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Economic performance of dairy goat farming in Greece. Preliminary results

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Abstract. The aim of this study is to outline the main technical and economic indicators of dairy goat sector in Greece. Through face-to-face interviews with farmers detailed accounting data were collected from 96 goat farms located in Northern Greece and a comparative analysis was carried out using milk yield/doe and farm size as classification criteria. Analysis showed that the farm indicators vary considerably, both in terms of milk yield and farm size. Milk production/doe is 155.17 kg for average farm, while in small size farms is considerably higher compared to medium and large size farms. The average farm uses 18.59 hours of labor/doe, of which 29.7% is hired labor. Small size farm uses more labor/doe, followed by medium and large size farm. Milk yield and farm size are both associated with the composition of the labor used, confirming that hired labor is more important in high milk yield and large size farms. Low milk yield farm pays less rent for land/doe than high milk yield farm, while farm size is negatively associated to land rent. High differences exist both among milk yield groups and among farm size groups regarding the composition of labor cost. Milk yield and farm size are also negatively related to the variable cost, fixed capital cost, and total production cost. In general goat farms exhibit losses, although the economic performance of the farms is improved as the milk yield and the size of the farm are increasing. The findings of this study could be useful for a more rational management towards increasing the productivity and enhancing the competitiveness of goat farming.

Keywords. Dairy goat farming - milk yield and farm size classification - farm technical and economic indicators - Greece

Performances économiques de l'élevage de chèvres laitières en Grèce. Résultats préliminaires

Résumé. L'objectif de cette étude est de décrire les principaux indicateurs techniques et économiques du secteur de l'élevage de chèvres laitières en Grèce. Par le biais des entretiens personnels avec des éleveurs, des données comptables détaillées ont été recueillies auprès de 96 exploitations caprines situées dans le nord de la Grèce. Une analyse comparative a été réalisée en utilisant le rendement laitier/chèvre et la taille de l'exploitation comme critères de leur classification. L'analyse a montré que les indicateurs des exploitations diffèrent considérablement, tant en termes de taille de l'exploitation et de rendement laitier. La production du lait/chèvre est de 155,17 kg pour l'exploitation moyenne. Parmi les fermes de petite taille, la production est considérablement plus élevée par rapport aux fermes moyennes et de grande taille. L'exploitation moyenne utilise 18,59 heures de main-d'œuvre par unité de production, dont 29,7 % de main-d'œuvre rémunérée. Les exploitations de petite taille utilisent davantage de main-d'œuvre par unité de production, suivies par des exploitations moyennes et de grande taille. Le rendement laitier et la taille de l'exploitation sont en relation directe à la composition de la main-d'œuvre utilisée, ce qui confirme que la main-d'œuvre salariée est plus importante aux exploitations à haut rendement laitier et de grande taille. Les exploitations à faible rendement laitier paient moins de loyer pour la terre/chèvre que les exploitations à haut rendement laitier, tandis que la taille de l'exploitation est négativement corrélée avec le loyer de la terre. Il est montré que la composition du coût de la main-d'œuvre diffère significativement quand les groupes de rendement laitier soient comparés aux groupes de la taille de l'exploitation. Le rendement laitier et la taille de l'exploitation sont également liés négativement au coût variable, au coût du capital fixe et au coût total de production. En général, les exploitations caprines présentent des pertes, bien que ses performances économiques s'améliorent à mesure que le rendement laitier et la taille de l'exploitation

augmentent. Les résultats de cette étude pourraient être utiles pour une gestion plus rationnelle en vue d'augmenter la productivité et d'améliorer la compétitivité de l'élevage caprin.

Mots-clés. *Élevage de chèvres laitières - classement des rendements laitiers et taille de l'exploitation - indicateurs techniques et économiques des exploitations - Grèce.*

I - Introduction

Goat farming is a dynamic livestock sector in Greece, contributing to the employment of rural population in disadvantaged and remote areas of the country and providing income to thousands of farmers (Voltsou, 2005; Miliadou D., 2010; Arsenos et al., 2014; Laliotis, 2018). Goat farms are mostly situated in LFAs featuring animals of local breeds and mainly of low milk yields, under the extensive or semi-extensive production system. Most of the farms are characterized by poor infrastructure and depend on grazing in specific regions of the country which are not suitable for other production activities (Zygogiannis and Katsaounis, 2009; Gelasakis et al., 2017; Vouraki, 2019; Theodoridis et al., 2019). In lowland areas, goat breeds of high productivity are reared, under intensive or semi-intensive systems by modern farms that depend heavily on concentrates and forage mainly produced on-farm (Vouraki, 2019, Theodoridis et al., 2019).

Greece has the largest dairy goat population in the EU(27), rearing 30.34% of the total number of goats, and producing 355,760 tons of milk and 26,480 tons of goat meat (FAO, 2021; ELSTAT, 2020). The sector accounts for 14.51% and 43.18% of the total goat milk and meat production in the EU(27), respectively (FAO, 2021).

Despite the changes that have emerged in the Greek goat sector during the last decades, the sector is still facing severe structural weaknesses, mainly due to the small farm size, the lack of modern facilities, and the lack of vocational training of goat farmers (Vouraki, 2019; Katsaounis and Zygogiannis, 2009; Gelasakis et al., 2017; Amarantidis, 2014; Ragkos et al., 2017). Sector's prospects and sustainability in the globalized market are directly linked to the rational management of the available inputs and the improvement of farm productivity and competitiveness of the sector (Liontakis, 2015). The characteristics of foreign trade in goat products in recent years outline the export potential that the Greek goat sector can acquire, expanding in the European markets and beyond. Thus, the viability of the Greek goat sector and the promotion of its socio-economic importance and its export character, constitute the description of the technical and economic profile of the sector significant.

The aim of this study is to analyze the economic performance of the Greek goat sector and to present the main technical and economic indicators of the typical goat farm in the sector. These characteristics are also described for groups of farms which are categorized in terms of milk yield and animals reared, providing insight regarding the efficient management of goat farms and, consequently, the strategies which are required to be adopted by goat farms in the modern entrepreneurial environment.

II - Materials and Methods

Through a farm management survey of 96 goat farms, which carried out in 2018, detailed accounting data were collected. The surveyed goat farms operate under various farming systems, which embody the prevailing characteristics of goat farming in the country and are located in the area of Macedonia and Thrace in Northern Greece (Figure 1). The goat farming in this area accounts for 26.16% of the total goat population of the country (ELSTAT, 2019 data) and of 30.62% of the total quantity of goat milk (ELSTAT, 2018).

Basic cost accounting methods were used, and the main technical and economic indicators were estimated for the average goat farm in the sector (Kitsopanidis, 2006), as well as for groups of farms which were categorized using as classification criteria “milk yield” per doe and “farm size” (number of does (adult female animals in the farm)). Two “milk yield” groups were formulated, “Low milk yield farms: ≤ 140 kg/doe” and “High milk yield farms: > 140 kg/doe” and three farm size groups, “Small size farms: ≤ 199 does”, “Medium size farms: 200 to 399 does”, and “Large size farms: ≥ 400 does”.

Furthermore, the Wilcoxon rank sum nonparametric test (Mann-Whitney U-test) was applied to evaluate “milk yield” depended differences, and the Kruskal-Wallis nonparametric test was applied to evaluate “farm size” depended differences, on the mean values of milk yield (kg/doe/farm) and on the mean the number of does/farm (Zolman, 1993). All analyses were conducted using the statistical software program SPSS for Windows (v. 25.0). Significance was declared at $P \leq 0.05$, unless otherwise noted.

III - Results and Discussion

Table 1 presents the main technical characteristics of the goat farms, for the average farm in the sample as well as for the milk yield and farm size groups of farms.

Table 1. Technical indicators of goat farms, in terms of “farm size” and “milk yield”.

Technical indicators	Average farm	“Milk yield” group		“Farm size” group		
		“Low milk yield: ≤ 140 kg/doe”	“High milk yield: > 140 kg/doe”	“Small size farms: ≤ 199 does”	“Medium size farms: 200 to 399 does”	“Large size farms: ≥ 400 does”
Number of farms	96	52	44	23	42	31
Milk production (kg/doe)	155.17	107.30	216.94	224.85	144.34	149.97
Milk yield (kg/doe/farm)	175.13	104.98	258.02	253,82	149,45	151,52
(Mean $\pm$ SD)	± 124.5	$\pm 21.05^a$	$\pm 144.01^b$	$\pm 181,48^a$	$\pm 99,75^b$	$\pm 71,35^b$
Number of does/farm	333.82	347.25	317.95	134.39	274.71	561.87
(Mean($\pm$ SD)	± 238.03	$\pm 263.13^a$	$\pm 206.34^a$	$\pm 40.403^a$	$\pm 50.84^b$	$\pm 292.50^c$
Total labor (hours/doe)	18.59	18.28	18.99	27.57	20.01	16.05
Family labor (hours/doe)	13.07	14.16	11.66	21.41	16.51	9.31
Hired labor (hours/doe)	5.52	4.12	7.33	6.16	3.5	6.75

a, b, c: Mean values in the same row and for the same classification variable, with a superscript in common do not significantly differ ($P > 0.05$) [Mann-Whitney and Kruskal-Wallis npar tests].

The results show that the milk production per doe for the average farm in the sample is 155.17 kg, while for the small size farms is 224.85 kg, for the medium size farm is 144.34 kg and for the large size farm is 149.97 kg. Moreover, for the low and high milk yield group is 107.30 kg and 216.94 kg, respectively. Meanwhile, the mean (Mean $\pm$ SD) milk yield in the sample (kg/doe/farm) is 175.13 ± 124.3 kg, while in the small size farms is $253,82 \pm 181,48^a$ kg and

significantly higher than in medium size ($149,45 \pm 99,75^b$ kg) and large size farms ($151,52 \pm 71,35^b$ kg). Likewise, in low milk yield farms the mean milk yield is $104,98 \pm 21,05^a$ kg and significantly lower compared to that in the high milk yield farms ($258,02 \pm 144,01^b$ kg).

The average goat farm in the sample, breeds 334 does, while the low milk yield farms breed 347 and the high milk yield farms breed 318 does. Although the farm size in the milk yield groups seems to be negatively related to milk yield per doe, with the number of does being lower in groups of high milk yield farms, the statistical evaluation shows no significant difference between the two groups ($P > 0.05$), maybe due to high variability observed among individual goat farms.

In high milk yield farms, the average farm uses more labor/doe compared to the low yield milk farms. Moreover, regarding the farm size groups, the small size farms use more labor/doe, followed by the medium and finally by the large size farms. In more detail, the average farm uses 18.59 hours of labor/doe, of which 70,3% is allocated to family members and 29.7% is hired labor. The low milk yield farms use on average 22.5% of hired labor, while for the high milk yield group this percentage increases to 38.6%. The small size farms use 22.35% hired labor, while for the medium and large size farms the share of hired labor is 17.49% and 42.05%, respectively.

In general, the milk yield and the farm size are both associated with the composition of the labor used in the farm, confirming that hired labor is more important in high milk yield farms and large size farms.

Technical indicators of Greek goat farming have been reported by several researchers, in the past. Tsiouni (2018) surveyed 120 goat farms and estimated the average number of goats at 242 does and the average milk yield at 173.03 kg/doe/farm, not far from our results. She also reported a total labor of 14.45 hours/doe/year. Kaimakamis (2017) in a sample of 492 sheep/goat farms, of which 76 goat farms, estimated the average milk yield at 182.33 kg/doe/farm, while Galanopoulos et al. (2011) studied a sample of 106 sheep/goat farms, of which 31 goat farms, and estimated the average milk yield at 137 kg/doe/farm. Moreover, Miliadou (2010) used a sample of 130 organic goat farms and estimated the average number of goats at 278 and the average milk yield at 92.80 kg/doe/farm, also reporting a total of 16.04 hours/doe/year.

Chatzitheodoridis et al. (2007), in a technical-economic analysis of 75 sheep-goat farms in a typical Greek island, declared that total labor (hours/animal) is positively affected by farm size, reporting 12.83 hours/doe/year for farms with >301 animals and 34.84 hours for farms with ≤ 50 animals. De Rancourt et al. (2006) calculated the milk yield at 120 kg/doe/farm, while Kitsopanidis (2002) have classified Greek goat farms in 3 sizes (<150 , 150-500 and >500 does), reporting a milk yield of 134 kg/doe/farm for the first class, a milk yield of 292 kg/doe/farm for the second class and a milk yield of 606 kg/doe/farm for the third class.

The main economic characteristics of the goat farms are presented in Table 2, both for the average farm in the sample as well as for the milk yield and farm size groups of farms.

Regarding the economic characteristics of goat farms, the analysis of the empirical data showed that the low milk yield farms pay less rent per doe (6.71€/doe) than the high milk yield farms (7.84€/doe). At the same time, farm size is negatively related to land rent, with the large size farms to depend less on home-grown feed to reduce the feeding cost (4.77€/doe), followed by the medium (8.54€/doe) and finally by the small size farms (15.91€/doe).

Table 2. Economic indicators of goat farms, in terms of “farm size” and “milk yield”.

Economic indicators	Average farm	“Milk yield” group		“Farm size” group		
		“Low milk yield: ≤140 kg/doe”	“High milk yield: >140 kg/doe”	“Small size farms: ≤199 does”	“Medium size farms: 200 to 399 does”	“Large size farms: ≥400 does”
Number of farms	96	52	44	23	42	31
Land rental (€/doe)	7.20	6.71	7.84	15.91	8.54	4.77
Total labor cost (€/doe)	52.96	51.52	54.82	90.61	58.21	42.81
<i>Family labor cost (€/doe)</i>	39.21	42.49	34.97	64.22	49.54	27.92
<i>Hired labor cost (€/doe)</i>	13.76	9.04	19.85	26.38	8.66	14.89
Variable capital cost (€/doe)	90.95	76.05	110.20	161.84	87.84	80.44
<i>Feed cost (€/doe)</i>	69.40	58.68	83.25	120.74	67.49	61.56
<i>Miscellaneous costs (€/doe)</i>	21.55	17.37	26.95	41.1	20.35	18.87
Fixed capital cost (€/doe)	33.01	28.54	38.79	65.38	32.86	27.37
Production cost (€/doe)	184.13	162.82	211.65	333.74	187.45	155.39
Gross revenue (€/doe)	161.73	126.42	207.30	279.33	146.98	150.62
Gross margin (€/doe)	70.77	50.37	97.10	117.50	59.14	70.18
Profit or loss (€/doe)	-22.41	-36.40	-4.35	-54.41	-40.47	-4.76

For the average sample farm, the labor cost is €52.96 per doe, with substantial differences among farm size groups, but no high difference among milk yield groups. However, high differences exist both among the low milk yield and high milk yield farms as well as among farm size groups of farms regarding the composition of the labor cost. Expenses for hired labor are much higher in the high milk yield farms compared to low milk yield farms. In more detail, the share of hired labor cost in the low milk yield farms is 17.55%, while for the high milk yield farms is 36.21%. This is also evident for the farm size groups, as the small size farms spend on average €26.38/doe for hired labor (28.8% of the total labor cost/doe), while the medium size farms spend on average €8.66/doe (14.88%) and the large size farms €14.89/doe (34.78%).

For the average farm in the sample, the variable cost (including feeding cost and other expenses) is €90.95/doe, while the feeding cost is €69.40/doe. The milk yield/doe and the farm size are associated with the composition of the variable cost, with the observed differences mainly attributed to the feeding cost. For the low milk yield farm, the feeding cost is €58.68/doe (77.16% of the total variable cost) and 29.5% lower than in the high milk yield farms (€83.25). Moreover, the small size farms spend almost double on purchased and/or on-farm produced feed, compared to the large size farm farms.

Milk yield and farm size appear to be related with the fixed capital cost and total production cost/doe. For the average farm the fixed capital cost is €33.01/doe and production cost €184.13/doe, while in the low milk yield farms are less than in the high milk yield farms. On the other hand, the fixed capital cost and the total production cost are negatively related to farm size, with the small size farms paying more than double compared to the large size farms.

Similarly, gross revenue and gross margin per doe vary considerably among milk yield groups as well as among farm size groups. For the average farm, the gross revenue is €161.73/doe, while for the low and the high milk yield farms it is €126.42/doe and €207.30/doe, respectively.

Moreover, gross revenue of the small, medium and large size farms is €279.33/doe, €146.98/doe and €150.62/doe, respectively.

Furthermore, the gross margin for the average farm is estimated at €70.77/doe, while the high milk yields average farm achieves considerably higher values of gross margin compared to the low milk yield farm. On the contrary, the gross margin in the small size farms is €47.32/doe higher than in the large size farms. The goat farms exhibit loss, in general, but high milk yield farms and large size farms exhibiting better results.

Tsiouni (2018), reported estimations of economic indicators in Greek goat farming, e.g., a labor cost of €43,88/doe, a variable cost of €88,80/doe, a feeding cost of €76,25/doe, a fixed capital cost of €29,50/doe, a production cost of €118,51/doe and a gross revenue of €156,36/doe. Kaimakamis (2017), also reported a labor cost of €50,18/doe, a variable cost of €102,36/doe, a fixed cost of €88,81/doe, a production cost of €191,17/doe, a gross revenue of €241,08/doe, a gross margin of €138,72/doe and a profit of €49,91/doe. Miliadou (2010), reported a variable cost of €92,54/doe, a feeding cost of €37,87/doe, a fixed cost of €29,50/doe, a production cost of €122,94/doe, a gross revenue of €159,30/doe and a profit of €36,36/doe. Moreover, Chatzitheodoridis et al. (2007) declared that small to medium size farms exhibit loss of €33.29/animal, but large and very large size farms achieve a profit of €15.42 and €17.91/animal, respectively.

IV - Conclusions

The analysis of the technical and economic indicators of goat farms reveals considerable differences among milk yield groups as well as among farm size groups of farms. Farm size is negatively related to rent, with the small size farm spend almost triple for land rent compared to the large size farm. Moreover, small size farms exhibit significantly higher amount of milk production/doe compared to medium and large size farms.

Milk yield and farm size are both associated with the composition of the labor used, and consequently with the composition of labor cost, confirming that hired labor is more important in high milk yield and large size farms. The milk yield and the farm size have also a considerable effect on the composition of the variable cost, with the observed differences mainly attributed to the feeding cost. The small size farms spend almost twice as much on purchased and/or on-farm produced feed compared to the large size farms, while for the low milk yield farm, the feeding cost is lower than in high milk yield farms. Milk yield and farm size appear to be related to the fixed capital cost and total production cost/doe, with the low milk yield farm and the large size farm spending less, compared to other groups of milk yield and farm size, respectively. Gross revenues and gross margin per doe are improved as the milk yield increases, however, they are deteriorating as the number of animals reared increases.

Overall, the evaluation of the estimates reveals that the high milk yield farms are based more on hired labor, spend more for land rental and variable cost and invest more in fixed assets per doe, but achieve higher economic results in terms of gross revenue, gross margin and profit/loss per doe. On the other hand, the large size farms are based more on hired labor, spend less for rent and variable cost and particularly for feed and invest less in fixed assets per doe, but achieve higher economic results in terms of gross margin and profit/loss per doe, utilizing scale economies. In conclusion, the high milk yield farms and the large size farms seem to operate under higher management standards, thus achieving higher economic performance. The findings of this study could be useful for a more rational management towards increasing the productivity and enhancing the competitiveness of goat farming.

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