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Abstract. The aim of this work is to analyse the evolution of 10 technical-economic indicators during the period 2006-2008 in 6 pastoral farms of Andalusia (Spain) in order to observe the most determinant factors for the viability of systems. For the technical-economic analysis, an adaptation of the FAO/CIHEAM indicators list has been used. Values of indicators for each year and also for the whole of the period have been obtained. By consequence of increases of quantity and price of feed, economic margins of farms decreased from 2006 to 2008. Although the milk prices also increased, the proportion of the increase was less than in the feed price. While in 2008 the family net margin and, overall, the business net margin per litre of milk sold, were very low, the family net margin per unit of family labour was fairly acceptable. The meaning of this situation is that, at present, farms can survive because a part of the pay of family workers is used to purchase feed. Several regression analyses have been made. Only in two cases is there a significant level: the business net margin per litre of milk sold in comparison to the milk sold per goat and the family net margin per unit of family labour in comparison to the total labour.

Keywords. Grazing systems – Technical-economic indicators – Spain.

Evolution des indicateurs technico-économiques des exploitations caprines laitières pastorales de l'Andalousie (2006-2008)

***Résumé**. L'objectif de cet article est d'analyser l'évolution de 10 indicateurs technico-économiques pendant la période 2006-2008 dans 6 exploitations pastorales de l'Andalousie (Espagne) afin d'observer les facteurs qui déterminent la viabilité des systèmes. Pour réaliser l'analyse technico-économique, on a utilisé des indicateurs adaptés de la liste de FAO/CIHEAM. On a obtenu les valeurs des indicateurs pour chaque année et aussi pour l'ensemble de la période. Les marges économiques des exploitations ont descendu entre 2006 et 2008 à cause de l'augmentation des quantités et des prix des aliments consommés par les chèvres. Bien que le prix du lait ait aussi augmenté, la proportion de cette augmentation a été inférieure à celle du prix des aliments. Tandis qu'en 2008, la marge nette familiale et, surtout, la marge nette de l'entreprise par litre de lait vendu ont été très basses, la marge nette familiale par UTH a été plus ou moins acceptable. Cette situation implique que, actuellement, les exploitations peuvent survivre parce qu'une partie du salaire qui devrait être assigné aux travailleurs familiaux est destinée à l'achat d'aliments pour les chèvres. Plusieurs analyses de régression ont été réalisées. Uniquement dans deux cas, on a trouvé un niveau de signification : la marge nette de l'entreprise par litre de lait vendu selon le lait vendu par chèvre et la marge nette familiale par UTH selon la main-d'œuvre totale.*

***Mots-clés**. Systèmes en pâturage – Indicateurs technico-économiques – Espagne*.

I – Introduction

Pastoral goat systems are decreasing in several zones of Mediterranean basin (Ruiz *et al.*, 2008). However, they have higher capacity than intensive systems to overcome economical difficulties due they have a higher feeding autonomy and better sustainability attributes (Nahed

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et al., 2006). In recent years the Spanish goat sector, like in many parts of world, has had many difficulties as consequence of important increases of feed prices. Moreover, prices of goat products haven't evolved favorably in these years. The aim of this work is to analyze the evolution of technical-economic indicators throughout the period 2006-2008 in 6 pastoral farms of Andalusia (Spain) in order to observe the most determinant factors affecting the viability of farms.

II – Materials and methods

Data of this work have been collected throughout 3 years (2006-2008) in 6 pastoral farms placed in the Sierra de Cádiz (Andalusia, Spain). Farmers belong to the association breeders of caprine race Payoya (ACAPA). Authors collected data in these farms monthly in order to make a technical-economic analysis. 18 indicators, 10 technical (Table1) and 8 economical (Table 2) have been calculated. These indicators have been adapted of FAO/CIHEAM indicators list (Toussaint *et al.* 2009), except two economical ones: *cost of sold milk* and *business net margin per litre of sold milk*, which have been added to the cited list. The familiar net margin has been obtained subtracting structural charges to gross margin. Structural charges correspond to external labor, leasing, etc. Depreciation costs haven't been included because of difficulties in their estimation. In place, costs of repayment of loans for investment have been included. The business net margin has been obtained subtracting familiar work force charges to the familiar net margin. Although familiar work force charges are difficult to estimate, they have been established in 13800 € per worker and year. Mean and standard error values of variables for each year and for the whole period were calculated. In addition, several regression analyses have been made, taking the different economical margins as dependent variables and those variables related to inputs and prices as independent ones. For the statistical analysis SPSS v.14 (2005) software was used.

III – Results and discussion

Table 1 shows the mean and the standard error of technical indicators for each year and for the whole period 2006-2008. First, some commentaries about the whole period are made. Values of indicators related to feeding are the following: *area per goat* (0.8 ha/goat), *concentrate per goat per year* (303 kg/goat), *forage per goat per year* (14 kg/goat) and *net energy from grazing* (59%). The *annual sold milk per goat* is 349 l/goat. Similar results, but with some differences, have been obtained by same authors in Andalusia's mountains: for Ruiz *et al.* (2008) (data collected in 2006) which the *concentrate per goat per year* is little lower (278 kg/goat) while the *annual sold milk per goat* is similar (334 l/goat); for Nahed *et al.* (2006) (data collected in 2001-2002 campaign) the *concentrate per goat per year* is little lower (270 kg/goat) but the *annual sold milk per goat* is also lower (270 l/goat); for Castel *et al.* (2006) (data collected in 2002-2003 campaign) the *annual sold milk per goat* is lower (260 l/goat, which has been estimated from the 338 l of milk produced per goat per year) but the *concentrate per goat per year* is rather lower (179 kg/goat). These differences are owing to changes that occur in pastoral systems because the offer of grass varies with farms and years. Other interesting indicator is the *proportion of milk produced in autumn*. The value of this indicator is low (10%) and similar to obtained by Ruiz *et al.* (2008). The reason is the low availability of grasses in autumn and winter in the zone, which conduces to a more milk production in spring and summer, especially in spring.

Next, the evolution of technical indicators along the three years is discussed (Table 1). Concerning to feeding management, the quantity of concentrate per goat per year has had an important change; the value increased 13% approximately in 2008 respect to the average of two previous years. Also the supply of forage and net energy from grazing changed, both decreased from 2006 to 2008. That occurred because of the scarce rain in autumn of 2007 (88 mm *vs* 228 and 282 mm in 2006 and 2008 respectively) that conduced to a bad setting up of grass used by animals in 2008 (AASN, 2010).

Table 1. Values (means and standard error) of technical indicators for each year and for the whole of the period 2006-2008

Indicators	2006	2007	2008	2006-2008
Goats present	412 (±85)	384 (±77)	391 (±81)	396 (±44)
Area per goat (ha/goat)	0.8 (±0.1)	0.8 (±0.1)	0.9 (±0.1)	0.8 (±0.1)
Familiar labor (%)	71 (±14)	71 (±14)	73 (±13)	71 (±7)
Total labor per 100 goats (YWU[†])	0.6 (±0.1)	0.6 (±0.1)	0.6 (±0.1)	0.6 (±0.1)
Concentrate per goat per year (kg) [††]	294 (±12)	288 (±15)	328 (±29)	303 (±11)
Forage per goat per year (kg) [††]	13 (±10)	18 (±12)	10 (±6)	14 (±5)
Net energy from grazing (%)[†††]	60 (±2)	61 (±2)	56 (±4)	59 (±2)
Annual sold milk per goat (l)	361 (±16)	362 (±17)	324 (±18)	349 (±10)
Proportion of milk produced in autumn (%)	14 (±2)	10 (±1)	9 (±1)	11 (±1)
Sold kids per goat per year	1.0 (±0.1)	1.1 (±0.2)	0.9 (±0.1)	1.0 (±0.1)

[†]Year worker unit.
[††]Concentrate and forage consumed by all animals of the farm.
[†††]Calculated based on the difference between estimated energy requirements and energy provided indoors.

Results of economic indicators, during the period 2006-2008 are presented in Table 2. The main indicators that determine margin values are obviously feed prices, especially the *concentrate price*, and prices of sold productions, especially *sold milk price*, because the milk is the main production. After the mid-1990s, prices of feedstuffs fell while the price of milk rose (Castel *et al.*, 2010). In 2000s, the price of concentrate has been acceptable, but in 2007 and overall in 2008, it increased notably, as was the case in general worldwide (in this study, prices for 2006 and 2008 are 0.20 and 0.30 €/kg respectively). As consequence of feed price increase, the *cost of sold milk* has also increased from 0.42 €/l in 2006 to 0.59 €/l in 2008 (data of this study). In relation to *sold milk price*, in 2004 the Spanish average was 0.42 €/l (Dubeuf *et al.*, 2004) and in 2006 was 0.46 €/l (Ruiz *et al.*, 2008). Continuing with the current study data, the *sold milk price* was maintained in 2007 and it increased to 0.55 €/kg in 2008. This increase was due to the relatively high demand by consequence of decreasing but yet important milk exportation to France (15% of production in 2005) (Sánchez-Rodríguez, 2006) and decreasing of census and milk production (13.1% and 2.8% respectively from 2006 to 2008) (MARM, 2010). However, increase of sold milk price did not compensate the increase of feed price and consequently economical margins have decreased. The *familiar gross margin per litre of sold milk* in 2006 (0.45€/l) is the same that the one presented by Ruiz *et al.* (2008) (data collected in 2006) and decreased to 0.40 €/l in 2008. The *familiar net margin per litre of sold milk* obtained in this study goes from 0.22 €/l in 2006 to 0.17 €/l in 2008, being rather lower than the one presented by Castel *et al.* (2006) (data collected in 2002-2003 campaign) and Nahed *et al.* (2006) (data collected in 2001-2002 campaign) in the same zone, 0.30 and 0.33 €/l respectively. Concerning the *business net margin per litre of sold milk*, it is practically zero, ranging from 0.05 €/l in 2006 to -0.04 €/l in 2008. The *familiar net margin per unit of familiar labor* has also decreased in period 2006-2008 (from 21,634 to13,684 €/YWU). The value of this last indicator in 2006 is similar to the one presented by Castel *et al.* (2006) (21,244 €/YWU, data collected in 2002-2003 campaign), while the value in 2008 is little lower than the one presented by Nahed *et al.* (2006) (15,385 €/YWU, data collected in 2001-2002 campaign). *Familiar net margin per unit of familiar labor* represents the wages of each familiar worker; value obtained for this margin (Table 2) is not acceptable for farmers to carry out a comfortable life, and less taking into account the hardness of their work. However, in despite of the low value of *business net margin per litre of sold milk*, farms can survive because familiar workers (which are 71% of total farm workers) do not receive one part of their wages because it is used to purchase feed.

Tabla 2. Values (means and standard error) of economic indicators for each year and for the whole of the period 2006-2008

Indicators	2006	2007	2008	2006-2008
Concentrate price (€/kg)	0.20 (±0.00)	0.24 (±0.00)	0.30 (±0.01)	0.25 (±0.01)
Cost of sold milk (€/l)[†]	0.42 (±0.03)	0.44 (±0.03)	0.59 (±0.50)	0.48 (±0.03)
Sold milk price (€/l)	0.47 (±0.01)	0.47 (±0.01)	0,55 (±0.01)	0.50 (±0.01)
Sold kid price (€/kg)	4.3 (±0.2)	3.8 (±0.0)	4.2 (±0.1)	4.1 (±0.1)
Familiar gross margin per liter of sold milk (€)[††]	0.45 (±0.02)	0.44 (±0.02)	0.40 (±0.03)	0.43 (±0.01)
Familiar net margin per liter of sold milk (€)[†††]	0.22 (±0.05)	0.20 (±0.04)	0.17 (±0.04)	0.19 (±0.02)
Familiar net margin per unit of familiar labor[†††] (€YWU[††††] familiar)	21634 (±3824)	20545 (±4814)	13684 (±2961)	18621 (±23201)
Business net margin per litre of sold milk (€)[†††††]	0.05 (±0.03)	0.03 (±0.03)	-0.04 (±0.04)	0.01 (±0.02)

[†]Include all production costs, even the familiar labor. However, incomes corresponding to sold kids and aids are subtract of the total costs.
[††]Gross margin = Incomes – Operational charges (feeding, etc.).
[†††]Familiar net margin = Gross margin – Structural charges (external labor, leasing, etc.).
[††††]Year worker unit.
[†††††]Business net margin = familiar net margin – Familiar work force charges.

Concerning the regression analyses, equations have been estimated by ordinary least squares (OLS) and only in two cases there are significant levels: the *business net margin per litre of sold milk* with respect to the *annual sold milk per goat* (Table 3) and the *familiar net margin per unit of familiar labor* with respect to *the total labor per 100 goats* (Table 4). In Table 4, the estimated slope (B) shows a decrease in *familiar net margin per unit of familiar labor* (2636 €/YWU familiar) when the *total labor per 100 goats* increases 0.1 units. In Table 3, the estimated slope (B) shows the increase in the *business net margin per liter of sold milk* (2 cents of €) when the *annual sold milk per goat* increases 10 liters. These results indicate that, the *annual sold milk per goat* has a big influence to the *business net margin per liter of sold milk*. But, as said before, this margin is nearly zero because of the low *sold milk price*. Only farmers' association for trade of products or farmer participation in the milk transformation (Castel *et al.* 2010), could help to increase this price. Results of regression analyses also indicate that, when the business net margin is very low, an efficient labor, especially if it's familiar, can help to the farm survival.

Table 3. Regression of business net margin per liter of sold milk (dependent variable) to respect to annual sold milk per goat (R^2=0.656; Error=0.056)

Independent variables	B	Standard Error	t	Sig
Constant	-0.597	0.111	-5.386	0.000
Annual sold milk per goat (l)	0.002	0.000	5.528	0.000

Table 4. Regression of familiar net margin per unit of familiar labor (dependent variable) to respect to total labor per 100 goats (R^2=0.436; Error=7558)

Independent variables	B	Standard Error	t	Sig
Constant	35167.7	5032.8	6.988	0.000
Total labor per 100 goats (YWU)[†]	-26357.6	7497.8	-3.515	0.003

[†]Year worker unit.

IV – Conclusions

The important increase of feed prices occurred in recent years have lead to a strong rise of *cost of sold milk* which is close to the sold milk price, in Andalusian pastoral farms.

In the period 2006-2008, the feed price increase was not compensated by the rise of sold milk price; so that margins also decreased.

Although both, the current *familiar net margin* and the *business net margin per litre of sold milk,* could improve with the increase of goat productivity, the cited current situation of high *feed prices* and low *milk prices* do not allow reaching an acceptable level for the farm survival.

The familiar net margin per unit of familiar labor is not acceptable for farmers to carry out a comfortable life, although in practice familiar workers use a part of their wages to pay the feed charges and contribute to the survival of the farm.

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