds of chickens (Amin *et al*, 1992) when kept under the free range system. Furthermore, IC meet their nutritional requirements primarily from the environment thus reducing any competition with humans.

Management Systems

The major form of management is the free range or extensive system. Under this system, birds fend for themselves through scavenging. Under very rare circumstances chickens are kept under semi intensive or intensive management systems.

Housing and equipment

When housing is provided, structures are usually made of materials locally available. The pigeon type of house which is raised above the ground is the most popular. The locally available materials used are small tree branches or bamboo and grass for the walls or thatch. Roofs made of iron or aluminium sheets are exceptions from the norm. Chickens also share dwellings with humans in the main house or kitchens. It is not unusal to see birds roosting in trees or nearby grass bushes at night. Losses due to predators such as dogs and night owls or thieves are common under such circumstances.

Feed troughs, when provided, are made of local materials such as wooden planks, broken clay pots, old plastic and/or aluminium basins or old motor car tyres split into halves. The latter are also used as drinkers. In most situations, this equipment is not provided since birds fend for themselves. Supplementary feed such as cereal grains are usually just scattered on the ground for birds to pick.

Table 1. Selected characteristics of Indigenous Chickens of Malawi.

Characteristic	Indicator/Value	Source
Age at sexual maturity	154 d	Kadigi, 1996
Egg weight at sexual maturity	31 g	Kadigi, 1996
Egg weight (28 weeks)	38 g	Kadigi, 1996
Body weight at point of lay	1 376 g	Kadigi, 1996
Live weight (mixed sex, day old)	21 g	Safalaoh, 1996
Live weight (rooster 8 weeks)	615-623 g	Safalaoh *et al*., 1996; Safalaoh, 1996
Live weight (pullets, 8 weeks)	295 g	Kadigi, 1996
Live weight (roosters 20 weeks)	2 100 g	Safalaoh *et al*., 1996
Carcass weight (pullets 8 weeks)	299 g	Safalaoh, 1996
Carcass weight (roosters 20weeks)	1 485 g	Safalaoh *et al*., 1996
Colour	Multicoloured	*
Feed/day (0- 8 weeks)	30 g	Safalaoh, 1996

*Author's observation

Figure 1. Comparison of Indian River (on the left) and an Indigenous Malawi Chicken at seven weeks of age

Nesting boxes for hens are hardly provided. Special shelters made of grass are sometimes provided for hens to lay eggs and brood in. Otherwise, birds lay eggs in the house or in any quiet place.

Feeding

Indigenous chickens are by nature and tradition scavengers and as such provision of feed or supplementary feeding is a rare occurrence. Birds scavenge for themselves from morning to evening. Insects, earth worms, green grass or young shoots, grains from wild grasses, wild fruits and fallen grains form part of the daily diet for IC. For supplementation, kitchen left overs or household scraps such as *nsima* (maize porridge) and rotten cereal grains such as maize, sorghum or rice bran are usually provided. Apart from recent experiments with IC (Safalaoh, 1996; Safalaoh *et al*., 1996), no commercial diets are given to IC in Malawi. There is virtually little or no financial input at all with regard to feed costs, making the production costs low (Amin *et al*., 1992).

Marketing

There is no established marketing system of IC in Malawi. Birds are sold by the roadsides, to individuals from house to house or at local markets. Chickens are carried in wicker baskets placed on the head, on bicycle panniers, in lorries, on carts and on top of buses on their way to the market. Better prices are fetched in urban and/or periurban areas. Chicken sales increase during festivities such as Christmas, weddings, family gatherings or celebrations. Outbreaks of diseases such as Newcastle also trigger forced sale of village chickens.

Indigenous Chicken Breeding

Natural mating

Apart from natural mating, no planned breeding programmes are followed under the free range management system. Aini (1990) also reported that there is no purposeful selective breeding in indigenous chickens in South East Asia. A lack of proper breeding

systems results in inbreeding. The prevalent genotypes and phenotypes have probably resulted from such breeding systems

Eggs from IC are naturally incubated and brooding is also natural using the hen's body heat. Eggs from a supposedly poor brooder and hatcher hen are placed under a hen renowned for its high brooding characteristics (DIC) to ensure high hatchability. Two to three clutches of 10-15 eggs are common. However, chick mortality is usually very high in early chick life due to predators and poor husbandry conditions. Chick mortality has been reported to be as high as 60-70 % in other countries (Oh, 1987).

Indigenous chicken improvement programme

The importance and benefits of improving productivity of the IC through cross breeding has been reported in many studies (Safalaoh *et al*, 1996; Kang *et al*, 1993; Amin *et al*, 1992; Bray and Moffat, 1990; Lee and Huang, 1989; Oluyemi, 1980). Due to the low production of the IC, the Malawi Government instituted the Smallholder Village Poultry Improvement Programme (SVPIP) in the 1950's. The SVPIP is aimed at improving productivity of IC in terms of meat and egg production through crossbreeding with the Black Australorp (BA). The BA breed was chosen for its dual purpose nature and its ability to survive the harsh tropical conditions. Under the SVPIP, BA pullets and cockrels are raised under controlled conditions at government breeding and multiplication centres spread out across the country. The birds are raised up to six weeks of age before they are sold to farmers at a subsidised price of MKI 10 000 (US$ 0.66) per bird. The transition from feeding balanced diets and proper management creates a stress for BA birds when sold to farmers in the rural areas and the bird usually performs below expected standards.

Figure 2. A black Australorp x Indigenous Chicken crossbred (on the left) and an Indigenous Chicken at twenty weeks of age

No proper training is given as to how the BA birds are to be managed and used for cross breeding with the ICs. As such, BA birds are just left loose and intermingle with the ICs. Buyers of BA birds prefer pullets to cockerels. Black Australorp pullets are naturally poor brooders and hatchers hence the difficulty to sustain a crossbreeding programme. Use of BA cockerels to cross with IC hens is a better alternative unless artificial incubation is used. Not surprisingly, despite the fact that this programme has been in existence for more than thirty years, the presence of BA chickens or crossbreds between BA and IC cannot be felt. The demand for BA birds is still high and is not being met. There is unequal distribution of birds and sale is biased. Recent studies and reports (Safalaoh *et al*, 1996; Kadigi, 1996) indicate that crossbreeding BA with IC can indeed improve the productivity of IC in terms of meat and egg production. Safalaoh *et al*. (1996) reported twenty-week-old body weights of 2 425 g, 2 250 g, 2 183 g and 2 100 g for BA x BA, IC x BA, BA x IC and IC x IC genotype roosters, respectively. Hen daily egg production (28 weeks of age) of 70 %, 56 % and 49 % for BA x BA, BA x IC and IC x IC, respectively (Kadigi, 1996).

Poultry Diseases and Health

Prevalence of diseases and lack of appropriate poultry health services are among the major constraints to poultry production in Malawi (Safalaoh, 1992). Newcastle Disease (NCD), Marek's Disease, Gumboro, Lymphoid leucosis, Urate nephritis, coccidiosis, Non-specific enteritis and lung congestion are some of the poultry health problems reported for indigenous fowls (Christiansen, 1986). Of

Figure 3. Indigenous Chickens feeding on grains being dried for human consumption

these, New Castle Disease is by far the most important disease (Malawi Government, 1995; Sagild and Haresnape, 1987).

There is virtually no poultry health programme followed when raising IC in Malawi. Provision of services such as free vaccines has long gone into oblivion. Due to high prices, farmers are unable to buy vaccines and curative drugs. With the majority of the rural farmers lacking proper knowledge in poultry husbandry and disease control, incidences where diseases can reach an advanced stage before recognition have been reported. Diagnostic facilities are far from the rural areas.

Conservation of Indigenous Chickens

Despite the aforementioned importance and advantages of the IC, no efforts have been undertaken to preserve the IC in Malawi. Current research by University and Government research institutions has focused on crossbreeding and performance of IC using balanced diets (Safalaoh, 1996; Jere *et al*, 1995). To prevent losing the important genetic traits of the IC, there is an urgent need to establish genome banks for preservation of the IC.

Conclusions

The indigenous chicken will remain the most prevalent breed of chicken in Malawi for years to come. Its importance as a provider of animal protein and income to the poor rural masses can not and should not be undermined. Every effort should therefore be made to improve its productivity through improved husbandry and nutrition. To preserve the important characteristics it possesses, there is need to conserve the IC genes through creation of genome banks. The government should provide adequate resources and policy in this direction.

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The population of laying hens loses important genes: a case history

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Summary

The switch from keeping laying hens in a floor or free range system into a cage system led to a considerable change in the way that breeding and selection took place. In the past 40-50 years up to the present date, the increase in genetic improvement of the egg laying trait was substantial. However, cage-adapted populations of laying hens seem to have lost some of their abilities to an adequate performance when returned to the old floor\free range systems. The strong concentration of all parts of the poultry production has meant that less than 10 international breeding companies supply most hens for laying purposes in the world and they have very little interest in developing genetic material for the West-European region where there are marked consumer preferences for eggs produced in non-cage systems. A particular Danish line, of White Leghorn origin named "The Skalborg hen" seems to have survived during an era of cage production system and they seems to have a production potential at farm level.

Resumen

El paso de la cría de gallinas en suelo o libres a la utilización del sistema de jaulas, ha llevado a un cambio importante en la cría y la selección. En los últimos 40-50 años el aumento en la mejora genética de los huevos ha sido sustancial. Estas poblaciones de gallinas ponedoras adaptadas al sistema de jaula parecen haber perdido algunas de sus habilidades de rendimiento cuando se las vuelve a colocar en el antiguo sistema libre. La alta concentración en la producción avícola ha llevado a que menos de 10 compañías internacionales provean la mayor parte de las gallinas ponedoras en el mundo. Estas compañías no están interesadas en desarrollar material genéticamente para Europa del oeste, donde las preferencias de consumo del mercado van hacia los huevos producidos con sistema tradicional sin jaula. Una línea danesa particular proveniente de la White Leghorn y llamada "The Skalborg Hen", parece haber sobrevivido sin una época en jaulas y mantiene un potencial de producción a nivel del de granja.

Key words: *Genetic stock, Floor system, Cages, Skalborg line*

Introduction

The introduction of the hen as a farm animal can be traced back to 2000 B.C., but systematic breeding did not take place until the beginning of the nineteenth century, at least in Europe and America. Thus for about 200 years hen breeding and selection has taken place in Europe and America with the purpose of developing specific breed characteristics and eventually to breed for an improved egg laying capacity.

Up to the middle of the twentieth century selection and breeding was mainly based on progeny testing of males, in which the progeny groups were tested in pens. Around

the 1950s an event of vital importance for housing layer hens occurred: the system of cages was introduced. The major impact of the change from the floor systems to the cage systems was that the "flock size" decreased dramatically, the "nesting behaviour" became non-interesting for the farmers and the hens were lifted out of the "manure environment". In this paper, some of the effects on the genotype as a result of such changes in the environment will be mentioned, as well as what happens when attempts are made to go back to the previous floor/free range system after a certain time The results of a search for genetic material which still has some of the ability to perform appropriately in floor/free range systems are reported.

The Effect of Switching from Floor Systems to Cages

The switch from keeping laying hens in a floor or free range system into a cage system also led to a change in the way that breeding and selection took place. Previously the breeders had kept their hens in floor systems in family groups of hens in small pens or in large pens with a trap nesting system to record the egg production of the individual hen. Breeders developed the new cage system very quickly in the form of single bird cages as it was then possible to identify the exact egg production of individual hens. The best illustration to document the rational of this came from a Californian research work (Lowry and Abplanalp, 1970) in which a considerably larger genetic improvement in egg yield was demonstrated, when selection and breeding were based on information from hens in individual cages compared to selection for high numbers of eggs laid by free range hens in a trapnest system. A considerable genotype-environmental interaction was recognised, as the difference in egg yield between the two breeding methods was three times as large when both experimental lines were tested in cage systems compared to a test of the two lines in a floor system. The authors concluded that a specific genetic adaptation had occurred to the system in which they were bred.

After 40 to 50 generations of selection for an efficient hen under the cage system, the laying hen has been genetically developed to produce more than 300 eggs during the first 12 months of their laying career, and using less than 2.2 kg feed per kg eggs. Part of this efficency is due to a reduced body weight. This substantial genetic improvement has taken place contemporary with a strong concentration and specialisation of the poultry production. On a world-wide basis less than 10 international breeding companies are presently supplying the majority of the breeding material which is behind the egg production in the developed world and they have a growing part of the market in the developing countries.

Correlated changes

When trying to assess the performance of a production system which allows hens to move around in larger flocks, observations and investigations on these cage-adapted hens have, during recent years, shown, that these genetically cage adapted hens:

1) have lost some of their ability to go to a nest before oviposition;
2) feather peck against each other;
3) tend to peck aggressively, sometimes ending in cannibalism.

These are all behaviour characteristics to which the hen is not exposed in an individual cage and therefore will not influence her egg laying record, but these three issues will always be of importance for a hen in a floor\free range system with many hens influencing her egg laying record and the chance to be selected as a parent.

Regarding nesting behaviour, some results and experiences were obtained from a selection experiment with laying hens. The base population was created in 1969 by crossing 7 international commercially bred laying stocks. After four generations of systematic crossing the base population was divided into 5 experimental lines which for the following 6 generation were selected as:

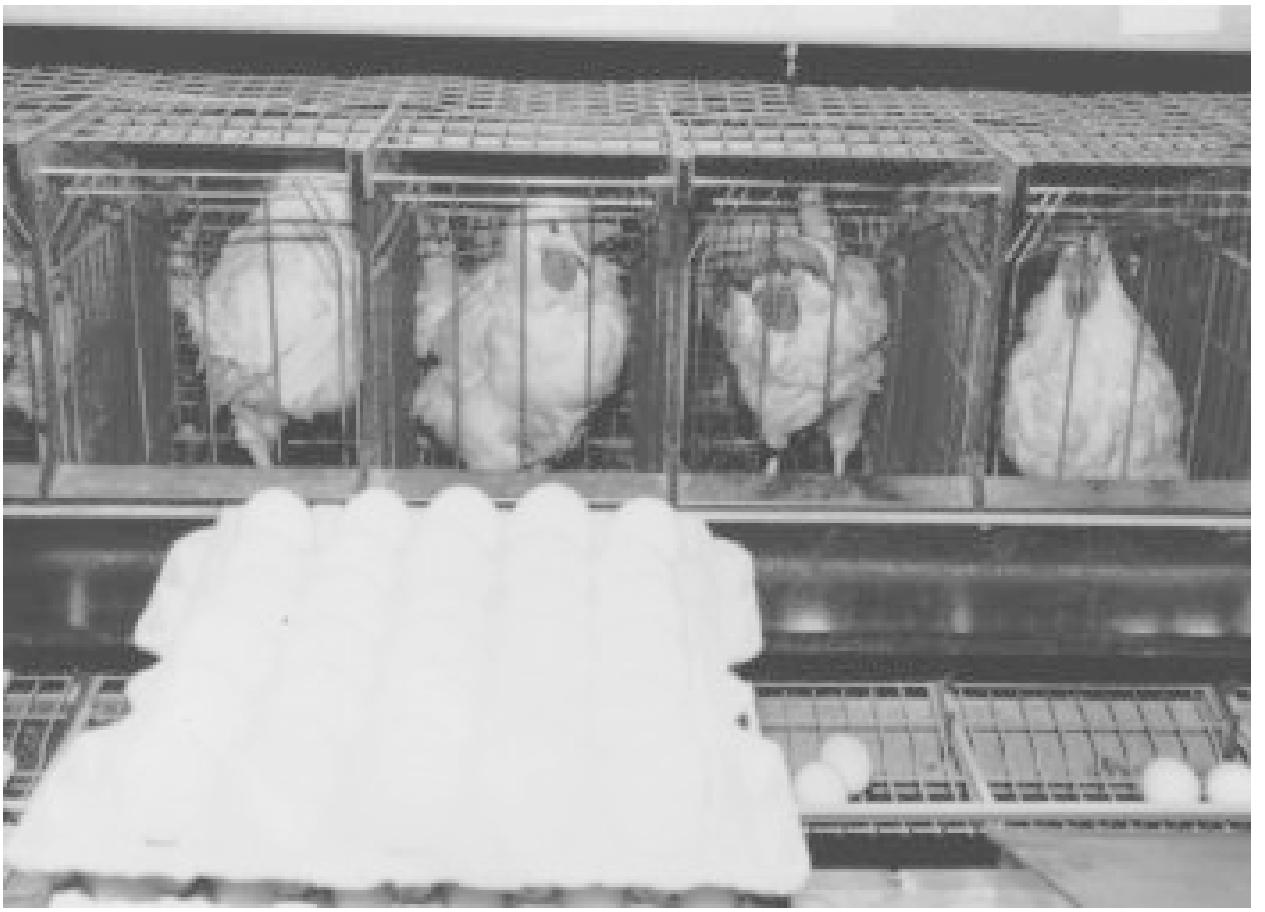

Figure 1 Frequency of floor eggs of the selected lines in proportion to the frequency of those in the control line.

- C-line. Control with complete random mating
- N-line. Selected for high egg number to 42 weeks of age
- E-line. Selected for high egg weight at the age of 38-40 weeks
- I_1-line. Selected for and index of high egg number and high egg weight
- I_2-line. Selected as line I_1

In each line, 400-500 hens were tested for egg laying traits. The hens were kept in floor pens with 30 to 200 hens and the eggs from the individual hens were recorded on the basis of those laid on the trap nest. (Sørensen *et al.* 1982; Sørensen, 1992). Figure 1 illustrates the change in eggs laid on floor for the various selected lines in relation to the control line. The decrease in the curves for lines N, I_1 and I_2 is substantial and could be interpreted that these lines have got a better ability or willingness to go to the nest when laying their egg, and this effect is genetic in origin, as these lines have been selected for a high number of eggs laid in the nest, while the selection in the E-line was based on egg weight. It was not possible to estimate the heritability but it is not negligible as the selected lines have reduced the frequency of floor eggs by 9% per generation compared to the control line. It has to be added that the 7 international laying stocks, who were the base for the control line, are supposed to have been

selected for high laying capacity in a cage system through several generations. The frequency of floor eggs in the control line fluctuated between 10 and 2 per cent during the experiment.

The conclusion was that a certain degree of inheritance exists for the nesting behaviour and breeding in a cage system. However, this does not necessarily imply that genes lie behind a good nesting behaviour.

Regarding feather pecking and cannibalism, there have been no reports demonstrating that selection for laying performance in individual cages has any correlated effect on feather pecking or cannibalism. On the other hand among flocks of hens in floor/free range systems there have been so many observations of defeathered flocks of hens and so many reports on flocks of hens in which cannibalism has been serious, that it is beyond just rare occasions.

During the last few years, there has been a growing interest in trying to test if there is any genetic variability which can be used to reduce these bad habits. Among those studies, the work by Craig and co-workers at Purdue University should be mentioned. For several years they have been working with problems related to the concept of aggressive pecking among hens or as they term it "beak-inflicted injuries" (BI). Over several years, they ran selection experiments based on seven generations, (Muir, 1996) in which the birds were kept in group cages with up to nine halfsib hens in each cage. The criteria for selection was a family based index which included survival rate. After 7 generations of selection. the mortality due to cannibalism was reduced to a third of what it was in the non-selected control line, 17% versus 48%, when tested in 12 bird cages and without beak trimming the hens (Craig and Muir, 1996). Thus there is obviously a considerable genetic potential in reducing the hens' disposition for cannibalistic behaviour, though it has not yet been tested if this change in genetic predisposition also would happen if the hens were tested under floor\free range conditions.

In Western Europe there has been much concern about the gentle feather pecking which leads to defeathered hens, but not necessarily to cannibalism. At Hohenheim University in Germany, developed equipments which can be used on a large scale to measure the birds' tendency to feather peck and he has recently presented a useful tool (Bessei *et al*. 1997). At Research Centre Foulum in Denmark, intensive studies have shown that the degree of inheritance is low (h^2=0.15), but there are prospects for genetic improvement through breeding and selection (Kjær and Sørensen, 1997).

From Cages to Floor/Free Range - the Consumer Appeal

Although the cage system from many rational points of view offers more advantages than any other systems of egg production, it must be admitted that the welfare of hens is generaly better in floor/free range systems (Figure 2). These arguments have been used by the general public and in particular some special animal protection groups to request a ban on the cage system in several countries in Western Europe. After 15-20 years of public debate on the subject, the situation is that a real ban on the cage system does not exist except in one country (Switzerland), but in many countries there is a certain market for eggs from non-caged hens. The market share of eggs from non-caged hens in Denmark was 30% in 1996 and has shown a rapid increase over the last 3 years; similar changes had occurred in the other Western European countries where such public pressure exists.

Genetic Stock to Be Used for the Floor/Free Range System

None of the few international breeding companies dealing with layer stock has shown real interest in developing a special hen for this floor/free range system as they argue that it is a small market for them, needs an expensive breeding programme and nobody knows if the existing genetic material is suitable to use. They also claim that future

consumer preferences are unpredictable, but above all they state that it does not fit into the large scale philosophy of the egg production.

Most of breeds developed by hobby breeders are poor layers because the main concern has been the exterior and not so much the laying efficiency. In spite of this there may be some original landraces which had formerly been bred to produce eggs.

Also there may also be some small scale breeders left in various countries who have had a particular interest in breeding for laying traits in special lines. These hens may not be as efficient as the ones from the international breeding companies but they have perhaps seen a particular possibilities to exist in a market of small holders or back yard hen farmers who obviously exist also in the developed world. The way these hens have been kept may differ substantially, but there may be some who have had their hens in floor systems for various reasons.

The particular situation in Denmark

For reasons which had nothing to do with animal welfare there was a ban against cage systems for laying hens right from the beginning of the cage era in the 1950s. The ban was abolished in 1979. Denmark had, as all other countries, large numbers of poultry breeders, a number which decreased down to 4 in 1970. During the next 10 years these 4 breeders worked hard to compete with the large international breeding companies which were in the Danish market during most of the time. As the ban on cages existed, the egg producers kept the hens in large flocks either in floor systems with litter or in wire netting systems, termed the "Pennsylvanian system".

The Skalborg hen

Among the four breeders, C. Christiansen, Skalborg has to be mentioned in particular. He had a long career as a poultry breeder and had already individual control over 3 000 hens in the middle of the 1960s under the floor system. They based the measuring of the laying of the individual hen on the trap nest 7 days a week in a 12 month period. The myth says that he always brought a small axe with him and hens he found with an egg outside the nest was immediately killed. Thus he had performed a most effective recording and a strong selection for hens which were well-behaved as to laying behaviour and relation to other hens in the house through

Table 1. Comparison of the Danish Skalborg hen with various international breeds, carried out in a floor system (Neergård, 1978) and in a cage system (Neergård, 1983).

Breeds	Country	Eggs in 365 days per placed hen*	Eggs in 365 days, hen day*	Eggs in 365 days per placed hen**	Eggs in 365 days, hen day**
Shaver	Canada	265	274	278	298
Babcock	USA	259	264		
Hisex	Netherlands	264	267		
Lohmann	Germany	259	268	276	285
Dekalb	USA			264	292
Skalborg	Denmark	262	267	240	266

*Test in floor system in 1978; **Test in cage system in 1982

Figure 2. Hens in floor/free range system.

30-40 generations. He and his successor continued in the same way up to 1980. The Skalborg hens which actually was a cross of two lines became well known to be high yielding, calm and well feathered hens weighing slightly more than average and laying large eggs. The Skalborg hen had to compete with others from two Danish poultry breeders as well as the large international breeding companies. Two others of the 4 breeders obtained special permission to keep hens in individual cages and they imported genetic material from some of the foreign breeders which meant that their special ability to the floor system was soon abandoned.

The Skalborg hen met her fate the day the ban on cages for laying hens was abolished, which is easily seen in table 1.
Denmark as most other countries ran a Random Sample Test station for laying hens, in which the genetic material available on the market was tested. Up to 1980 this test took place in a pen-based floor system with 30 hens per pen and 4 pens per breed. From 1981 the system was changed to a 4-bird cage system and 128 birds per entrance.

From table 1 it is seen that the Skalborg hen competed reasonably well with other international breeds when the test was carried out in a floor system, but later when changed to the cage system Skalborg was the loser, partly because the other produced better in cages and partly due to a higher mortality observed in the Skalborg hen. The latter had been observed in other comparisons already and is most probably caused by the fact that the Skalborg hen was not adapted to the cage system.

The Hellevad hatchery and the Skalborg line

Among the four breeding centres mentioned above, the Hellevad hatchery had a particular position as they had the policy to be a supplier for the small holder and back yards. They had since 1956 bred a line of New Hampshire derived from a breeding company in USA. The Hellevad hatchery has long been known to produce a cross of White Leghorn × New Hampshire which has proven to be particularly value in small-scale egg production under semi optimal conditions. The breeding programme is rather simple and as no multiplying units was in play they have run a low cost operation and been able to survive due to the interest from the small scale market. The important aspect to mention is that they use and have used all the time egg yield laid in a trap nest, good feather condition and persistency in egg production as the base for selection. Also it should be mentioned that they had never used vaccine for the breeding bird, nor had they used beak trimming.

Our particular interest for the Hellevad hatchery is that the White Leghorn line they use and have used for many years is the female line of the Skalborg hen or line 01. In former times the Hellevad hatchery each year bought day-old male chickens from this line at Skalborg. At the time of uncertainty for the Skalborg breeding centre, the Hellevad hatchery agreed with the Skalborgs to receive material from line 1 of the Skalborg hen so that they could continue the breeding with this line and have continued for 18 years.

Conclusion

The enormous concentration in the commercial poultry world has created a considerable degree of risk for monotypic populations as pointed out by Crawford (1990). The fact that these world-wide populations seem to have lost some of their ability to behave in a fully appropriate way in production systems which are still in use and preferred by consumers of the product should not be neglected. By discussing of the matter in Denmark it became clear that at least one line exists, the Skalborg line, which has not been through the process of a genetic alteration and adaptation to a system in which some behaviour traits could be harmful under other systems. It is important to identify these types of genetic material which may have a broader genetic variation and still have a production capacity at the farm level

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A note on Indian farm animal genetic resources

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Summary

India has a rich diversity of cattle, buffalo, sheep and goat breeds which are not only important to the people of India, but have contributed significantly to livestock programmes in many other tropical and sub-tropical climatic areas of the world. Most important is the fact that our domestic animal genetic resources (AGR) are under threat. This paper highlights the main AGR of India; the threat to biodiversity and the efforts made for conserving and improving indigenous livestock breeds.

Resumen

La India posee una buena diversidad de razas bovinas, búfalos, ovinos y caprinos que no sólo son importantes para la población india, si no que han participado de forma significante en los programas ganaderos de muchas otras zonas climáticas tropicales y sub tropicales en el mundo. Un hecho importante es que nuestros recursos genéticos animales (AGR) se encuentran en peligro. Este artículo subraya los principales AGR en la India; el peligro para la biodiversidad y los esfuerzos realizados para conservar y mejorar las razas ganaderas indígenas.

Key words*: Biodiversity, Indigenous breeds, Conservation.*

Introduction

Biodiversity (biological diversity) is the variety and variability of plant, animal and micro-organisms. The fundamental relationship of diversity and germplasm is evident, the diversity of organisms being the source of all germplasm. Our planet's essential goods and services depend on the variety and variability of genes, species, populations and ecosystems. Biological resources feed, clothe, and provide housing, medicine and spiritual nourishment.

Rich Biodiversity

India is a vast country, rich in biodiversity.

With its geographical area of 329 million hectares, India has almost all the climatic conditions and ecological zones found in different parts of the world, ranging from perpetual snow cover to equatorial and tropical conditions, from mangroves to humid tropics and hot and cold deserts as well as all the intermediate conditions.

The animal wealth of India is of some 68 371 species which includes 60 000 insect, 1 693 fish and 372 mammal. The country is endowed with large genetic variability in most of the important domestic livestock species as is reflected by a number of described breeds and strains. Currently there are 26 described breeds of cattle, 7 buffalo, 40 sheep, 20 goat, 4 camel and 6 horse, 3 pig and 18 poultry breeds. In spite of such a large number of breeds, the majority of livestock and poultry have not been described. In the country there is a number of rare species viz. Yak, mithun and wild (arni) buffaloes, the ancestors of modern day buffaloes. In addition, several other forms like ducks, rabbits, donkeys, geese, quails etc. are also an important component of animal wealth and contribution to animal production.

Threat to Biological Diversity

Most of the breeds of livestock and poultry in India that exist today have evolved through natural selection for adaptation to the agro-ecological conditions and to a very limited extent through artificial selection based on the social or economic needs of the breeders. It has been contended that indigenous genetic resources are endowed with unique genetic attributes such as superior adaptability to hot-humid conditions, long migration, ability to subsist on inferior and scarce feed resources and highly brackish drinking water. They also have some resistance/lower susceptibility to tropical diseases.

There is very little appreciation of such valuable genetic resources available in many distinct types, species, breeds and forms. Some of these already face the danger of extinction and, as such, need to be conserved before it is too late. There is great concern among the officials in the Government of India that many of the unique breeds of animals will become extinct and a valuable resource will be lost. It has been recommended by several persons and groups that India make a concerted effort to describe its diverse species and breeds of livestock and that conservation measures be initiated at the earliest.

Among various reasons for the loss of indigenous genetic resources in India, the most important are:

a) introduction of exotic breeds. The improvement programmes, though expected to be restricted to crossing with non-described and low producing animals, have a spillover onto the described breeds, since initial increase in productivity of crossbreds is too large to be ignored;
b) large inter-mixture among breeds in the region where two or more breeds exist
c) no breeding societies or agencies as those existing in countries more agriculturally advanced to register animals of a particular breed to maintain herd/flock books and ensure purity of a breed or type;
d) decrease in population size resulting in inbreeding and its deleterious effects; and
e) changing preference towards a particular production trait over time.

Earlier Efforts for Maintaining and Improving Indigenous Livestock Breeds

Earlier the Government of India had initiated a herd registration scheme. The scheme did not make any serious impact on improvements of the breeds or maintenance of their purity, neither did it provide data on pedigree progeny which could be utilised for progeny testing of bulls nor did it assure the use of bulls conforming to the breed type. Even the pedigree information was not properly utilised in selection of prospective bulls.

The Indian Council of Agricultural Research has published bulletins containing breed characteristics of important breeds of buffalo and cattle and revised them from time to time. More recently, efforts to describe the breeds of sheep and goats along with their productivity and associated characteristics and those of other livestock and poultry has been made both by the Acharya and Bhat (1984).

Breeds Needing Conservation Efforts

Although very little information is available on the breeds needing priority attention for conservation, more recent work done shows that all the sheep breeds in Jammu and Kashmir, the Magra Pugal and Chokla breeds of Rajasthan and the Mandua breed of Karnataka, and the Barbari and Jamnaparti breeds of goats, the Sahiwal, Red Sindhi, Tharkpar, Vachur, and Punganur breeds of cattle; the Nili Ravi and Toda breeds of buffaloes, the Karknath and Naked Neck breeds of poultry need immediate attention for conservation.

Animal Genetic Resources

It said that Zebu cattle can stand heat better than the temperate cattle. They do perform better than *Bos taurus* under harsh climates. Perhaps the presence of more sweat glands in Zebus does not allow their body temperature to rise fast when the air becomes hot and dry. They do not pant in the heat and nor does their milk yield drop. Their milk yielding capacity is less and perhaps they are less distressed by tropical diseases and physical environment. They are multipurpose and are used for milking, ploughing and hauling. In the Indian sub-continent as many as 26 defined breeds, constitute germplasm resources.

Milk breeds: Gir, Sahiwal, Red Sindhi and Tharparkar.

Draught breeds: Nagori, Bachaur, Kenkatha, Malvi, Kherigarh, Hallikar, Amritmahal, Khillari, Bargur, Kangayam, Ponwar, Siri, Galao and Krishna Valley.

Dual-purpose: Nimari, Dangi, Hariana, Mewati (Kosi). Rath: Ongole, Kankre; and Deoni.

One of the best buffalo breeds of the world, Murrah, is found in India and is being used as an improved breed for increasing milk production potential in other countries. Other useful breeds like Nili-Ravi whose home tract is now in Pakistan, Surti, Mehsana, Jaffarabadi and Bhadwari, also play an important role in milk production.

A number of breeds of goats are available in the country. Some breeds like Lohi, Beetal, Marwari, Sirohi, Surti and Osmanabadi do well in semi-arid, arid and desert conditions of the North Western part of India; other types like Gaddi, Chegu and Changthangi live only in cold and mountainous areas. Other important breeds like Jamunapari and Barbari are found in Central India; Black Bengal, White Bengal and Assam Hill in the eastern part; and Sangamneri, Malabari and Konnai Adu and Deccani in coastal areas. The Jamunapari breed of the chambal ravines in the Etah district (UP) has been extensively used for improvement of native breeds in India and many other countries. The dwarf breeds of goats like Black Bengal, Barbari, Malabari and Assam Hill are famous for high prolificacy (multiple births), early sexual maturity and generally produce two crops in a period of 14 months. The Pashmina (Cashmere) goats of Leh-ladakh produce the fine quality Pashmina fibre which has no substitute so far.

A wide biodiversity exists among the sheep breeds of India. The Indian breeds of sheep are mostly of coarse carpet wool types except those in the northern temperate region which produce softer and slightly finer wool. As many as 40 distinct breeds are available in many geo-climatic conditions. Among the apparel wool types of breeds are Kashmir Merino. Nilgiri, Hissardale and Karnah: among carpet wool and meat type are Chokla, Nali, Patanwadi, Gaddi, Changthangi, Muzzafarnagri, Deccani, Marwari, Magra, Jaisalmeri, Malpura and Sonadi and among meat types are Nellor, Mandya, Hassan and Madras Red.

The Indian wild pig is found in the Shiwaliks and Tarai areas throughout northern India. All domestic varieties except the Chinese are the descendants of the Indian wild pig.

The one-humped camel known as 'dromedary' is the most common type available in desert areas in India especially the North-western region comprising the states of Rajasthan, Gujarat and Haryana. The Yak is another milk animal for people living in the high mountain regions of Himachal Pradesh. India is considered as the original home of the red jungle fowl. Aseel, Desi, Kadaknath, Naked Neck, Chittagong and Basara are still considered as the important indigenous breeds of India. They are active and can easily withstand adverse conditions. Aseel or Malay fowl are reported to have given rise to all the present day breeds of poultry in the world.

The National Bureau of Animal Genetic Resources (NBGAR) in India has established indigenous farm animal literature and a germplasm resources data bank. Strategies for the establishment of an animal gene bank *in-situ* and *ex-situ* conservation have been formulated. Pilot breed surveys for

characterisation of several farm animal breeds have been undertaken by the Bureau. These included surveys on Hariana, Rathi, Nagori and Suri Cattle, Bhadawari Buffaloes, Yak and Mithun. The field surveys led to the generation of information on population dynamics, utilisation and management practices vis-à-vis the conservation status of these breeds in their respective breeding tracts. Work plan monographs, a manual on the National Animal Gene Bank of India, characterisation and description of the Tharparkar and Rathi breeds of cattle have been published. Genetic evaluation of animal genetic resources through cytogenetic characterisation of several breeds of cattle, sheep, goats camels, equines, pigs and poultry is in progress. Intensification and expansion of a Network programme on evaluation and conservation of animal genetic resources and work on physical mapping of genes will be undertaken in the immediate future.

With a large number of species (both domesticated and wild relatives of some) that exist in India, as well as the different status of knowledge regarding their population size, location and composition of populations, some ordering of priorities for identification, characterisation etc. is necessary. In addition, some decision must be made regarding optimum technical procedures to be applied within each species for their characterisation, evaluation and conservation. NBAGR should prepare a Memorandum of Understanding to be carried out with each of the collaborating agencies specifying in each of the terms under which co-operative programmes it would be carried out including those of proprietary rights and management of data and information. While the proprietary rights to data of the originator must be respected, safeguards should be provided in the policy statement which would prevent undue delay in making such data available for Bureau use.

The International institution, the World Trade Organization (WTO) will form a strong instrument for international economic affairs. Now efforts need be concentrated on finding ways to utilise the new system to the maximum benefit. It would be prudent for Indian researchers to take out patents on their products/strains/breeds to prevent them from being misappropriated by outsiders. For Indians the real importance of WTO lies in the role that a dynamic export industry can play in the nation's development. This will inject a new dynamism into the economy by finding new markets to sell our best valued germplasm of livestock for entering into a new economic regime.

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Recent advances in goat research

Ed.: P. Morand-Fehr
Collection of papers presented by members of the FAO-CIHEAM Network of Co-operative Research on Sheep and Goats at the 6th International Conference on Goats held in Beijing (China), 6-11 May 1996
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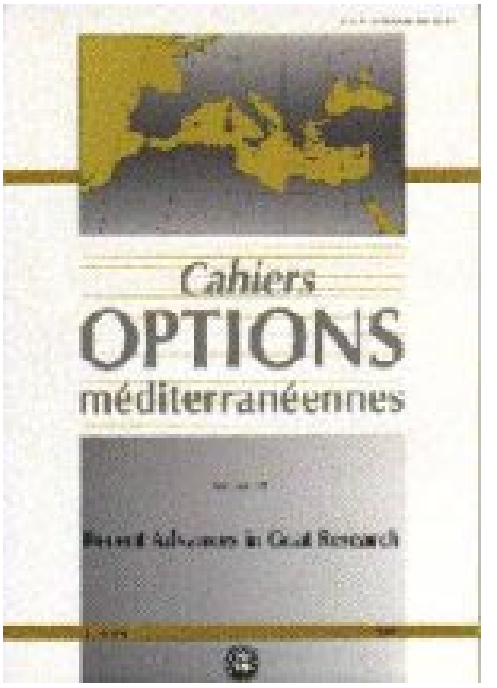
Since 1982, the International Conferences of the International Goat Association (IGA) (Tucson USA, Brasilia Brazil, New-Delhi India) played an important role to present the latest advances on goat research and development. At every conference, the FAO-CIHEAM co-operative network on sheep and goats has presented the activities and reflexions of its subnetworks and working groups. For the last conference held in Beijing the contribution of the network was particularly important: six invited papers presented in symposia, one invited paper presented in a round table, 29 short papers presented in sessions on production systems, nutrition, genetics, reproduction, products and environment.

All these subjects interest the main goat experts in Europe and Mediterranean region; this explains why this special issue of Options Méditerranéennes is published.
Unfortunately, all the papers written by network members could not be published. Consequently a selection of selected main papers was made.

In the first paper Rubino with Haenlein analysed the particularities of goat milk production systems in developed and developing countries, while at a round table on genetic resources, Gabina presented a paper on the management of European sheep and goat genetic resources. Chemineau *et al*. dealt with the control of goat reproduction particularly by analysing the new methods of the sector

Three important papers were presented in goat nutrition, which have been prepared with the contribution of all the members of the subnetwork Nutrition and Feeding Strategies (Coordinator E. Lindberg) . The diet selection is very important in goats, and Nastis mentioned in his paper that goats exhibited very rapid seasonal shifts between shrubs, grasses and forbs. Fibre and protein digestion in goats is a subject that raise controversies because the results principally depend on the experimental conditions. Lindberg and Gouda presented very objective conclusions on this subject. Recent interesting results on nitrogen and glucose metabolism in goats were clearly summarised by Landau *et al*.

The factors determining the quality of goat milk for cheese making are now more known. Jaubert analysed them in his paper.



Data collection and definition of objectives in sheep and goat breeding programmes: new prospects

Eds: D. Gabina & L. Bodin
Proceedings of a joint FAO-CIHEAM Network Congress on Sheep and Goats, Subnetwork on Animal Resources. Toulouse (France) 9-11 March 1997
Série A. Options Méditerr. 1997, Vol. 33, pp. 247
CIHEAM, Ctra. Montanana 177, 50059 Zaragoza, Spain
ISSN 1016-121-X

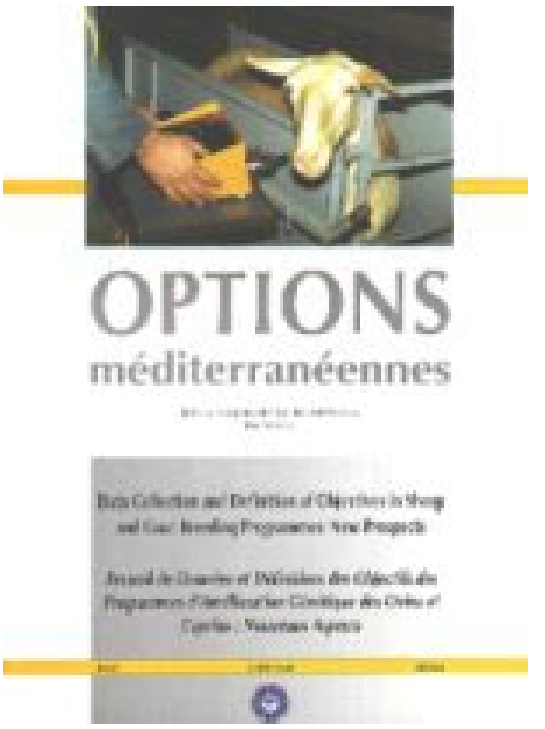
The use of advances in electronics and computer science is bringing important changes into the design and development of livestock breeding programmes. Electronic identification of animals has proved to be more reliable and economical than the conventional metallic or plastic ear-tags, making it possible to integrate this identification into the automated data collection systems in performance recording programmes. However, as often happens, the adaptation of these technological advances is not very widespread in sheep and goats due to the generally lower technological level of these production sectors.

The objective of the meeting was to obtain an updated and comprehensive view of the state of the art and the present research activities in the above mentioned subjects which are becoming key topics in sheep and goat breeding. Furthermore, it was the opportunity to present and discuss the results obtained by a FAO-Working Group of the Subnetwork on Standardization and Simplification of Weighing Protocols in Performance Recording Programmes for Lamb Growth Rate, which is a relevant subject in the simplification and reduction of costs in sheep breeding programmes.

The meeting was attended by 68 experts from Albania, Bulgaria, Cyprus, France, Greece, Hungary, Israel, Italy, Lebanon, Morocco, Poland, Spain, Tunisia and Turkey and 21 presentations were made.

During the meeting, it has been shown, that research concerning Electronic Identification and Automated Data Collection, is providing consistent results and it can be expected that these technologies will be ready to be used by most advanced farmers in the next years. In relation to the third point, Alternative Selection Objectives, it was shown during the meeting that important advances are being achieved in the held of the genetics of the resistance to some diseases in sheep. As a consequence, strategies to obtain genetically improved animals are starting to be designed.

Very interesting work has also been carried out in sheep in the methodology to select udder traits in order to improve their mechanical milking ability.



Fifth World Buffalo Congress

Eds: A. Borghese, S. Failla &V.L. Barile
Proceedings of the 5th World Buffalo Congress, organised by Associazione Nazionale Allevatori Specie Buffaline & Istituto Sperimentale per la Zootecnia
Caserta, Italy, 13-16 October 1997
ISZ, Via Salaria 31, 00016 Monterotondo, Rome, Italy
E-mail: isz@flashnet.it

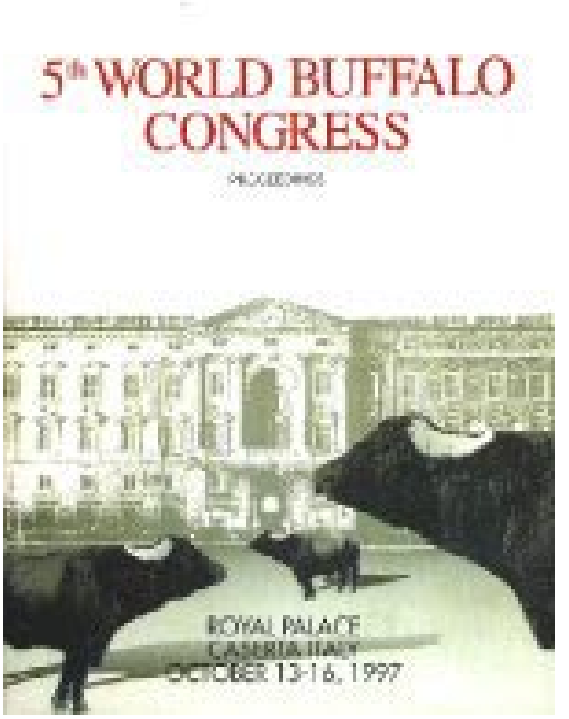
The 5th World Buffalo Congress was held at the Royal Palace la Reggia at Caserta and organized jointly by ANASB (Associazione Nazionale Allevatori Specie Buffaline) in Caserta and the Istituto Sperimentale per la Zootecnia (located in Monterotondo). The Congress registered more than 150 participants form more than 25 countries from Europe, Asia and South America. It was preceded by the 3rd Course on Biotechnology of Reproduction of Buffaloes which was attended by more than 70 participants.

The Scientific Programme comprised five Plenary Sessions with invited papers on: 1. Buffalo production in different environments; 2. Genetic improvement of buffaloes; 3. Reproduction; 4. Social and economic aspects of buffalo breeding and 5. Management processing and marketing problems and sessions with Short Communications in contemporary session.

The scientific presentations were very heterogeneous i.e. in reproduction varying from very basic aspects in reproduction in males over embryo transfer and OPU to recent advances in biotechnology.

In two evening sessions the country co-ordinators of the FAO Research Network at present headed by had its regular meeting. The Network has established itself very well and is very much appreciated by the countries. The Buffalo Newsletter helps to exchange information between the partners in the network and is very much appreciated. A 16 page summary of recent publications of Near Eastern European and European researchers on the Buffalo has been compiled. The Network is actively supported by REUR and RNEA. The meeting discussed amongst other things the venue for the next meeting of the Network: Turkey has expressed interest to host this meeting and the request of a number of countries to run a breed comparison trial using buffaloes from different origins. An outline of the theoretical requirements to run such a trial was given by Dr. Fabiola Canavesi (Italy). The following discussion centred on three main points: 1. Health requirements for the exchange of semen between the countries; 2. Testing of the different origins in one country only (proposed country Egypt) 3. Testing of the different origins in different countries. The meeting did not come to a conclusion, but decided to establish a small group to prepare a more detailed outline for such Programme with possible alternatives. The RO was asked to participate in the elaboration of the programme.

During the conference, discussions were held with Alpha Laval on aspects and problems of machine milking of buffaloes.



Etnobiologia e conservação do bovino Pantaneiro [Etnobiology and conservation of Pantaneiro cattle]

(in Portoguese)

Ed: M.C. Medeiros Mazza, C.A. da Silva Mazza, J. Robson Bezerra Sereno, S. Aparecida Santos, A. Oliveira Pellegrin

Empresa Brasileira de Pesquisa Agropecuária, Centro de Pesquisa Agropecuária do Pantanal Rua 21 de Setembro, 1880 Cx. Postal 109 CEP 79320-900 Corumbá, MS, Brasil Tel. 067-231-1430

ISBN 85-85007-38-9

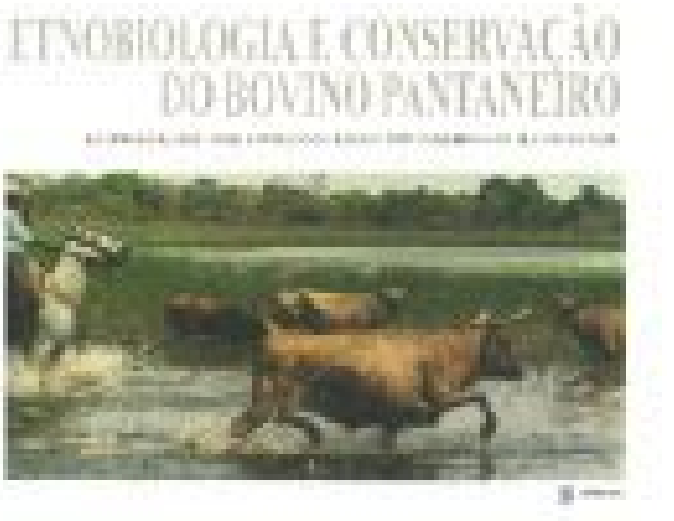
The subject of animal conservation is relatively new in Latin America. However, the high rate of substitution of "local" by exotic, less adapted, breeds has just recently awakened the consciousness of breeders and researchers who do not want to witness their complete disappearance. The establishment of national or regional programmes for the conservation of livestock breeds in danger of extinction are a must in order to avoid this imminent disappearance. Many Latin American countries, like Argentina, Bolivia, Brazil, Colombia, Peru and Venezuela have established National Conservation Programs for their animal genetic resources. In Brazil, the National Agricultural Research Corporation EMBRAPA has been co-ordinating research in this field since 1981.

The fast-growing of biotechnology may lead to new techniques of gene preservation. DNA-recombinant techniques, embryo manipulation, cloning of desirable genes from the same or other breed populations may one day become commonplace. In any case, we cannot risk the future of this important germplasm, which certainly will be utilised.

The initiative of writing this book, by a group of researchers, working with the Pantaneiro cattle at the Pantannal Agricultural Research Centre - CPAP is very important; it represents an attempt to define the historic origins of the breed, potentialities and an analysis of the production systems.

The book opens with a description of cattle-farming expansion in the Paraguay river basin, followed by a chapter on the history of the Iberian peninsula cattle introduced into the Americs during the time of Colonisation. Chapter three analyses the origin and the formation of the Pantaneiro cattle, its adaptation, acclimatization, and the probable contribution of other breeeds toward its development. The last part examines the ongoing programmes and measures for its conservation, together with a description of size and location of Pantaneiro cattle heards.

Finally, in order to increase the awareness of breeders and to inform the public about the state of the art of Pantaneiro cattle conservation programmes, this book, with its pleasant layout and excellent graphics -in Portuguese and in English- represents a good and informative contribution to the information of the initiative in progress for the conservation of the animal genetic resources.



Cibo biotecnologico [Biotechnology food]

(in Italian)

By C. Nardone

Hevelius Edizioni s.r.l., Via Vanvitelli, Pal. Ricciardi, 82100 Benevento
Tel.: xx-39-824-317558; fax: xx-39-824-51655
ISBN 88-86977-04-2

This book opens with the preface by Luciano Violante, the Chairman of the Italian Parliament and closes with a major technical contribution by Laura Conti. It rigorously analyses, in a very documented and exhaustive way, the problems arising from biotechnologies, with their scientific, technical and cultural implications, especially those related with biodiversity.

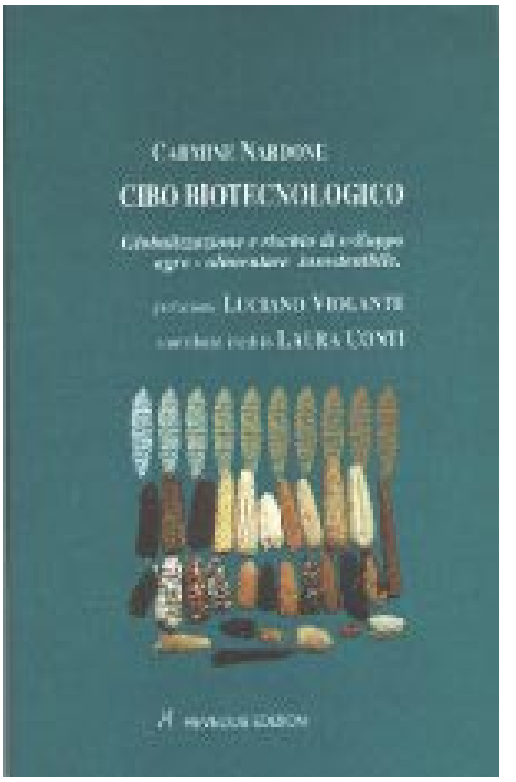
The analysis of the Author, an agronomist and member of the Italian Parlament, developed in seven chapters, starts from the globalisation processes in the agro-food system and follows with an analysis of the relationship between globalisation and biotechnologies, through the problems of food security and biodiversity conservation. After an analysis of the EU subsidies to the farmers and their impact on the continental and Mediterranean agriculture systems and on the quality of the production, Carmine Nardone deals with the attitude of the politicians regarding the agro-food problems.

Nardone researched and evaluated the global biotechnologies sector and produced a careful examination of what happened in the past, in order to obtain some indications for future developments.

This book underlines the irrationality of the present-day model of development that, beneath the differences between the rich and the poor places side by side the contradiction of a contemporary presence of over-production and food scarcity. An increasing reality together with the globalisation processes, actually in phase of achievement in most of the developed countries.

The "World-scale-economy" tends to produce a total separation between production and consumption, with the functional specialisation of the areas intended to the only supply of row materials, production or consumption

Nardone offers here a strong, clear, convincing definition, easy readable on a subject which dominates our time, particularly in Europe. It is a definitive evaluation from a man of principles with a strong western cultural approach. This book is meant to be read but it is also a honest and open discussion with oneself. The autocriticism also comes out clearly in a way that reveals a man of culture and of science who became a politician and not the other way around, as it happens in so many cases.



L'ovinicoltura nella gestione del territorio [Sheep production in land management]

(in Italian)
Proceedings of a Round table organised by Accademia dei Georgofili
Isola Capo Rizzuto, Italy, 7-8 June 1996
Suppl. to "I Georgofili. Acts of the Accademia dei Georgofili" 1996, Vol. XLIII
Logge Uffizi Corti, 50122 Florence, Italy, Tel.: +39-55-212114/213360
ISSN0367/4134

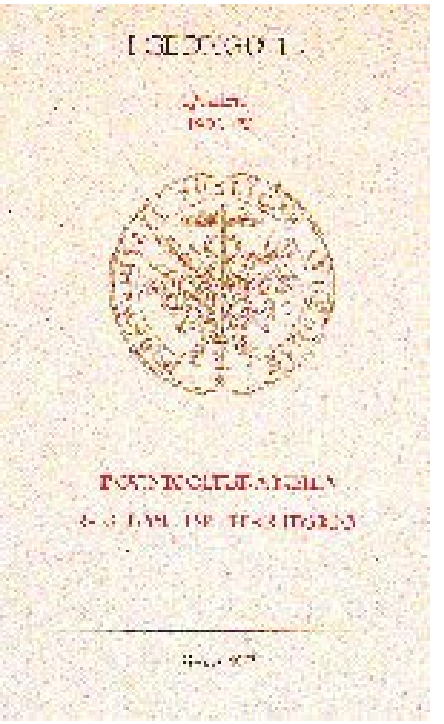
At the treshold of the 21th century, the commitment of scientists, technicians and agricultural operators turns towards the optimization of the ecosystem, according to the advanced technology evolution, the valorization of the natural resources, the protection of the environment, the security and specific needs of the consumers.

In this reality, that involves all the agricultural sectors for the definition of the modern concept of sustainable agriculture, sheep, thanks to their adaptability, can play a major and relevant role, supported by on technological innovations and/or the easy exploitation of rural resources that other animals are incapable to use.

According to this vision, the Accademia dei Georgofili organised in Isola Capo Rizzuto (in the Calabria region, in the Southern part of Italy, a very representative Mediterranean region for sheep production) a round table from the 7 to 8 June 1996, in order to define the state of the art regarding this kind of production.

During the two day debate, it was pointed out that:

- sheep production has a key role in the land and pasture management, role that must be increased with a rational management of the fodder resources;
- it is a necessity to conserve the agro-pastoral diversity, either for productive or ecological purposes;
- there is a necessity to help the modernization of the structure and the farm organisation, the realisation of an agro-industrial matrix and the interactions among the different levels of the productive network:
- public intervention is a priority in order to achieve a development that support the private intervention.



Editorial Policies and Procedures

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

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

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

Electronic publication

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

Types of Articles

The following types of articles are published in AGRI.

Research articles

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

Review articles

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

Position papers

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

Other published material

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

Guidelines for Authors

Manuscript submission

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

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

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

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

Preparation of the manuscript

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

Headings

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

Tables and figures

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

Tables

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

Figures

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

All the submitted diagrams, must be accompanied with the original matrix of the

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

References

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

Example for reference in a periodical is:

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

When there are more than one author:

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

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

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

For an article in the proceedings of a meeting:

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

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

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

Normes et règles éditoriales

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

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

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

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

Publication électronique

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

Types d'articles

Les articles suivants pourront être publiés sur AGRI:

Articles de recherche

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

Révisions

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

Articles spécifiques

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

Autre matériel pour publication

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

Guide pour les auteurs

Présentation du manuscript

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

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

Lorsqu'un article, après sa révision, sera accepté, on demandera à l'auteur d'envoyer la version finale révisée sur disquette (format 3$^1/_2$″) en Word 6.0 x Windows, ainsi qu'une copie sur papier.

Préparation du manuscript

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

Titres

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

Tableaux et figures

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

Tableaux

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

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

Figures

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

Références

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

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

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

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

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

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

S'il s'agit d'un acte d'une réunion:

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

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

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

Reglas y normas editoriales

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

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

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

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

Publicación electrónica

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

Tipos de artículos

Serán publicados en AGRI los siguientes tipos de artículos:

Artículos sobre investigación

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

Artículos de revisión

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

Artículos específicos

Se solicitarán puntualmente artículos sobre temas específicos para ediciones especiales.

Otro material para publicación

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

Guía para los autores

Presentación del manuscrito

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

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

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

Preparación del manuscrito

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

Títulos

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

Cuadros y figuras

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

Cuadros

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

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

Figuras

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

Referencias

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

Ejemplo en el caso de una referencia de una revista:

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

Cuando se trata de más de un autor:

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

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

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

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

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

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