DEVELOPMENT OF A MORENAS GALLEGAS CATTLE BREEDS PRESERVATION PROGRAM STARTING FROM PILOT HERDS

DESARROLLO DE UN PROGRAMA DE PRESERVACIÓN DE LAS RAZAS BOVINAS MORENAS GALLEGAS A PARTIR DE REBAÑOS PILOTO

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SUMMARY

In the last 15 years, galician autochthonous cattle populations have declined to a situation of vulnerability, between the critical status (less than 100 breeding females, very reduced genetic variability) and the endangered status (from 100 to 1,000 breeding females, which is not sufficient to survive). In order to prevent an eventual extinction, an Operative Program to maintain animals in situ (cattle farms and natural reserves) has been established to ensure preservation and facilitate study from a sociologic, genetic, ethnologic, productive and reproductive point of view.

Five herds of Cachena, Caldelana, Frieiresa, Limiana and Vianesa breeds, have been chosen taking into account their origin, history, localization, morphology, adaptability and resistance, and genetic markers. Pilot herds for each breed have been formed with 30 animals (24 females and 6 males), due to the scarce number of animals in these populations. Every reproductive group is formed by one male and 4 females, mating all these females with the appointed male. Rotational mating plans in the 6 reproduction groups are conducted to obtain the minimum increase in the consanguinity of the herd.

RESUMEN

En los últimos quince años, las poblaciones bovinas autóctonas de Galicia han descendido hasta una situación de vulnerabilidad enmarcada entre el estado crítico (menos de 100 reproductoras, variabilidad genética muy disminuída) y el de peligro de extinción (de 100 a 1,000 reproductoras y dificultades para sobrevivir). Para evitar una eventual desaparición se ha establecido un Programa Operativo para el mantenimiento de animales in situ (exportaciones ganaderas y reservas naturales) que garantice la

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preservación y facilite su estudio desde el punto de vista sociológico, genético, etnológico, productivo y reproductivo.

Se han elegido ejemplares de las razas Cachena, Caldelana, Frièresa, Limiana y Vianesa, en función de su origen, historia, localización, morfología, estado de adaptabilidad y resistencia, y marcadores genéticos. Se han formado rebaños piloto para cada raza con 30 animales cada uno (24 hembras y 6 machos), debido al escaso número de animales existentes en estas razas. Se han establecido 6 grupos de reproducción, integrados cada uno de ellos por 4 hembras y 1 macho, apareándose todas las hembras del grupo con el macho asignado, instaurándose un sistema rotatorio de apareamientos para obtener el mínimo incremento en la consanguinidad del rebaño.

INTRODUCTION

In Spain, concern with animal genetic resources is very recent. The state policy on livestock improvement was firstly based in crossbreeding, using improved foreign breeds, and therefore many autochthonous breeds were endangered, but it was difficult to establish preservation programs for some of these breeds.

It is not easy to say when an activity began, because other previous activities can be forgotten. Nevertheless, in Spain the first attempt in the preservation of endangered domestic breeds can be said to have emerged from the First World Congress on Genetics Applied to Livestock Production, Madrid, October 1974, where a round table entitled: The Conservation of Animal Genetic Resources, was celebrated and organized by Dr. I.L. MASON, Animal Breeding Officer, from Animal Production and Health Division, FAO (Food Agriculture Organization).

The results of this congress were so interesting that a Pilot Plan for Animal Genetic Resources Conservation was initiated in 1975. This plan gave birth to the first inventory of Galician autochthonous cattle breeds, under the supervision of Dr. I.L. MASON (FAO Consultant), where the Rubia Gallega was considered a paternal beef cattle breed to be fomented, and other breeds such as Caldelana, Cachena, Limiana and Vianesa, to be studied and defended. The report stated that these breeds were not endangered at that moment, but they should be in observation to be catalogued and used as genetic resources.

After 1975, in spite of the efforts made in the last fifteen years, on behalf of the Central and Autonomous Governments to establish a Germplasm Bank and the works on the genetic catalogue of Spanish native cattle breeds, we must say that the situation has been aggravated. Nevertheless, works with native breeds have been very important, because in many ways the loss of these autochthonous populations has been prevented.

But the loss of basic and objective values and breeding conditions has had a bad influence, even though it is certain that one of the most important causes for that loss has been the land owning system, an ancestral system derived from Germanic law, and that a long time has been necessary to adaptate to the new social behaviours, which has had a great influence on the abandonment of certain districts.

Some consequences of this have
been the abandonment of large pasturable areas, with important degradation in the environment, forest fires and erosion, and, of course, the loss of some animal genetic resources and the promotion of crossbred populations, where the crossbreeding does not show the heterosis nor the most valuable characteristics of these breeds, like rusticity.

This situation has made necessary the promotion of farm livestock breeds conservation and management programs, to carry out the recommendations of the FAO/UNEP Technical Consultation on Animal Genetic Resources Conservation and Management (Rome, 1980) and the Permanent Zootechnic Committee of the EEC (Rome, 1989), to establish a specific program of conservation of Morenas Gallegas cattle breeds. Nowadays, this is an operative program by Consellería de Agricultura, Gandería e Montes of the Xunta de Galicia (Agricultural Autonomous Administration, Galician Autonomous Government).

MATERIAL AND METHODS

Animal material consists of herds of Cachena, Caldelana, Frieiresa, Limiana and Vianesa breeds, which have been chosen taking into account their origin, history, location, morphology, adaptability and resistance, genetic markers and other measurable values. Their situation of vulnerability is between the critical status (less than 100 breeding females with very reduced genetic variability) and the endangered status (from 100 to 1000 breeding females which is not sufficient to survive).

In the organizational aspects, the election of a qualified technician and the financing of the actions have been considered. The person responsible for a preservation program must be honourable and specialized (one of the breeders, a researcher, a professor, an administrator...), familiar with the breed and with the preservation policy, accepted by the breeders and associations, being in good and permanent contact with them, and with other organizations (Government-central, autonomous and local-, FAO, preservation organizations...); at the same time the responsible must be an enthusiastic person in every aspect: technical, scientific and financial. Finally, this person must make and keep the herd books and be responsible for all data.

On the other hand, a preservation program is not profitable due to the maintenance of the animal costs, and therefore official support is necessary to pay the costs of production and commercialization of the products, but always executing preservation instructions. The main financial supports are:

- Subsidy per breeder under the program.
- Subvention per number of animals involved in the project.
- Aids per breeding female.
- Financial helps per progeny born.
- Aids to the number of weaned or mated progeny.
- Subsidy to progeny having recently given birth.
- Aids to buy sires or seminal doses of the rare breeds.
- Subvention to rural tourism, to
supplement the small income of the breeders.

- Promotion of herd size.
- Guarantee for commercialization of the products.

The operative methodology was the following:

a) Fixation of breed prototype: breed origin, historical antecedents, origin and distribution areas, ethnologic description, biometric parameters, census (purebred and crossbred), productive and reproductive aptitudes and performances, and breeding systems.

b) Actions to develop: conservation, recuperation.

c) Development of the basic program (1st stage): constitution of basic nuclei, identification, study and estimation of their genetic structures, cariologic testing of breeding animals, production and maintenance of males and females from pilot nuclei, with live animals and frozen embryos.

d) Development of the program (2nd stage): creation of new conservation nuclei in their natural area, with the support of governments, organizations, associations and breeders; control of reproduction; replacement of females in the collaborator farms with females from the basic nuclei and embryos (by embryo transfer).

e) Support payments: specific subsidies, structural improvements, acquisition of animals, and commercialization of products.

f) Knowledge of the breed in question and its possibilities: study of numeric and ponderal productivity, growing characteristics and beef qualities.

RESULTS AND DISCUSSION

Considering, on the one hand, the development of the EEC Operative Programs, and on the other hand, the serious risk of loss of some galician autochthonous cattle populations, whose decreasing censuses are obvious, the Consellería de Agricultura, Gandería e Montes, of the Xunta de Galicia, has worked out and initiated a Morenas Gallegas preservation program, with evident points of sensibility and opportunity, incorporating all technical, scientific and legal aspects, recommended by the international organizations.

The establishment of a live animal conservation program for an endangered breed must maintain genetic variation within the live populations over a long period of time. Because of this, the effective population size must be relatively large and minimum, and the animals must not be related or very little. Therefore, reproduction must be managed with a minimum consanguinity mating system, to preserve genetic combinations.

MINIMUM HERD SIZE. The estimated minimum herd size for a conservation nucleus and the number of animals which must be replaced per year vary with the authors and whether inbreeding is considered. Smith (1984) has estimated the minimum size of a breeding unit (10 males and 26 females) and the number of breeding animals that should be replaced annually (10 males and 5 females) to keep inbreeding levels to about 0.2 percent.
a year. Brem (1988) considers tolerable an inbreeding level of 1 percent per generation, and recommends a herd size of about 100 animals, to breed and select successfully on quantitative traits. Table I indicates the genetically effective population size and expected increase in inbreeding in a small herd maintained for preservation of a breed. The small numbers of males reduce the effective population size drastically.

Bodo (1990) has estimated bigger figures because he considers conservation nucleus populations in normal conditions of exploitation (10-100 males and 600-1.500 females). These figures in terms of breeding females, agree with Alderson (1981) and Maijala (1982), who have calculated that 750 and 1000 females are necessary, respectively. These theoretical minimum figures vary depending on the authors and situations, but sometimes the limited population sizes are lower than these minimum figures. In these cases, other preservation methods should be used, but at the beginning a closed nucleus should be formed.

Mason (1974) advised a mix of genes, using a combination of several breeds, to preserve rare genes. Smith (1984) considers that when technical, censal and economical factors limit the formation of a breeding unit, some recommendations should be kept in mind:

- It is better to establish many nuclei with few animals each, than many animals in few nuclei.
- It is more interesting to conserve nuclei of different animals (genotypically and phenotypically) than nuclei of similar animals.
- Conservation of pure lines of animals is better than a conservation of a mix of genes, to maintain a higher flexibility for the recombination of preserved lines.

After this discussion of criteria, the FAO/UNEP Expert Panel, have

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**Table I. Number of animals, effective population size and increase of inbreeding (Brem, 1988).**

<table>
<thead>
<tr>
<th>Number of males</th>
<th>Number of females</th>
<th>Total numbers</th>
<th>Effective population size</th>
<th>% Increase of inbreeding*</th>
</tr>
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<tbody>
<tr>
<td>50</td>
<td>50</td>
<td>100</td>
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<tr>
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<td>51</td>
<td>3.92</td>
<td>12.75</td>
</tr>
</tbody>
</table>

* Inbreeding per generation assuming random mating

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established that the minimum herd size for cattle must be 30 animals (24 females and 6 males), when herd members are not related; these animals should be a good representation of the breed.

In our case, pilot herds for each Morenas Gallegas cattle breeds, have been formed with 6 males and 24 females, because of low censuses and other questions.

Figure 1. Formation of the n+1 generation "reproduction groups" from offspring of n generation "reproduction groups". (Formación de los grupos de reproducción de la generación n+1 a partir de los individuos descendientes de los grupos de la generación n).
MATING SYSTEMS. Pilot herds are divided in 6 "reproduction groups" of one male and four females each; every female is mated with the male included in the same group. The mating system has been designed to avoid inbreeding, obtaining the minimum increase in the consanguinity coefficient. With a rotating mating system, showed in Graphs I and II, the minimum increase of inbreeding in closed populations is obtained. An additional advantage of

\[ G_{1}^{n} \rightarrow \square \]
\[ G_{2}^{n} \rightarrow \square \]
\[ G_{3}^{n} \rightarrow \square \]
\[ G_{4}^{n} \rightarrow \square \]
\[ G_{5}^{n} \rightarrow \square \]
\[ G_{6}^{n} \rightarrow \square \]

\[ = MALE \ (Macho) \]
\[ = FEMALE \ (Hembra) \]
\[ = MATING \ (Apareamiento) \]

**Figure 2.** Practical performing of the new "reproduction groups". (Realización práctica de los nuevos grupos de reproducción).

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this scheme is the easy understanding on the part of breeders and technicians.

**MANAGEMENT OF REPLACEMENT.** The number of breeding animals in the reproduction groups is fixed and cannot be increased (4 females and one male). The method to form the next generations reproduction groups is replacing every female with her daughter and male with one of his sons as far as possible.

**REFERENCES**


Mason, I.L. 1974. Introduction to round table

In this scheme proposed by Rochambeau and Chevalet (1990), males are always in the same reproduction group, but females rotate between reproduction groups. Some rules are followed for replacement and moving animals within and between reproduction groups, such as not replacing a female until its daughter is born, replacing old females as soon as possible, eliminating animals with defects, and so on.


