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Dairy sheep farming in Sardinian irrigated lowlands

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SUMMARY - Irrigation represents an important tool to increase forage yield and animal performance in Sardinian lowlands but the intensification is strongly dependent on the economic advantages that it can offer to the dairy sheep farmers. Four system models differing in agronomic inputs and feeding regimes were studied with the aim of evaluating the output/input balance of irrigated dairy sheep farming systems during 1994-1996. They consisted of two groups fed on pasture and differing in lambing season, group A lambed in autumn whereas group W at the end of winter, the stocking rate was 20 ewes ha^{-1}. The other two system models with a stocking rate of 33 ewes ha^{-1} differed in feeding regimes: group CD (zero grazing) was fed with a complete diet containing hay, silage and concentrates, group CDP in addition to the complete diet, grazed Italian ryegrass throughout the lactation period, for 3-5 h day^{-1}. The forages were lucerne and white clover (only in A and W) and Italian ryegrass, replaced in summer by sorghum and maize (only in CD and CDP). The percentage ploughed each year was 47% in both A and W whereas in CD and CDP systems was 81%. Milk production per ha was on average 4.78 in A, 5.26 in W, 6.04 in CD and 6.50 t ha^{-1} in CDP and weaned lambs production in tons per hectare were on average 0.29, 0.31 in A and W, 0.45, 0.46 in CD and CDP. However the economic return is higher for grazing than housed systems that have higher production cost. On the basis of these results intensive production systems can increase stocking rate and milk production per ha; in particular it is possible to plan the lambings and delay part of milk production in summer.

Key words: Dairy sheep, forage crops, lambing season, complete diet.

RESUME - *"Elevage de brebis laitières dans les plaines irriguées de la Sardaigne". L'irrigation constitue un important instrument pour accroître les productions fourragères et animales dans les plaines de Sardaigne mais l'intensification dépend de façon étroite des avantages économiques qui peuvent en résulter pour les éleveurs de brebis laitières. Dans le but d'évaluer le bilan économique des exploitations de brebis laitières en zone irriguée entre 1994 et 1996, quatre modèles de systèmes différenciés par leur niveau d'intensification agronomique et par leur régime alimentaire ont été comparés. Les modèles consistaient en deux lots alimentés au pâturage, avec une charge de 20 brebis ha^{-1}, dont le premier (A) agnelait à l'automne et le deuxième (W) en fin d'hiver. Dans les deux autres modèles de systèmes, où la charge était de 33 brebis ha^{-1}, un lot (CD) était alimenté avec une ration complète composée de foin, d'ensilage et de concentré, tandis que l'autre (CDP), en plus de la même ration, pâturait durant la lactation une prairie de ray-grass d'Italie pendant 3 à 5 h j^{-1}. Les fourrages cultivés étaient : luzerne et trèfle blanc (ce dernier seulement pour A et W) et ray-grass d'Italie remplacé en été par du sorgho et du maïs (seulement pour CD et CDP) ; le pourcentage de surface labourée chaque année était de 47% en A et W et de 81% en CD et CDP. La production laitière par hectare a été dans la moyenne des trois années de 4,78, 5,26, 6,04 et 6,50 t ha^{-1} respectivement pour A, W, CD et CDP. Cependant la marge brute par ha a été plus élevée pour les systèmes qui pratiquaient le pâturage par rapport à ceux basés sur les rations complètes en raison des coûts de production plus élevés. Ces résultats montrent que les systèmes de production intensifs peuvent augmenter la charge et la production laitière par ha ; en particulier il est possible de planifier l'agnelage et de différer la mise bas pour produire du lait en été.*

Mots-clés : *Brebis laitière, productions fourragères, saison d'agnelage, ration complète.*

Introduction

Dairy sheep farming systems represent a important source of agricultural income in Sardinia, where are raised at pasture about 3.5 million of Sarda dairy ewes (ISTAT, 1992). Sarda dairy ewes usually lamb in late winter and then cheese production is concentrated within the winter-spring period (Molina *et al.*, 1991). In the last two decades has been spread of irrigation on the Sardinian lowlands that resulted in the development of highly-intensified farms. Irrigated forage crops as maize (for silage or corn grain), lucerne (mainly for hay) and hybrid forage sorghum (used as green fodder) and white clover (for pasture) represent an excellent tools for increasing stocking rate and animal performance per hectare. Furthermore in irrigated lowlands to plan the lambings in late winter-spring (Fois *et al.*, 1996) allow to delay milk production to the summertime, when cheese market opportunities are increased by tourism. However the intensification is strongly dependent on the economic advantages that it can offer to the farmers.

Considering these perspectives some trials were conduced in IZCS with the aim to evaluate the technical and economical efficiency of intensive dairy sheep farming systems differing for agronomic inputs, stocking rates, lambing seasons and feeding regimens. This paper is mainly focused on input-output balance of these farming systems.

Materials and methods

Experimental site

The trial was carried out during 1993-1996 in irrigated lowland of Monastir (Southern Sardinia, 39° lat.; Italy). The climate of the area is classified as semiarid, with a mild winter and an average annual rainfall of 482 mm.

System-models

Four system-models differing for agronomic inputs, stocking rates, lambing seasons (autumn A *vs* winter W) and feeding regimens (complete diet, CD; complete diet plus pasture, CDP), were compared.

A and W (grazing systems): each system covered an area of 1.20 ha and they consisted in 42% of white clover (*Trifolium repens* L.) and perennial ryegrass (*Lolium perenne* L.) mixture, 25% of lucerne (*Medicago sativa* L.) and 33% of Italian ryegrass (*Lolium multiflorum* Lam.) replaced in summer by sorghum (*Sorghum halepense* L.*Sorghum sudanense* Stapf.). Each year 47% of surface was ploughed and 70% of it twice a year. The models were rotationally grazed for 6-8 hours per day in winter and 12-14 hours per day in spring-summer period, by 24 mature Sarda ewes (stocking rate 20 ewes ha^{-1}). Hay, produced in the systems, and commercial concentrates were fed as supplements.

CD and CDP (housing systems): each system covered an area of 1.44 ha and they consisted in 25% of Lucerne (*Medicago sativa* L.), 75% of Italian ryegrass (*Lolium multiflorum* Lam.) replaced in summer by hybrid forage sorghum (*Sorghum halepense* L.*Sorghum sudanense* Stapf) in 1/3 and by maize (*Zea mays* L.) in 2/3 of the surface. Each year 81% of surface was ploughed and 93% of it twice a year. The ewes were fed with complete diet (CD) and complete diet plus pasture (CDP) during the autumn-spring period. The pasture consisted of Italian ryegrass and was splitted in 6 plots grazed rotationally, for 3-5 hour day by 48 mature Sarda ewes (stocking rate 33 ewes ha^{-1}). Forage production was fully consumed within each system. Extra hay and concentrates were also supplied when needed.

Animal management

The ewes after synchronization were artificially inseminated in May (A, CD and CDP) and in September (W). Two weeks after insemination one ram was introduced in each group for mating the ewes that returned to estrus. The ewes of group A, CD and CDP lambed on average in October and W ewes lambed in February. After suckling period (30-35 days), the ewes were machine milked twice a day from November to July (A, CD and CDP) and from March to October (W).

Measurements

Lamb birth and weaning weight, milk yield and its fat and protein (N*6.38) contents were measured. Each forage production and consumption were also measured. Main financial results of the systems were calculated taking into account standard market price.

Statistical analysis

Individual animal performance were analysed using GLM with main treatment (grazing and housing) and sub treatments (lambing season and diet regimen) within main treatment as fixed effects.

Results and discussion

Lamb birth weight and daily growth are reported in Table 1. The higher milk yield per head was recorded in the grazing than housing system (251 *vs* 190 kg ewe^{-1}, P<0.01) and system W was the most productive (Table 1). This was probably due to high availability of herbage and in particularly to high quality of white clover in early spring at the beginning of lactation, as well as the effect of photoperiod that increase intake and milk yield (Bocquier *et al.*, 1997). In the housing system the milk yield tendency to be higher in CDP than CD (P<0.06) because of the better quality of the diet as already reported in previous studies (Fois *et al.*, 1995, 1997) resulting in better metabolic parameters (Moniello *et al.*, 1997).

Fat and protein percentage were significantly higher in housed system (7.38 and 5.84%) than in grazing system where A showed the better quality (fat: 6.85 and 6.57%, P<0.05; protein: 5.32 and 5.42%, P<0.05 in A and W respectively). However fat and protein production were significantly higher in A and W than the counterparts (Table 1).

Table 1. Three year averages of milk yield, fat and protein production (l.s.means ± stderr)

	Grazing A	System W	Housing CD	System CDP
Lamb birth weight (kg)	2.7 ± 0.09^{b}	2.9 ± 0.10^{a}	2.4 ± 0.08^{c}	2.5 ± 0.08^{c}
Daily growth (g head^{-1} day^{-1})	219 ± 6.4^{ab}	224 ± 7.1^{a}	197 ± 3.9^{c}	208 ± 3.8^{b}
Milk (kg ewe^{-1})	239 ± 7^{b}	263 ± 7^{a}	183 ± 5^{c}	197± 5^{c}
Fat (kg ewe^{-1})	16.3 ± 0.5^{a}	17.3 ± 0.5^{a}	13.4 ± 0.4^{c}	15.0 ± 0.4^{b}
Protein (kg ewe^{-1})	13.4 ± 0.4^{a}	14.3 ± 0.4^{a}	10.6 ± 0.3^{c}	11.5 ± 0.3^{b}

a,b,c: Different letters within row indicate significant differences (P<0.05)

Milk yield per hectare was higher by 24% in housing than in grazing systems (Table 2) nevertheless they need more extra-system concentrates and hay. As a consequence the self-sustaining capability, calculated on the basis of the average ewe's energy requirements (INRA, 1988), of housing systems were 35% (CD) and 40% (CDP) as compared with the grazing systems where it amounted to 71% (A) and 77% (W).

Table 2. Three year averages of milk yield, weaned lambs production (output) and extra-feedstuffs consumption (input)

	Grazing A	Systems W	Housing CD	Systems CDP
Output				
Milk (t ha^{-1})	4.8	5.3	6.0	6.5
Weaned lambs (t ha^{-1})	0.29	0.31	0.45	0.46
Feedstuffs input				
Concentrate (t DM ha^{-1})	2.2	1.9	4.5	3.3
Hay (t DM ha^{-1})	-	-	5.4	4.6

The monetary figures as a average for the three years is reported in Table 3. On the basis of the current prices, W showed on average a gross margin higher than the others.

Table 3. Financial appraisal of system models (1 ECU = 1910 Italian Lira)

	Grazing A	Systems W	Housing CD	Systems CDP
Total output (ECU ha^{-1})	4477	5076	6272	6360
Total output + EU subsidies (ECU ha^{-1})	4948	5547	7313	7401
Total costs† (ECU ha^{-1})	2074	1940	5149	4890
Gross margin (ECU ha^{-1})	2403	3136	1123	1470
Gross margin + EU subsidies (ECU ha^{-1})	2874	3607	2164	2511
Gross margin (ECU ewe^{-1})	120	157	34	45
Gross margin + EU subsidies (ECU ewe^{-1})	144	181	66	77

†Total costs include: extra system food, cropping, vet and medication costs

Conclusions

The degree of intensification of Sardinian sheep farms is strongly dependent on the economic advantages that it can offer. On the basis of this results CD and CDP showed high incidence of cost, high input requirement and as consequence of this the worst gross margin. However the grazing, restricted for some hours per day, markedly improve the gross margin of CDP system.

Systems based more on grazing (W and A) perform better results both in term of economics and self-sustaining capability particularly in the case of late lambings (W).

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References

Bocquier, F., Ligios, S., Molle, G. and Casu, S. (1997). Effet de la photopériode sur la production et la composition du lait et sur les consommations volontaires de la brebis sarde. *Annales de Zootech.,* (in press).

Fois, N., Ligios, S., Molle, G., Deiana, S., Sanna, L., Ruda, G. and Casu, S. (1996). Effect of different lambing seasons on the zootechnical performances of a dairy sheep farming system based on irrigated forage crops. In: *4th International Livestock Farming Systems Symphosium*, Tjiele, Denmark, 22-23 August 1996.

Fois, N., Molle, G., Ligios, S. and Casu, S. (1995). Effetto del pascolo razionato sull'ingestione e le prestazioni produttive di pecore alimentate con diete unifeed. In: *XLIX National Congress SIS VET.* Salsomaggiore Terme, Italy, 27-30 September 1995, pp. 893-894.

Fois, N., Molle, G., Sitzia, M., Pani, R., Moniello, G. and Pinna, W. (1997). Alimentazione con unifeed ed unifeed + pascolo in pecore di razza Sarda: aspetti quanti-qualitativi della produzione lattea. In: *XII National Congress ASPA*, Pisa, Italy, 23-26 June 1997, pp. 255-256.

INRA (1988). *Alimentation des bovins, ovins et caprins.* Jarrige, R. (ed.). INRA, Paris, p. 476.

ISTAT (Istituto Nazionale di Statistica) (1992). *Statistiche dell'agricoltura, zootecnia e mezzi di produzione.* Annuario No. 40, 1994, Rome.

Molina, M.P., Casu, S. and Caja, G., (1991). La raza Sarda y el sistema de producción de leche de oveja en Cederna. *OVIS Tratado de Patología y producción ovina*, 14: 51-68.

Moniello, G., Cosseddu, G.M., Pinna, W., Fois, N., Molle, G. and Ligios, S. (1997). Alimentazione con unifeed ed unifeed + pascolo in pecore di razza Sarda: profilo metabolico nel corso della lattazione. In: *XII National Congress ASPA*, Pisa, Italy, 23-26 June 1997, pp. 257-258.