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Evaluating dairy sheep systems for conversion to the optimized agroecological model

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Abstract. Interest is growing in promoting sustainable animal production systems because of their healthy relation to the natural environment. Ecological systems stand out, as they pay special attention to preserving natural resources, promoting biodiversity, guaranteeing animal well-being, and obtaining healthy products from raw materials and natural processes. The objective of this study is to evaluate proximity to the agroecological model of dairy sheep systems in Sardinia, Italy. Based on the methodology described by Mena et al (2012) for goat milk systems, a questionnaire was designed for dairy farms, including 55 variables integrated into 9 indicators. Twenty-two dairy sheep farms were surveyed, all farms with Sarda breed. The results show that farms are close to this agroecological model, necessitating some changes in aspects related to: i) use more sustainable products for the cultivation of forages and grains; ii) improve farm management and data collection and iii) increase the autonomy in products sales.

Keywords. Sarda breed – Sustainability – Index.

I – Introduction

An agroecological production system should comply with the following requirements: contribute to the equilibrium of agricultural systems integrated with the natural environment, contribute to sustainable agriculture development, minimize all types of contamination, respect animal well-being, avoid systematic use of chemically synthesized substances, and renounce the use of genetically modified organisms. According to these requirements, grazing livestock systems, in which feeding is largely based on pasture, could already be functioning close to the agroecological model. In Italy, Greece and in some regions of Spain, in Corsica and French PaysBasque, dairy sheep systems are substantially based on forage direct utilization (Sitzia and Ruiz, 2016). In Sardinia are raised more than 2.5 mil dairy sheep. The animals are commonly fed incultivated or natural pasture and the farming system is strictly linked to the environment.

The objective of this study is to evaluate approximation to the agroecological model of dairy sheep systems in Sardinia (Italy). Furthermore, those aspects which should be improved in order to increase sustainability are analyzed in the light of sustainable animal production and management techniques.

II – Material and methods

Based on the methodology described by Mena et al. (2012) for the conversion of mountain dairy goat systems into ecological systems, a questionnaire for sheep farmers was designed, including 53 binominal variables (yes = 1 or no = 0). Variables (NV) were grouped into nine multi-criteria indicators, as shown in Table 1. Each indicator was assigned a value based on the proportion of positive responses of this indicator's variables, with 100% as the optimum for each indicator. Later, an organic conversion index (OCI) was elaborated using the sum of the ponderation value (PV) for each indicator. In this index each indicator has a different ponderation value, the ponderation value was fixed by organic expert group.

Table 1. Indicators of level of ecological conversion: number of variables integrated into the indicators (NV) and ponderation value (PV)

Indicator	NV	PV (%)	Indicator	NV	PV (%)
Feeding management	6	16	Breeds and reproduction	3	6
Sustainable grassland management	6	14	Animal well-being	11	8
Soil fertilization	5	6	Food safety	4	14
Weed and pest control	6	8	Ecological management	6	16
Prevention and treatments	8	12			

Twenty two dairy sheepfarmers were interviewed in 2016 in Sardinia island, all farms with local Sarda breed.

Statistical analyses were carried out using the program SPSS.20 (2016).A descriptive statistical analysis of each indicator has been conducted (mean and standard deviation).

III – Results and discussion

In Table 2the level of approximation to the agroecological production modelcalculated for each indicator is reported. From these results, it is possible to describe three groups of indicators according to the obtained value: i) 30-50% (Ecological management), ii) 50-70% (Weed and pest control, Prevention and treatments and Soil fertilization) and iii) more than 70% (Feeding management, Animal well-being, Sustainable grassland management, Food safety and Breeds and reproduction).

Table 2. Indicator level of approximation to the agroecological production model (average and standard error) in Sarda dairy system

Indicator	Average (%)	SE	Indicator	Average (%)	SE
Feeding management	72.7	15.9	Breeds and reproduction	90.9	16.7
Sustainable grassland management	84.8	11.4	Animal well-being	79.8	7.9
Soil fertilization	66.4	14.3	Food safety	89.4	15.3
Weed and pest control	50.8	20.2	Ecological management	32.6	18.9
Prevention and treatments	59.7	12.8	OCI	67.2	7.9

The average value of Weed and pest control (50.8%) and ecological management (32.6 %) indicators resulted equal to or less than 50%, and therefore they require particular attention in order to get to an optimal value to fit the agroecological system requirements.

The Ecological management indicator is the farthest from what would constitute adequate agroecological management, which includes: (i) data recording and technical-economic management, essential to obtain and maintain organic certification, (ii) direct marketing of the products in order to make them available to consumers who value them, and (iii) farmer efforts toward ecological conversion. All farmers surveyed currently sell their milk to large milk cooperatives, none of which has an ecological or sustainable product line.

With respect to “Weed and pest control”, the use of conventional products for treatment is the main problem. Almost none of the farmers use organic products (4% farmers).The others analysed indicators range between 54 and 87 percent of positive situation.

In the case of the indicator “Prevention and treatments “, the use of phytotherapy or homeopathy is not widespread, only 9% of breeders do it. Likewise, they do not use cleaning products allowed by European regulations in organic farming, only the farmers who are in organic production (13.6%farms) do it. For the remaining 6 determinants, the percentage of farmers who meet it is high, ranging between 50 and 95%.

The indicator “Soil fertilization” has a value of 66.4%. Even almost all farmers do an optimal management of farm livestock waste, the low use of fertilizers not registered as ecological and the scarce attention to soil characteristics (farmers who do not do soil analysis) represent the two conditions of the indicator with the lowest score. The rest are above 90%,

The indicators related to feeding have a score above 70% (Feeding management and Sustainable grassland management). With respect to Feeding management, the situation of the systems is acceptable, mainly due to the fact that the animals pasture daily and the majority of the farms produce hay and more than 60% produce grain to feed their animals. This points out the high level of farm feeding self-sufficiency; in more than 90 % of farms, at least 50% of the dry matter ingested comes from own farm. For the conversion, only it has to change conventional feeding to organic feeding. The very deficient feeding autonomy is reported by Mena et al. (2012) as a principal constraint for the conversion in dairy goat farming system in South of Spain where only few farms produce fibre or/and grain. With respect to Sustainable grassland management, the majority of the farmers perform techniques according to a sustainable management, but they should improve pasture productivity by means improving techniques (sowing, fertilizer...).

Finally, the indicators of Animal welfare, Food safety and Breeds and reproduction have values between 70 and 90%. The tail docking and the short period during which lambs are allowed to nurse from their mother are the aspects that should be modified to improve animal welfare. For the other two indicators the values are close to the optimum.

Table 3 shows the values for three traditional livestock systems in the Mediterranean area: Sarda dairy sheep breed in Italy, Segureña sheep breed specialized in meat production in Spain and Payoya goat for dairy production in Spain. The highest values of the OCI appear in the systems studied in Sardinia and the lowest values in the Payoya goat systems. Payoya farms are located in mountainous areas, where it is difficult to cultivate and the management is general low, although this aspect has improved in recent years. Comparing the two sheep systems, the differences appear mainly in the Sustainable grassland management, Breeds and reproduction and Ecological management. In the Segureña breed systems any improvement of the pasture nor forage cultivation is done, and the majority of the farms use artificial insemination in the reproductive management. Instead, they have a better score in terms of Ecological Management, they make an optimal record of the data of the farm, they sell their lambs to cooperatives and they have made the conversion to ecological.

Table 3. Average for each indicator in three traditional small ruminant systems in Mediterranean area

Indicator	Sarda dairy sheep breed	Segureña meat sheep breed¹	Payoyadairy goat breed²
Feeding management	72.7	81.4	49.6
Sustainable grassland management	84.8	61.0	29.4
Soil fertilization	66.4	56.4	20.5
Weed and pest control	50.8	63.3	79.5
Prevention and treatments	59.7	53.2	38.2
Breeds and reproduction	90.9	64.7	77.9
Animal well-being	79.8	70.7	76.5
Food safety	89.4	70.7	66.2
Ecological management	32.6	61	5.9
OCI	67.2	64.4	54.9

¹ Ruiz *et al.*, 2016; ² Mena *et al.*, 2009.

IV – Conclusions

Dairy Sarda breed farms have a high value of the indicator of approximation to agroecological production model. To achieve the complete conversion to agroecological or organic systems, the following changes must be made: i) to use inputs allowed by organic regulations (fertilizers, feed and medicines), ii) to eliminate traditional techniques such as docking lamb's tail, iii) to improve on farm data collection and iv) to search new circuits of proximity marketing and to diversify cheese and dairy products with the aim to create more sustainable channels that recognise the right value to organic products.

Compared with other Mediterranean breeding systems, the Sarda dairy systems are better positioned towards conversion, especially in terms of food management and pasture resources.

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