EFFICIENT DATA ACQUISITION AND MANAGEMENT FOR GENETIC IMPROVEMENT OF COMISANA DAIRY SHEEP IN SICILY.

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Summary

An information system was developed in order to efficiently collect and manage productive and reproductive data within a nucleus based program implemented in Sicily (Italy) to improve milk production in Comisana dairy sheep. Electronic identification of animals is used in the flocks enrolled in the breeding program. The information system consists of four components. The Database Program storages and manages all records related to the productive and reproductive events of each animal. The Field Interface Program facilitates the collection of records on farm and their transfer to the database. The Genetic Evaluation Program utilizes an autoregressive test day animal model to compute genetic and environmental parameters of milk yield traits in the population, and estimates the breeding values and their accuracy for all animals. The Mating Program allows the formation of breeding groups for matching of available rams and ewes for breeding, using a set of criteria chosen by the operator. These computer programs are completely integrated with each other and are mainly used to run the genetic evaluation of animals routinely. This allows to monitor the population and plan optimum mating within the nucleus. The information system was designed and is implemented to work efficiently in extensive dairy sheep systems.

Keywords: dairy sheep, data management, genetic improvement, software

Introduction

Effective on-farm animal identification and production recording systems are critically important in farm management and the genetic improvement of an animal population. A genetic improvement program and good management are essential components of a viable dairy sheep industry.

In the Mediterranean, variable and sometimes inaccurate production recording systems are used by the local farmers' associations. The difficulties encountered in creating an efficient system for data recording and management are partly due to factors related to the peculiarity of the dairy sheep production system, such as poor animal identification and the lack of farm infrastructures for the recording of milk production.

The Experimental Zootechnical Institute of Sicily (Italy), the Farmers' Association of Matera Province (Italy) and Cornell University (USA) have developed a specific information system for the complete management of data from the flocks in the nucleus

created in conjunction with the implementation of the breeding program to improve milk production in Comisana dairy sheep in the region of Sicily (Pinelli et al., 2002).
This information system facilitates the monitoring and management of the sheep population and supports all selection and breeding decisions needed for the genetic improvement program. The information system was designed and implemented to work efficiently in a wide variety of management systems: in intensive or extensive systems using marginal land resources, with efficient or rudimentary farm housing, with milking parlors or milking by hand.
This paper presents the different components of the information system developed to support the genetic improvement program for the Comisana breed. This system addresses not only the storage of data but also the collection of production and reproduction records, the genetic evaluation of animals and their mating.

Animal identification

The accurate identification of animals is a precondition for ensuring efficient flock management and for implementing a genetic improvement program in the field. In the nucleus flocks enrolled in the Comisana breeding program, electronic identification by means of the rumen bolus system is adopted.
The animals are identified by using individual tags and ear tattoos immediately after birth. At the age of six months the lambs receive the rumen bolus (Figure 1), which is ingested orally and will lodge permanently in the animals' reticulum. The rumen bolus is a ceramic capsule (cylindrical in shape and weighing 70gr) containing an ISOHDX type transponder of 32 mm. The transponder is a passive battery-less device functioning between - 25°C and + 85°C.
When stimulated by the handheld reader emitting low frequency electromagnetic waves, the microchip transmits a unique and inviolable number. The stick antenna enables the production controller to identify each animal without having to approach it closely, as shown in Figure 2. The handheld reader is connected to the records keeper. This is actually a field computer, which associates the microchip number with the animal's identification and allows the operator to enter the production and reproduction records for each animal in the flock.

The database

The database to store the production and reproduction data for dairy sheep or goat records was developed by the Farmers' Association of Matera Province (Italy) and is named *Progecom* (Figure 3).
The program works on a PC with a Windows 95/98/NT/2000 operating system. The general structure and the main functions of the *Progecom* database are:

1. **Farm identification and storage**. This function of the database stores various information related to the farm, such as its name, location, telephone number, type of farm etc. Each farm has a unique code, which allows for a fast and easy search of the database. The date of the last milk control is also automatically reported.
2. **Animal identification and storage**. The identification of animals is associated with a unique microchip number. All the information related to the individual animal, such as its sex, date of birth, sire and dam, farm, last event status code, lactation number, etc., is stored. The database allows for the easy retrieval of the productive and reproductive career of each individual animal.

3. **Record collector identification**. The names of the technicians of the breed association or the farmer association who are responsible for the collection of records on each farm are recorded.
4. **Productive and reproductive data management**. This function of the database allows the operator to store the productive and reproductive data collected in the field such as the date and type of lambing, the milk yield and other events such as the dry-off date, the sale or elimination of animals, etc.. The operator is also enabled to transfer this information to the main database. A number of editing filters are built into the system to ensure the high accuracy of the collected records. The lactation curve is also constructed for each ewe, if requested.
5. **Breeding groups management**. This procedure assigns a ram to a single ewe or a group of ewes, either with natural mating or with artificial insemination. The operator enters the starting date and the last breeding date for each group as well as the result of the pregnancy diagnosis. When the lamb's date of birth is entered, the program automatically assigns the sire according to the time interval between the breeding dates of the group and the birth date of the lamb.
6. **Milk composition storage**. The database can import the milk components, such as fat, protein, SCC, urea, lactose, total dry matter, etc., which will be associated with the milk yield records for the corresponding test day.
7. **Building the dataset for the genetic analysis**. A specific function of the program extracts the dataset used by the genetic evaluation program to estimate the genetic merit of all the animals.
8. **Genetic indexes storage**. The estimated genetic merit (the breeding values) can be automatically imported and stored in the database.
9. **Interrogating the database via screen reports**. The database provides a number of reports that have a direct application to flock management. These include: the list of the farm animals (the entire flock, the males, the lambs, etc.), the milk production for each farm in each control, the milk production in a predefined time interval for each farm, the list of animals that have produced more than a predefined amount of milk, the productive and reproductive career of each individual, the breeding groups, the morphological evaluation of each animal, the list of ewes that have lambed in a predefined time interval and the main statistical parameters. An image of the database highlighting the list of screen reports is shown in Figure 4.

Collecting records in the field

When dealing with dairy sheep, the collection of milk records on a farm is particularly laborious and typically biased owing to the poor identification of individual animals. This is why a specific field interface program has been implemented for the flocks involved in the Comisana breeding project. The field interface program consists of two software components named *Progport* and *Ovichip*.

Progport works on a portable personal computer and is designed to manage the productive and reproductive data on a farm. The software imports the records collected on the farm and provides the farmer with all the information related to the milking.

Ovichip works on the portable keeper and has two important functions: it associates the microchip number with the animal's identification and allows the operator to enter the individual milk production measured in the field. This program allows the records keeper to interrogate the identification of animals and greatly facilitates the collection of records on a

farm and their transfer to the data-base, while maximizing the accuracy of the records. Figure 3 shows a phase of the recording of milk production.

The genetic evaluation program

The *Genetic Evaluation Program* is an important component of the information system. The first function of the program is to edit the data coming from the *Progecom* database and structure it in a format required by the genetic evaluation program.
The genetic evaluation program uses an autoregressive test day animal model (TDAM) developed by J. Carvalheira *et al.* (1998). The computer software is based on a series of programs that build the incidence matrices according to the structure of the data, and compute the inverse of the genetic additive relationship matrices to be incorporated into the coefficient matrix of the BLUP mixed model equations.
The variance components, heritability and repeatability are estimated and used as inputs for subsequent genetic evaluation analysis in which the genetic ranking of all the individuals in the data set is determined. In the second stage of the analysis the breeding values (EBV) and the accuracy of EBV are estimated for all the animals in the data set after adjusting for the effect of environmental factors such as of farm, age, parity and days in milk.

The mating program

This component of the program allows the breeding groups to be formed for the progeny testing of young rams or for the matching of available rams and ewes for breeding by using a set of criteria chosen by the operator. The matching can be effected on the basis of age, production, location, genetic merit, etc, while controlling at the same time for the level of inbreeding in future offspring.

Conclusions

The information system that has been developed to support the nucleus-based breeding program with a view to improving Comisana dairy sheep in Sicily is making a significant contribution to increasing the efficiency of animal management and selection in the flocks that are involved in the genetic improvement program.
The information system has been designed and implemented to work efficiently in a wide variety of management systems, including those which are typical of dairy sheep farming in the Mediterranean areas. In Sicily, the dairy sheep production system is typically extensive, based on pasture and located in the hilly and mountainous areas of the island. Moreover, the amount of capital investment for management and infrastructure is generally low, and there are very few farms with a milking parlor. In such environmental conditions, efficient data acquisition and management are critically important for the implementation of a genetic improvement program.
An important feature of the system described here is that, though the technology involved makes the most of natural resources available, it does not interfere with traditional farming systems.

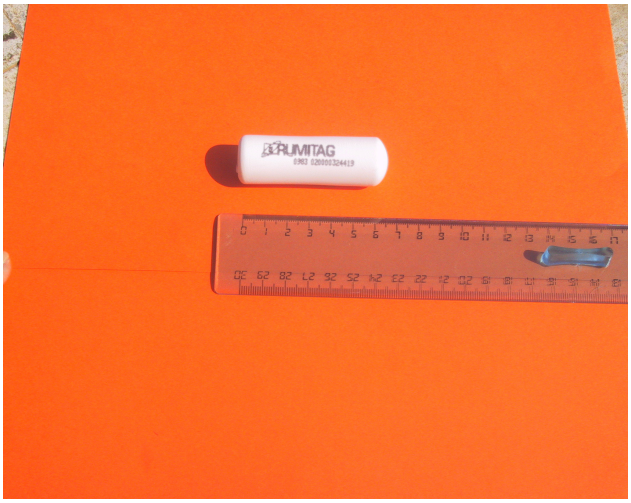

Figure 1. Rumen bolus microchip.

Figure 2. Reading an animal's identification in the field.

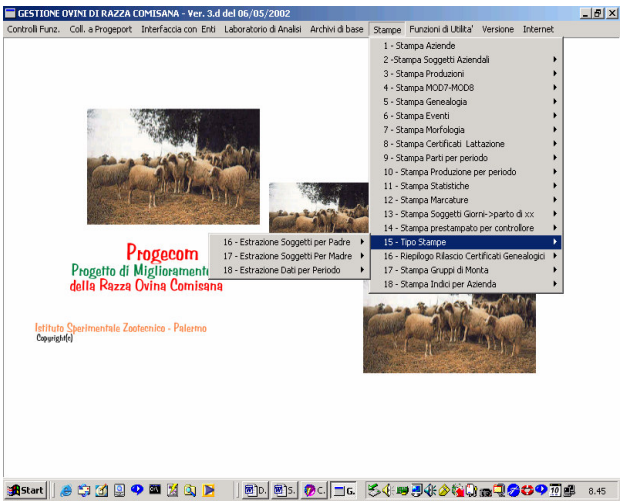

Figure 3. Progecom opening screen.

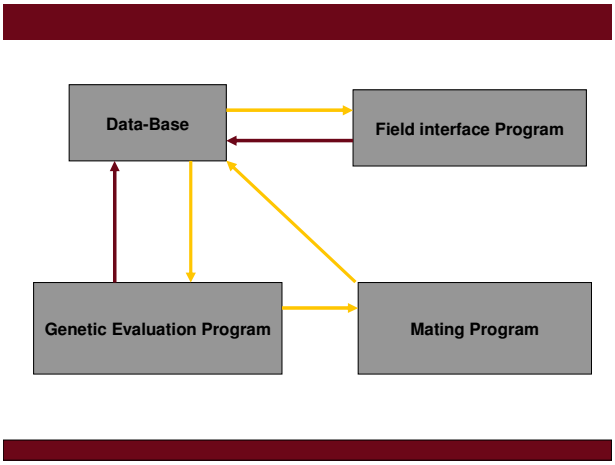

Figure 4. The data flow in the information system to evaluate animals and monitor the population.

References

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