The farm model production in Mediterranean Croatia

A. Ivanković[1], B. Mioč[1], Z. Barać[2], I. Štoković[3], P. Mijić[4] & I. Jakopović[5]

[1]Dep. of Animal Production and Technology, Faculty of Agriculture, Svetošimunska cesta 25., 10000 Zagreb, Croatia
[2]Croatian Agriculture Agency, Ilica 101, 10000 Zagreb, Croatia
[3]Dep. of Animal Production, Faculty of Veterinary Medicine, Henizelova 55., 10000 Zagreb, Croatia
[4]Dep. of Animal Production, Faculty of Agriculture, Trg. Sv. Trojstva 3., 31000 Osijek, Croatia
[5]Ministry of Agriculture, Fisheries and Rural Development, Vukovarska 78, 31000 Osijek, Croatia

Abstract

Models of farm production in Mediterranean part of Croatia are special because they use at significant level traditional technologies and breeds, respect consumers' habits, and take care of the environment and its biodiversity. According to economic importance and impact on the environment, sheep production is dominant, followed by cattle production, while pig and poultry production are slightly present. Autochthonous sheep breeds of smaller body frame are dominant and main product is lamb meat. They produce from 70 to 300 kg milk per year. Breeding of dairy cattle use moderate levels of production pressure, modern technology and allochthonous genotypes. In beef production profiling of recognizable types of beef with the principles of organic production in the autochthonous breeds is noticeable. The main food sources for sheep and cattle production are Mediterranean pastures and grasslands, which partially limit the production, but on the other hand ennoble the final product. Numerous recognizable animal products are part of rural, gastronomic and touristic offer, and in accordance with traditional heritage preserve their way of production. Farm production doesn't distort ecological harmony of the region, and using traditional production technologies contribute to that. The awareness of necessity to keep the tradition, recognition, economic vitality of rural areas, habitats quality and entire biodiversity are developing. Experiences in animal production in Mediterranean part in Croatia point to effective models which combine traditional and new technological experiences in autochthonous breeds, with respect to consumer demands.

Introduction

Farm production in Mediterranean part in Croatia is special in terms of technology, genotypes and products quality. There is necessity of adjustment cattle breeding to environment and market demands with retention of traditional values. Of primary importance is sheep breeding based on autochthonous breeds, followed by cattle, goats, pigs and poultry production. In the Mediterranean part of Croatia significant number of equidae are bred, primary donkeys that were previously used for work as they are now mostly bred for hobby and tourism purposes, and to less extent for milk and meat production. There is no major horse breeding, but the development of tourism contributes to the construction of new farms and horse breeding.

The main parameters which influence on animal production of Mediterranean part in Croatia are: climate, lands, forage, breeds and market. The clime is one of the basic parameter in livestock production since it considerably determines the technology, suitable breeds and

productivity. Its influence can be reduced using modern technologies which make the production process less dependent on climatic conditions. For example, unfavorable climatic impacts on livestock animals can be reduced to some extent, but this requires new investments in objects, equipment and renovation of agricultural lands. Such solutions considerably increase the cost of production, provide limited effects and can disrupt sensitive ecological Mediterranean system. Experiences indicate necessity to adjust direction of production, technologies and genotypes to the extent which target production make less demanding and economically sustainable. Climatic environment and available agricultural area define the yield and quality of forage which are the basis of competitive livestock production. Potentials of Mediterranean pastures and cultivated lands are generally modest but the quality is high and botanical composition is often very specific. Karst Mediterranean pastures are efficiently used in production of sheep meat and milk, while the cultivated areas of karst are mostly in the function of cattle breeding, along with other aspects of production (field crops, vegetable crops, pomology, etc.). The rich and quality pastures with utilization of traditional technologies contribute to high products quality. Examples of production of sheep cheese from the island and coastal area, lamb and kid meat and others products with recognizable quality and suitable prices provide approximate guidelines for future development of the Mediterranean livestock production. Therefore, special attention should be given to preserve the delicate ecosystem of the Mediterranean region.

Available Mediterranean agricultural areas are very diverse and have great impact on the production character. Coastal rocky pastures and bushes, with modest quantity of forage are dominated on those areas. Compositions of Mediterranean forage on available areas transfer part of its qualitative characteristics on meat, milk and other products. Market of Mediterranean and continental Croatia recognizes and appreciates animals' products from coastal areas and consumers are happy to have possibility to buy and consume them (milk, cheese, crud, meat from lamb or kid, beef, dry-cured ham). The necessity to preserve the identity of products and protection of consumers as well as producers encouraged the farmers to initiate through their own associations procedure for protection of geographical origin of a major number of native products.

Models of the livestock production in Mediterranean part of Croatia use traditional and new experiences, primary native genotypes and "soft technologies" in order to better preserve the originality of the environment. In that aspect, models of livestock production can be divided into: traditional, transitional and conventional, while considering the farm size can be divided into: small, medium and large. Considering the type of domestic animals that farmers grow, models of livestock production can be divided into: specialized and mixed. The largest numbers of farms involved in livestock production of Mediterranean part of Croatia are traditional and mixed type, while larger farms tend toward specialization which requires the introduction of classical conventional technologies.

1. Status of animal production in Mediterranean area of Croatia

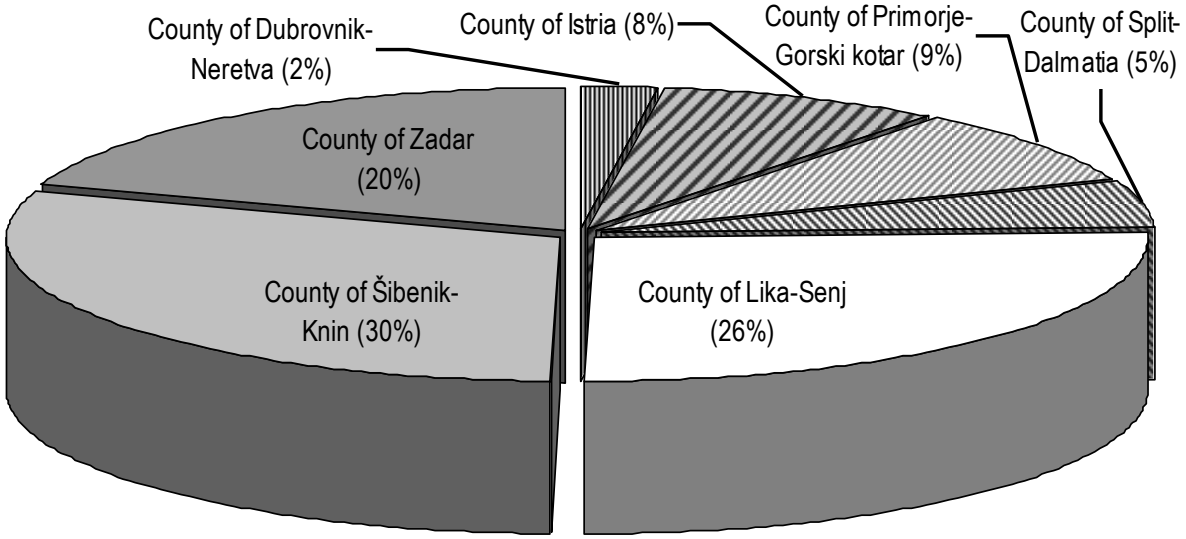
Farm production in Mediterranean part of Croatia is in a state of dynamic adjustment which has in recent decades experienced significant structural changes. There are numerous direct and indirect factors that affect the dynamic of changes in livestock production, and the main are: industrialization of livestock production, structural changes in rural areas (depopulation of villages, age of the population, decline of the interest in dealing with livestock production), Homeland War, market openness for food import from others countries and focus on sustainable (competitive) production. Each of there factors acted with certain intensity in a specific period of time. We can see that the structural changes of rural areas are especially noticeable during last two decades, and depopulation of villages is still very

present. Homeland War was in short period of time left deep traces on life in Mediterranean area and large part was exposed to the direct effects of war which considerable devastated livestock fond. Over the last decade market liberalization has led to import of cheaper food from aboard, what cause a pressure on competitiveness of small livestock households in Mediterranean area.

1.1. Sheep breeding

Sheep breeding is the primary branch of livestock production in Mediterranean area. Tradition, climate, karst areas and modest but extremely diverse vegetation made sheep breeding very suitable in these areas. In Croatia around 630.000 breeding ewes are bred, of which 48.500 are under selection control, of which about 53% of population (25.800, HPA 2010) are bred in seven county of coastal region (County of Istria, County of Primorje-Gorski kotar, County of Lika-Senj, County of Zadar, County of Šibenik-Knin, County of Split-Dalmatia and County of Dubrovnik-Neretva).

Graph 1. Breed structure of sheep under selection control in coastal counties



In Mediterranean areas autochthonous breeds are dominate, of which some are geographically isolated (Rab island sheep, Krk island sheep, Cres island sheep, Pag island sheep, Istrian sheep and Ruda sheep) while in submediterranean zone Dalmatian pramenka is dominated one. Sheep from Mediterraneam area have smaller body frame, lambs have smaller birth weight (2.5 to 4.0 kg), achieve smaller daily gain (0.2 to 0.3 kg) and have smaller dressing (22 to 26 kg).

The lamb meat (carcass) is the main reason for sheep breeding in mentioned counties, while milk production is less in use. The choice of production orientation is numerous and some of the most important are: traditional (simple) technologies, lower consumption of working labor, production of sheep milk is more demanding, simpler and cheaper objects, (non)organization of markets and etc.

Almost all sheep milk is processed into cheese and curd in dairy industry or on family farms using the old technology of production. During 2009 year eleven manufacturing facilities processed sheep milk from 471 producers (HPA, 2010), mainly from the central part of Mediterranean Croatia (Zadar County; 40.4%). From the total buy-out amount of sheep milk (2.742.000 kg), four cheese manufacture on island Pag bought and processed more than

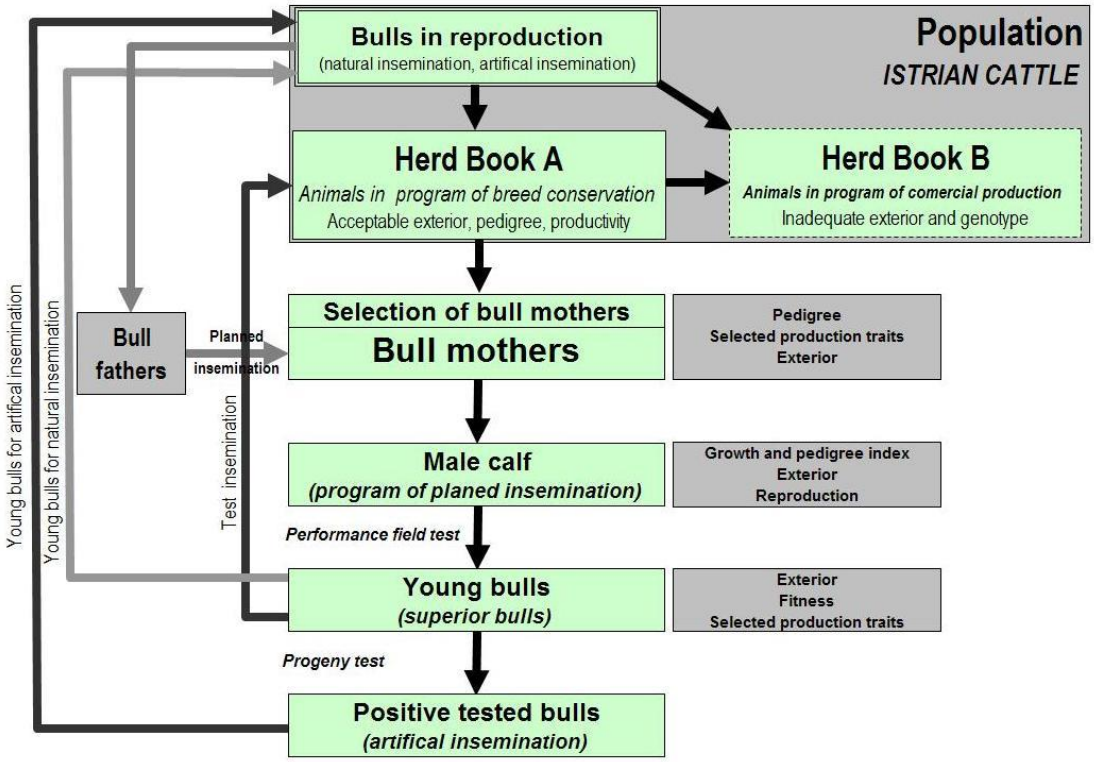
50% milk (53.2%; HPA, 2010). In terms of quality and hygiene indicators sheep milk on average contained 7.22% milk fat, 5.74% protein, 684.000 somatic cells/mL and 145.900 CFU/mL.

1.2. Cattle breeding

Cattle production in Mediterranean part of Croatia is mainly focused on milk and meat production, while in the past they were used for work. However, today they lost function as working animal, and with some other factors contribute to marginalization of autochthonous breeds. In Mediterranean area there are conventional dairy/combined breeds (Holstein, Brown Swiss, Simmental), breeds for beef production (Hereford, Angus) and autochthonous breeds (Busha, Istarian cattle, Gray Dalmatian cattle). In addition to mentioned breeds, one part of population is consisted from crosses.

Milk yield in Mediterranean area are based on small and medium sized herds and production technologies of moderate intensity. From a total of 1.480 farms with diary cows in mentioned area, 73.3% of them milk yield realized up to five dairy cows per herds, 20.4% possess from 6 to 15 dairy cows, and only 6.3% farm keep more than 15 dairy cows. The average milk yields per breeds do not differ significantly from the national average. The average milk yield in lactating Holstein cows are 6.690 kg, while Brown Swiss cows on average produce 6.020 kg, and Simmental cows around 5.280 kg of milk. Considering the height of lactation production, farmers from County of Istria achieves the best results (6.380 kg), while the average production per cow in County of Split-Dalmatia is more modest (5.630 kg). These results suggest that good production results can be achieved in Mediterranean area if the optimal environment and suitable management with particular emphasis on the quality of nutrition are ensured. In Mediterranean area of Croatia 25.2 mil. kg of milk is produced, which is 3.73% of total produced and delivered amount of milk in Croatia (675.3 mil. kg; HPA, 2010). In terms of quality and hygiene indicators, cows milk in average consist of 4.01% milk fat, 3.4% protein, 160.000 somatic cells/mL and 29.350 CFU/mL (HPA, 2010). Hygienic parameters of cows' milk are the results of farmers education considering milking process, udder protection and investment in milking equipment.

In Mediterranean area beef production is specific regarding to intensity of production, technology and breed structure. The modest pastures give advantage to autochthonous and beef breeds medium or smaller body frame. We can highlight the example of beef production from Istrian cattle from project "Permanent protection of Istrian cattle through commercial exploitation in system or rural development of Istria". Istrian cattle during eighties of the twentieth century and after losing the main (working) function were brought to the edge of biological survival. Government subsidies for Istrian cattle breeders during past two decades provoke an increase in population size from 100 to almost 800 animals today. Population is under systematic supervision under implementation of breeding program (Scheme 1). In order to develop a program of the economic viability of Istrian cattle, a program with organic beef production is launched and it's placing due to controlled gastronomic offer in rural tourism. The potential in organic beef production has also Gray Dalmatian cattle, especially in extensive production systems (cow-calf). For beef production to a minor extent are used allochthonous cattle breeds of smaller body frame (Hereford, Angus) in cow-calf systems



Sheme 1. Breednig program for Istrian cattle

In Croatia, including the Mediterranean area, we can observe production profiling and decreasing number of small mixed farms. Example is reduced number of milk suppliers from 58.800 to 22.250 (HPA, 2010) during last seven years in Croatia. A significant number of smaller farm producers disappear who were not willing or able to enter in the intensification (specialization) of production or increase production capacities.

1.3. Goat breeding

In the past goat breeding, along with sheep breeding, was the main branch of animal husbandry in Mediterranean areas in Croatia. However, today its importance much smaller taking accounts a total number of goats and economic production. The reasons lay in social-economic environment and in recent past when the goat production (extensive, traditional) was forbidden by law. In the eighties of the twentieth century goat production re-runs again, primary through milk production in continental parts of Croatia. In Mediterranean part of Croatia goat production is based on autochthonous breeds, almost exclusively through meat production with extensive use of traditional breeding technologies. From a total amount of delivered goat milk (4.21 mil. kg) just 3.8% is produced in Mediterranean area. Chemical composition of delivered goat milk, on average contain: 3.2% milk fat, 2.97% protein, 869.000 somatic cells/mL and 56.500 CFU/mL.

1.4. Equidee breeding

Donkeys, known as modest and endurable animals of arid areas are traditionally bred in Mediterranean part of Croatia. Currently, we have three autochthonous donkey breeds which were in the past important as working animals. Populations of Istrian donkey and North Adriatic donkey are in status of critically endangered breeds, while the population of Littoral Dinaric donkey is in somehow better position considering sustainability, so systematic monitoring for all three populations is needful. Donkey lost their function as working animals,

so the necessities for alternative way of utilization exist. There has been considerable interest in breeding donkeys as animals for recreation, tourists' activities and meat and/or milk production. Littoral Dinaric donkey has modest potential for milk yield, but since the market recognizes the donkeys' milk as food with healthy effects, it is possible to obtain considerable income through this type of production. Donkey meat is traditional meal in County of Istria which represents gastronomic delicacy.

Horse breeding in coastal region of Croatia is relatively modest. In the past in these areas were used smaller and more durable horses that have been preserved in very small numbers in some island and coastal regions. In the past horses were used for work, but today are mainly used in recreation purposes, for tourism and touristic events (Sinjska alka). Horse breeding in Mediterranean part of Croatia in the future will not have major importance and will be oriented for breeding of quality animals from other breeding areas. From the position of preserving tradition and genetic heritage it is necessary to support protection models of native genotypes of donkeys and to preserve native horse breeds which were for the centuries in these areas.

1.5. Pig and poultry breeding

Pig production in Mediterranean part of Croatia is almost negligible, although there is a long tradition of production of meat products which originate from quality pork hams for dry-cured ham production. In these areas around 30 processing manufactures are established which primary and mostly use traditional technologies in processing pork hams into dry-cured hams. The capacities of processing manufactures are around 300.000 dry-cured hams. Manufactures raw material for dry-cured hams production are delivered from continental part of Croatia or are imported from other countries. Severe pig production in the coastal area is not possible to establish because of the lack of areas for production of quality forages and it is important to take into consideration problem of environmental protection and ecosystems of carst areas. In accordance with mentioned above, the strategy does not include significant development of pig production in Mediterranean part of Croatia, and row material for dry-cured hams production will be ensured through connection with pig breeders from continental areas in Croatia.

Poultry production of coastal part of Croatia doesn't have any significant capacity, and in future there are no plans to make investments in it. Some of the limiting factors are: climate, forage production, and environmental contamination.

2. Models of animal production in Mediterranean

2.1. Models of cattle production

Mediterranean model of milk yield in Croatia is based primary on minor agglomeration of cattle and moderate level of specialization. Thus we can distinguish four basic production models: the traditional model in smaller and mixed farms, modernized traditional production model, model of smaller and conventional farms and model of specialized diary farms. Models are specific according to the level of investment, specialization, management and development potentials. Feeding is moderate emphasizing the use of pastures and avoiding the use of fermented forage in the diet. Winter feeding is mainly based on hay.

Traditional model of milk production in small and mixed farms use traditional technologies. Such farms have up to five dairy cows and occasionally achieve minor commercial surplus of milk. The level of investment in production is low as well as average milk yield (up to 2.500 kg/lactation). Milk production technologies don't get much attention

and considering nutrition small amount of concentrate are used in animal feeding. This model of production ensure minor income to economy and in a long term it is not sustainable

Modernized traditional production model achieve more suitable production effects due to technological improvement of traditional technologies (2.500 to 4.500 kg milk/lactation). It includes small dairy farms (up to 15 cows) and in coastal region there are around 20.4% of them. This kind of model requires a moderate level of investments in objects, genetics, and in skills. Considering used breeds, there are dairy and combine breeds, as well as intermediate genotypes (crossbreds). For farms that use this production model limited factor is available amount of land surfaces. The model of modernized traditional production is acceptable because of its adaptability and suitability for ecological system of Mediterranean environment, and its further development is expected.

Model of smaller and conventional farms includes dairy farms from 16 to 50 cows. It use modern technologies for milk yield and a moderately high level of investments, using dairy genotypes (Brown Swiss, Holstein), and achieve moderately high level of milk yield per lactation (from 4.500 to 7.000 kg). This kind of livestock production is a market – oriented and is acceptable considering environmental protection,

Model of specialized diary farms which include more than 50 cows per farm in Mediterranean area is very little represented. They use diary breeds (Holstein, Brown Swiss) and modern technologies which needs high invest to achieve high milk production (>7.000 kg). The main limiting factors for expansion these kinds of production model are: lack of arable lands for quality forage production and problem of environmental pollution. Bigger number of such dairy farms could potentially be a problem in order to preserve the ecosystem of Mediterranean area where tourism is favored as one of primary industries.

In coastal region of Croatia some special model of beef production has not yet been profiled, except for production of smaller series of specific meat (*mature meat of Istrian cattle*). Mediterranean region because of modest forage yield on pastures has limited potentials in meat production. One part of farmers reasonably believed that in submediterranean zone can be produced beef through extensive systems “cow-calf” using local genotypes or meet breeds with smaller body frame (Hereford, Angus). Previous experiences show that this way of production is rentable and local genotypes in comparison with allochthonous meat breeds are more adjustable to environmental conditions. Therefore, it is planned to further develop the program for recognizable beef production from autochthonous cattle breeds. The program of meat production from Istrian cattle shows good results because of appropriate connection of food chain between producers and consumers. Previous experiences indicate extremely importance of appropriate marketing promotions of meat so that consumers can recognize and appreciate these foods, and by paying higher price for such products reward the effort of farmers and compensate the lower meat productivity of autochthonous breeds.

2.2. Models of sheep and goats production

There are primary two basic technologies of breeding sheep and goats in Mediterranean areas of Croatia. The first one is extensive, traditionally used for meat production, especially younger and lighter lamb carcasses and this technology is based on the autochthonous, resistant and modest breeds bred in hard environmental conditions (Rab island sheep, Krk island sheep, Cres island sheep, Pag island sheep, Istrian sheep and Ruda sheep of Dubrovnik, Croatian spotted goat, etc.). In mating usually used method is wild mating, without knowing father origin which limits and considerably slows selection process. The basic facts of these technologies are minimal investments in farms, nutrition, equipment, veterinary expenses and etc. and getting an autochthonous and recognizable products. The

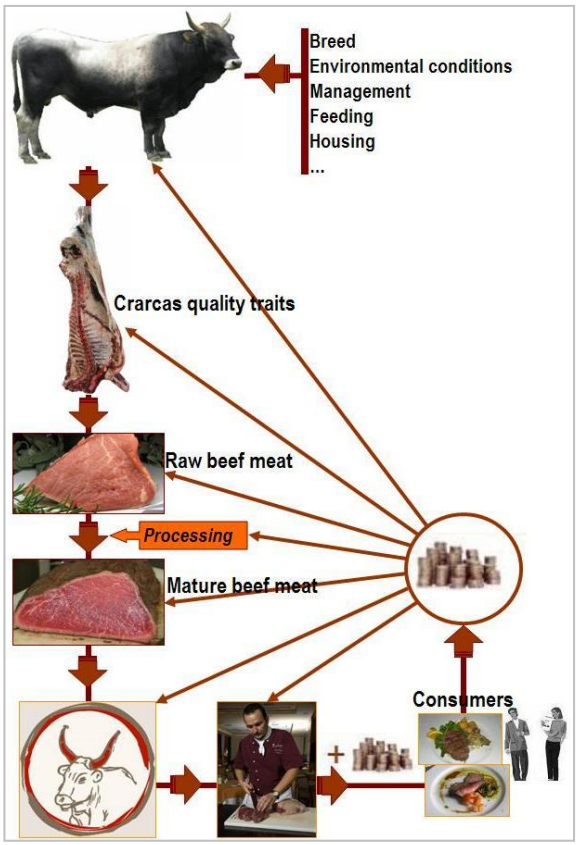
second technology is used in cheese production from sheep and goat milk, which are semi-intensive. It involves cots building, milking parlours, investment in equipment and mechanization (milking machine, milk cooling tank, a tractor with necessary equipment for hay making and etc.) and preparation of concentrate for winter nutrition. It involves organization of mating and insemination the best female individuals with best males. Animals are additionally fed by concentrates, mainly with corn kernel or braised grain in critically growing stages (prior to mating, at the end of pregnancy, at the beginning of lactation, and in some breeders during all tame of lactation). Since in this system the main goal is milk yield, and meat is another important product, lambs are early separated from mother and have been slaughtered at the age of 30 to 45 days, so you get light, young carcass of suckling lambs and kids. A certain amount of milk is processed into cheese on family farms using an old, traditional technology, while the other milk is processed in dairy industries. From sheep and goat milk in Mediterranean areas are produced albumin cheeses also known as crude or puina. Milk production are primarily based on autochthonous sheep breeds (Pag island sheep, Istrian sheep, Krk island sheep, Cres island sheep and Dalmatian pramenka) and in minor extent on imported East Friesland sheep with only a few herds. Depending on breeds, sheep produce from 70 (Cres island sheep and Krk island sheep) to 200 or 300 kg of milk (Pag island sheep and Istrian sheep) in lactation. Milk possess an excellent chemical composition and on average contain around 18% of dry matter, 8% milk fat and 6% proteins and is an excellent raw material for cheese production. From sheep milk are produced well known chesses with high quality, like: cheese from the island Pag, Cres, Brač, chese from Istria and etc. For production of goats' milk, in continental Mediterranean areas are used imported dairy breeds, mostly Alpines, Bounte Deutsche Edelziege and Saanen. Milk yield is very variable and dependent on the flocks and nutritional conditions. In average, milk yield from the above mentioned goat breeds are from 300 to 600 kg milk/lactation with 3.4% milk fat and 3.2% protein content.

3. Traditional farm products of the Mediterranean

Farm production in Mediterranean part of Croatia is recognizable by its products, appreciated on domestic and international markets. We can point out an example of Pag cheese as a special food with high quality, recognizable and highly appreciated at markets. Lamb meat is also appreciated and concerning its quality very recognizable, to which contribute genotype, special technology and botanic composition at Mediterranean pastures. In this respect, Mediterranean areas cherish its own characteristics, and initiated standardization and protection programs for certain products.

In terms of cattle production, as traditional products we can mention different types of cheese from cows' milk or mixture of several kinds of milk (cow, sheep, and goat). So we can emphasize "Lećevica cheese", "Cetina cheese", "Istrian cheese" and others. Mentioned cheeses are standardized, and for some others types of cheese the procedure for protection its originality is initiated. Worth to mention is "Lička basa" and "Škripavac" cheese, which were previously produced from milk from Busha cows. Since the actual population of Busha is small and insufficient for major milk production, specified types of milk products are produced from milk of other breeds in relatively small quantities. Production program for cheese "Škripavac" from Busha milk, as well as semi-hard cheese from Dalmatian Gray cattle is in preparation. Also, there is a preparation of program for beef production using traditional extensive technologies in Dalmatia and Gray Dalmatian cattle genotype. The meat from Istrian cattle is good example of a planned program for beef production, an additional bonus of origin and organic production (Scheme 2). Although the total amount of meat from Istrian

cattle is small, excellence, traceability and good marketing are examples of successful conservation program of endangered old breeds and its traditional values.



Scheme 2. Production program for mature meat from Istrian cattle

Sheep production is recognizable through traditional products from milk and meat. Mediterranean areas have tradition in production and consumption of sheep cheeses that are recognizable thanks to the special climate, genotype and production technology. Besides earlier mentioned Pag island cheese, numerous other types of cheeses (Istrian cheese, sheep cheese in sheep skin) provide stimulating incomes for breeders and cheese makers. Meat from lamb and kid produced in Mediterranean area are highly appreciated by local consumers and foreign guests. Almost the entire amounts of produced meat are spent through gastronomy in Mediterranean and continental part of Croatia. Dry meat from ewes and goats (kaštradina) is one of the traditional products for which standardization is implemented as well as specific preparation of markets.

Dry-cured hams are recognizable delicacy of Mediterranean. Methods of processing and drying of dry-cured hams s are specific for some areas, which are why we have several types of dry-cured hams (Dalmatian, Istrian and others). Climate and technology of production makes it special compared to other dry-cured hams from neighboring regions. Processing capacity of dry-cured ham manufactures in Mediterranean are around 300.000 pieces per year, although developing an additional processing capacity is ongoing as well as procedure for protection of geographic origin for Dalmatian and Istrian dry-cured ham. Notable problem in dry-cured hams production is lack of quality raw materials (pork ham) with clearly defined genotypes.

4. Influence of farm production on environment

Farm production in Mediterranean part of Croatia achieved primarily positive effects in terms of production of high quality food, preserving the ecosystem, and small negative influences on the environment. Reduction in livestock, especially numbers of cattle in last two decades have negative effects on sustainability of habitats, particular Mediterranean pastures. Succession of pastures has been observed in areas where grazing stopped thus reducing the biological diversity of habitats, especially valuable plant communities and rapid spreading of aggressive weeds. Adjusting to the EU Directive of habitats, Croatia has plans within the frame of ecological network NATURA 2000 for preserved areas to take care about protection of habitats. In great manner traditional production systems can contribute to that habitat protection. For example, it has been proved that when the island Cres and Krk have no sheep and goats, i.e. carcasses, population of griffon vulture are directly endangered which the symbols of the island are. Livestock at pasture at the same time provide fertilization of karsts pastures and thus induce the development of certain vegetation, not allowing the forest, weeds and briers to plant propagation.

Developed cattle and sheep production contribute to maintain of rural areas in their original function. Example of island Pag shows how income from sheep production contribute to the preservation of pasture lands and contribute to the quality of life in the rural area. On this island interest for sheep breeding does not fall because the actual production technologies, pasture lands and interest of consumers for cheese and lambs ensure a save placement with minimal investment. Income that is realized is stimulating for young farmers to continue their traditional way of sheep production. The importance of livestock in the Mediterranean areas is reflected in the maintenance and cleaning the areas from low and dry bushes and thus preventing fires.

5. Conclusion

Models of farm production in Mediterranean part of Croatia substantially contain traditional elements, although certain level of introducing of modern technologies and genotypes are noticeable. In cattle production in last decades, there have been significant structural changes that reflect reduction in the number of diary farms, introduction of conventional dairy breeds and modern technologies on larger farms. There are interests for programs of extensive beef production, primarily for autochthonous genotypes and meat breeds of a small body frame. In sheep production traditional technologies are dominated which use autochthonous genotypes of sheep with production focused primarily on production of lamb meat. Pig and poultry production are not developed, and specific programs for production of products from dried meat and dry-cured hams are based on raw materials from the continental part of Croatia. The market recognizes and appreciates traditional products, which supports actual livestock production of coastal area. Actual size of the farm i.e. populations of cattle, sheep, equine animals, pigs and poultry are not threat for ecological systems of Mediterranean and is in accordance with the economic orientation of the region.

6. List of reference

Barać Z., Mioč B., Havranek J., Samardžija D. (2007): Paška ovca: hrvatska izvorna pasmina. Matica Hrvatska, Novalja.

Caput P., Ivanković A., Prekalj G., Šubara G., Šuran E. (2009): The Istrian cattle. AZRRI, Pazin.

Caput P. (1996): Govedarstvo. Celeber, 1996.

Caput P., Ivanković A., Konjačić M., Pranić D., Dadić M. (2004): Načini trajne zaštite i iskorištavanja izvornih pasmina domaćih životinja u Hrvatskoj. Zbornik radova 39.

znanstvenog skupa hrvatskih agronoma s međunarodnim sudjelovanjem, Opatija, 17-20.02. 2004., 647-650.
Hrvatska poljoprivredna agencija (2010): Godišnje izvješće za 2009. Zagreb.
Ivanković A. (2004): Konjogojstvo. Hrvatsko agronomsko društvo, Zagreb.
Mioč B., Pavić V. (2002): Kozarstvo. Hrvatska mljekarska udruga, Zagreb.
Mioč B., Pavić V., Sušić V. (2007): Ovčarstvo. Hrvatska mljekarska udruga, Zagreb.
Uremović M., Uremović Z. (1997): Svinjogojstvo. Agronomski fakultet Sveučilišta u Zagrebu, Zagreb.