
Breeding strategies for the Mediterranean Modicana cattle breed

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The cattle breed investigated in this case study is the Modicana breed reared only in Italy, in Sicily. This wine-red colour breed has Podolian roots and like other Podolian derived breeds has blood group factors indicating a probable affiliation with zebu. Modicana derived from other Podolian root breeds, like the Apulian Podolian and Chianina, and from dark-red Podolian of Illyrian type and maybe from some other cattle of Central Europe arriving in Sicily through the many invasions suffered by the island in the last centuries.

Modicana cattle breed

Modicana pure-breed has three varieties:

- 1) the Modicana of the lowland or Modicana Olivastra, representing the best developed and most common type;
- 2) the Mezzalina, living in the hilly region; and finally
- 3) the Montanara that lives in the mountainous areas. This variety is the least developed.

At present the most important production of the breed is milk. Meat is less important. Modicana produces meat mainly through cross-bred calves progeny of Modicana cows mated with beef bulls. In the past, the breeding purpose was mainly for milk yield and working. Development of agricultural technology caused disappearance of working as a breeding purpose. Milk yield average for cows belonging to the herd book is 2 786 kg for first lactation, 2 961 kg for second lactation and 3 122 kg for third and higher lactations. The average lactation length is 250 days. The averages for all lactation fat and protein percentages respectively are 3.58 ± 0.37 and 3.46 ± 0.17 .

Modicana is highly resistant to anaplasmosis, piroplasmosis and tuberculosis. Performances of Modicana, relative to other cattle breed, are good in fat and protein percentages in the milk. On the other hand, the Modicana breed has low performance in terms of milking. Overall the performances, in relation with the environment where the animals are bred, are relatively good, with good resistance to disease and high utilisation of poor pastures and by-products. Modicana does not have the desirable characteristics for producing meat as pure-bred, daily gain performance and quality of the carcass are poor. The skeleton is solid and big. Dressing percentage in young animals is about 53-54 percent and of adult individuals is about 45 percent for cows and 50 percent for bulls. Body size is medium to high with adult males weighting from 900 to 1 000 kg and adult females from 550 to 600 kg, height for adult males and females is, respectively, 155 ± 5 and 140 ± 5 cm. Morphology of the animals is not desirable either for milk production or for meat production. The wide spread technique of hand milking caused disagreeable udder morphology. Modicana has good maternal attitude, being able to produce calves in environments where no other breeds could.

At present Modicana lives in the mountainous and hilly regions of Sicily. Milk yield of Modicana is less than half of the average yield of the cosmopolitan breeds living on the island today. The possibility of using good quality semen from Modicana sires was denied by the complete absence of a semen market as a consequence of the former selection scheme with no bull progeny tested.

The number of animals is not well defined. In 1989 it was estimated at about 80 000 Modicana cows with only 4 360 registered in the herd book and milk recorded. Nowadays, the population size is decreasing, while the number of the registered cows is growing: 6 067 recorded animals on 338 farms. The average number of animals is 18 per farm. Most of the farms are in the class between 11 and 20 cows, with 63 percent of the farms having less than 20 cows and only 16.6 percent of the farms with more than 30 animals.

Modicana production system

Modicana is a cattle breed that is competitive only in areas where pasture productivity is very low, those areas are also the poorest in Sicily. In other zones more productive breeds are currently bred. In the last century people emigrated from the poorest zones of the island. Furthermore, many farms were abandoned and a large number of Modicana cattle were lost.

Nowadays in Sicily, Holstein Friesian is present mainly in the best territories, the Ragusa Province and the plain of Catania, where the Modicana breed used to give the highest production. Some herds of Brown Swiss are also present. In the rest of Sicily most of the cattle bred are Modicana, both as pure-bred and as cross-bred.

As only a few farms have milking machines, most of the farmers still hand-milk. Many farmers still milk cows leaving calves close to the mother, because it is believed that otherwise cows become difficult to milk. Recent research showed that the presence of the calf is not significant in milking and in the daily milk production of Modicana cows. A positive influence was instead found on lactation persistency.

The history of the breed shows that over time many different attempts have been made to improve productivity. All of them have failed. Between 1864 and 1867 a disease killed most of the cattle reared in Sicily. Brown Swiss animals were imported to the island to help restore cattle population and to improve milk yield, mainly by cross-breeding Modicana cows. The Modicana breed was at that time mainly used for draughting and secondly for milk. Cross-bred animals were less resistant to the severe conditions present in Sicily about one hundred years ago. Furthermore, the cross-breeds were less capable of working. For this reason the project was a complete failure. To re-establish a bovine population adapted to the Sicilian environment, farmers were obliged to back-cross to Modicana, obtaining a new type of Modicana with still some portion of Brown Swiss genes in their genotypes.

A subsequent plan to improve milk yield was made about fifty years ago to again cross-breed Modicana cows with Red Danish and Holstein Friesian bulls. This plan was not organized by any regional or local policies, but only by private intentions. This effort also failed because the cross-breeds were not adapted for working and for pasturing in the less productive meadows of the island. At that time animal power was also losing its importance. Pure-bred Holstein Friesian and Brown Swiss were imported to Sicily to use the more productive meadows. As a consequence Modicana was mainly confined to the worst territories of the island and the numbers of Modicana animals reduced. After the Second World War many farmers left the worst territories of Sicily to live in the main cities or away from the island. The result of this social change was that many farms rearing Modicana animals closed down.

The cross-breeding approach of Modicana with beef cattle began in 1975, mainly with Charolais bulls from France. The purpose was to combine the Modicana good attitude as “maternal breed” and Charolais beef morphology. Modicana cows have a good capacity for feeding calves even in harsh environments. The danger of cross-breeding most of the breed with beef cattle soon became real. For this reason the regional technical offices divided Sicily into two zones: in some areas (free zone) it was permitted to cross-breed Modicana cows with bulls of any other breed and in the other areas (pure-bred zone) it was permitted to breed Modicana cows only with pure-bred Modicana sires. Due to the lack of organization

Selection schemes applied

of herd books it was impossible to check if the law was respected in the pure-bred zone. The aftermath was that a portion of the Modicana pure-bred population was lost and the rule was cancelled after some years.

The outcome of the third attempt to improve efficiency of Modicana breed was similar to the first two, completely negative. The common peculiarity for all three failings strives to improve productivity and efficiency of the Modicana breed by cross-breeding with animals selected in different environments, having characteristics that do not fit in the severe Sicilian environments. At present, the plan actually followed is influenced by the failings of the previous strategies.

Present selection scheme actually followed

A selection scheme was recently planned by the Sicilian Association of Animal Breeders (ARA-Sicilia), the Regional Agriculture Offices and the Italian Association of Animal Breeders (AIA). The goal of the selection scheme is to improve milk yield and milk quality for cheese production.

About 20 percent of the estimated pure-bred cows, about 6 000 cows, are milk recorded with the A4 ICAR system that is recording daily yield every month. Milk samples are taken monthly from each cow to estimate fat and protein percentages. Lactation yield is estimated by the Fleischmann method. All lactations are projected to 305 day length. An animal model is then performed to estimate breeding values for milk, fat and protein yield and for fat and protein percentages. Another trait is also modelled to estimate breeding values: kilograms of cheese produced: a combination of milk yield in kilogram and fat and protein percentages produced for each cow. This last trait is assumed as a selection index.

Breeding values for all recorded population are estimated each year. Pedigree indexes are also predicted to choose, together with good morphological characteristics, five young bulls for progeny testing. Five hundred heifers are chosen according to pedigree indexes and good morphological characteristics. Semen of the selected young bulls is used to breed the heifers to obtain about 225 female calves, that have about 180 parities and about 125 complete lactations. Analysing lactation data through an animal model, the best bulls are selected for artificial insemination. Best cows are also selected to become mothers of sires and heifers, and pedigree indexes are estimated for the new generation of young bulls to be progeny tested.

The reason for the small number of young bulls and heifers tested is due to the fact that only part of the farmers join in the plan.

In the new selection scheme applied to the Modicana cattle breed the characteristic to be improved are: milk yield in relation to cheese production and meat production. To increase the commercial value of the milk it was decided to link milk from Modicana cows to a particular type of cheese named, in the Ragusa province, “Ragusano”, elsewhere with different names, but always a “Caciocavallo” cheese type. It was important to establish a connection between a well recognised cheese with Modicana milk, richer in fat and protein than Holstein Friesian milk. The plan is to improve milk yield using only pure-bred animals.

In the future the production of meat will be improved by cross-breeding Modicana cows with beef cattle bulls. This practice already exists in Sicily and at present produces about 35 percent of the meat consumed on the island. Modicana has good maternal traits even in a difficult environment. In the Sicilian hills and mountains, summer is always dry and grass production is close to nothing between May and October. Those areas are also difficult to reach for lack of roads and insufficiency of infrastructure. Improving maternal traits of Modicana cows can be done by planning a selection scheme and by keeping genealogy information and measuring calves daily gain at fixed intervals. Animals with good conformation for meat production and having legs resistant to pasture in harsh environments must be selected. This selection goal can be reached by adding to genealogy data and morphological evaluations performed on each animal by breed experts.

A good industry importing semen of Charolais and Limousine sires is present. When genetic indexes will be performed it will also be possible to select beef cattle sires giving calves, when mated with Modicana cows, having high production in the Sicilian environment.

The result will be to obtain two lines each specialised in a particular production with more possibility to survive in their respective environments. Nevertheless, offering both lines the possibility to register animals in the same herd book, genetic variability will be maintained.

Improved genotypes are actually disseminated through all animals of the herd book. The Italian law stipulates that all cows, both belonging to any herd book or not, must be bred with improved sires belonging to the herd books. A Modicana cow can be bred, by artificial or natural insemination, only by semen of Modicana sires registered in the herd book or by sires, of any other breed, registered in the respective herd book. To help dissemination of improved genotypes, semen of improved Modicana sires is offered for free to all pure-bred Modicana breeders.

Modicana pure-breds are mainly bred by natural insemination with sires in the herd. Male and female calves from the most productive cows are kept for replacement. Cows' productivity can have good estimation if milk

Traits included in the breeding goal

Dissemination of improved genotypes

is recorded, if completely voluntary. If cows are not milk recorded the choice is based on morphology and on rough estimation of milk yield. Cows are usually kept for a long time, it is common to keep cows for more than 13-14 years.

Mating is often influenced by meadow seasonal production, that in Sicily is more abundant at the end of winter and the beginning of spring, and cows naturally regulate months of highest grass production with the period of lactation peak. Modicanas bred in the low-input low-output system have seasonal breeding, most of the calvings occur between December and March with the lowest percentage in July. Use of artificial insemination is opposed by lack of Modicana bull semen. Only recently, with the development of a selection scheme has Modicana semen become available.

Breeding structure

The genetic improvement will act directly only for animals registered in the herd books. Some farms, with animals registered in the herd book, join the “selection nucleus”. Interest of the breeders for the selection scheme and advanced breeding system are essential. The farms belonging to the “selection nucleus” participate actively in the scheme by programmed matings to produce young male calves to a progeny test. These farms will be able to increase their income by selling improved genotypes, both offering semen and live animals. The rest of the farms participate in the selection scheme by recording milk yield for each cow thus, with a larger population size, improving accuracy of genetic indexes and enlarging genetic variability. Full participation in the selection scheme is voluntary. Farmers can join the “selection nucleus” anytime, but they must follow the requirement to permit a good operation level of the selection scheme. The farmers having animals not registered in the herd book can not participate in the selection scheme, but they can ask for the admission to the herd book and then fully participate. The requirement for joining the herd book is that all animals must have a morphological evaluation attesting Modicana breed morphology.

Farmer and Government involvement

Most of the expenses, about 80 percent, for planning, implementing and maintaining the selection scheme, for each cattle breed having an Italian herd book, are paid by the Italian Ministry for Agricultural Policy. The cost pays for herd book keeping, milk recording, planning and activity of the selection scheme, morphological evaluation, plus some cost to organize meetings, exhibits, etc. Modicana farmers, joining the herd book, pay for the remaining part whilst the Sicilian regional Government helps Modicana farmers pay a part of the remaining 20 percent.

The Sicilian regional Government recently requested that Modicana cows be exempted by the quota system of production, as in most other regions of the European Union. Sicilian farmers had very few quota allowed to

produce milk. The possibility to be released by a quota system will help the dissemination of the Modicana breed in those areas where it was substituted by Holstein Friesian and Brown Swiss cattle.

Several attempts were made to modify legislation to better implement the selection scheme, to help productivity and increase the value of products and overall to develop breeding of Modicana cattle. Funds were destined to farmers for buying and maintaining pure-bred Modicana animals. Funds were also destined to facilitate marketing of Modicana products.

The Italian Ministry for Agricultural Policy also helps research for developing genetic improvement and to improve environmental conditions where Modicana is reared, especially to improve the meadows where those animals are present.

The economic support to farmers for joining the herd book was not completely positive for selection scheme success. Many farmers joined the herd book although not really interested. The number of animals participating in the selection scheme is higher, but milk yield records and genealogy registration were less accurate having a negative effect on the genetic indexing and selection scheme. More successful was the support for marketing products of Modicana breed.

Strategy for developing the Modicana breed is coordinated by the Modicana Breeders' Association (A.N.A.MOD.). The technical body of A.N.A.MOD. is composed of animal production experts from universities, research centres and breeder associations. Representatives of regional governmental bodies are also present. About half of the components are Modicana breeders. All decisions regarding planning and implementing the selection scheme are made by this technical body.

The purpose of the scheme to be initiated and maintained is related to increase in milk yield by breeding animals in the less developed areas of the island. This aim can be reached only by rearing Modicana pure-bred or cross-bred. The goal is also social, as having farms in such areas provides work for people in those zones of the island from where people traditionally emigrated from to look for jobs in the main cities in or outside of Sicily. Rearing Modicana breeds in those less developed parts of Sicily is sometimes the only way to give economic value to those territories. Cultural reasons must not be forgotten. The long history of interaction between Modicana, men and environment helps to understand the adaptation and therefore furnishes hints to better manage animals in the actual production schemes.

Technical support

Reason for introducing the scheme

The presence of cattle of native origin interacting as part of the environment has high ecological importance. Farms with pasturing animals, keep meadows and grasslands in good condition, as a result of landscape and farm management.

Future activities and results

The support given by the national and regional governments is already encouraging farmers to breed Modicana animals. Support for marketing Modicana products will increase farm efficiency in the future especially for the creation of a brand name defining products only from Modicana farms. Consumers will be attracted by products having the Modicana label because it represents, especially for Sicilians, a synonym of traditional breeding and production. A typical label for local breeds was successful for Parmesan cheese of the Reggiana cattle. For Modicana it was decided to follow the same procedure. In the near future, governmental support and strategy for marketing Modicana products will stop the decreasing trend of breeding populations. For the following years the positive genetic trend of the selection scheme will be effective and the improved production of the breed contributing to increased economic efficiency of breeding Modicana animals.

Development of a milking machine together with the improvement of udder conformation are needed to increase milk yield and milk with low somatic cell count. Helping farmers to buy and use even simple milking machines is one of the key actions that can improve efficiency of farms. Also farmers should have a refrigeration system to enable them to keep milk without having problems of the loss of quality.

Another key action is to organize regular collection of milk for all farms. Modicana milk must be transformed in the cheese factory or in the farms without being mixed with milk from cows of other breeds. Only in this way can milk have a higher price due to certified cheese to be produced only with Modicana milk.

A good extension service should help farmers to make culling decisions, choose semen from improved sires, increase health and fertility of the herd and choose a feeding system. A specific extension service is needed for improved participation in the selection scheme.

Genetic changes of the Modicana breed of milk yield traits were not significant during the last ten years with the exception of a small positive trend for all productive traits for the last generations. Positive trends were probably due to farm selection and reduction of worst genotypes by the diminishing number of small and less developed farms. The expected genetic trend when the selection scheme will be fully operative is about 35 kg of milk yield per lactation. It is more difficult to predict genetic change for the planned selection to improve meat production by cross-breeding Modicana cows with beef cattle sires.