

# Intake and milk production of goats grazing Sulla forage under different stocking rates

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**ABSTRACT:** A total of 24 Girgentana goats was divided into 3 homogeneous groups grazing a sulla monoculture under stocking rate of 30, 50 or 70 goats/ha (LSR, MSR and HSR). Available biomass, herbage selected by goats and milk yield were measured and sampled. The DM intake of goats and its botanic composition and digestibility were assessed by the *n*-alkane method. Grazing at HSR was suspended 18 d before MSR and LSR (35 vs. 53 d), due to the low biomass availability. Over the first 35 d of grazing, the HSR reduced height and availability of herbage. The herbage intake and milk yield of goats increased from HSR to LSR, without relevant changes in milk quality. During all grazing period (53 d), the higher grazing pressure led to a lower total milk yield *per* goat, whereas the HSR produced the highest daily and total milk amount *per* ha.

**Key words:** Goats intake, Sulla forage, Grazing intensity, Milk production.

**INTRODUCTION** – The productive system of Mediterranean goats is mainly based on grazing extensive natural pastures, whereas in favourable environments the natural resources are integrated by grazed or stored cultivated forages. An efficient grazing management of forage cultures, as of every type of pasture, requires the adoption of an appropriate stocking rate (SR) ensuring the maximum forage and animal productivity. The effects of SR has been mainly investigated for goats browsing shrubby and woody lands (Njwe *et al.*, 1995; Tsiouvaras *et al.*, 1999). Considering goats grazing herbaceous cultures, where higher SR can be opportunely adopted, recently Bonanno *et al.* (2005) obtained the highest milk yield *per* ha with goats grazing a sward of ryegrass and berseem clover at a SR of 48 goats/ha, in comparison with a lower and a higher SR (36 and 72 goats/ha); thus, a moderate SR was confirmed to have the better effects on forage resources and animal products. Based on this result, another experiment was planned changing the grazed forage into a first-year sulla meadow. The sulla forage (*Hedysarum coronarium*, L.), widespread in the southern Italy, is known for its positive impact on animals productivity, attributed to its higher protein content and ratio between degradable and structural carbohydrates (Terrill *et al.*, 1992), and to the adequate presence of condensed tannins (Min *et al.*, 2003). Thus, the aim of this experiment was to examine the effects of SR on selective behaviour, herbage intake and milk production of goats grazing sulla forage.

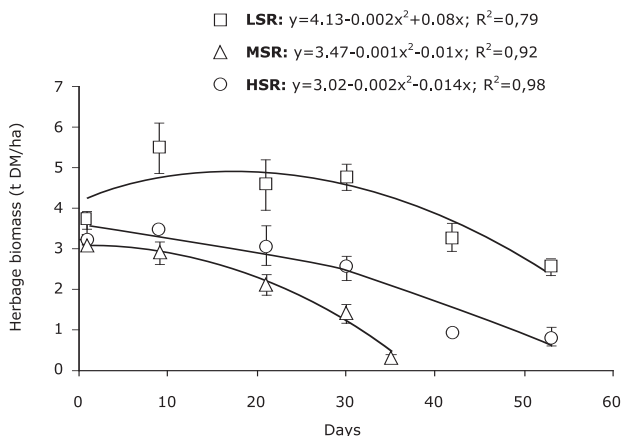
**MATERIAL AND METHODS** – The experiment, carried out in a semi-arid hilly area of Sicily (37°37'N; 13°29'E; 178 m a.s.l.), lasted 53 d from 19<sup>th</sup> April 2005, and involved 24 goats of Girgentana breed, averaging 121±13 days in milk and 37.5±4.7 kg of liveweight, divided into 3 homogeneous groups. During the daytime (9:00-16:00), each group was left to continuously graze a one-year sulla meadow divided into 3 paddocks of different size (2625, 1612 and 1139 m<sup>2</sup>), according to a low, medium and high SR, corresponding to 30 (LSR), 50 (MSR) and 70 (HSR) goats/ha. Measurements and sampling were executed over the experimental period, regarding forage (sulla height, available biomass, selected herbage) and goats (live weight, BCS, daily mass milk yield, individual milk yield). The herbage DM intake of goats was assessed in 3 occasions by the *n*-alkane technique (Dove and Mayes, 1991) using the least-squares optimisation procedure to estimate botanical composition and DM digestibility (Dove and Moore, 1995). Analysis for DM, CP, fat, ash, NDF, ADF and ADL were carried out on selected forage.

The estimation of net energy for lactation (NE<sub>L</sub>) of forage was based on estimated digestibility and equations of Van Soest and Fox (1992). Individual milk samples were analysed for pH, fat, protein, casein, lactose and somatic cells (SCC) by Combi-foss 6000, and urea by enzymatic method using difference in pH with CL10 instrument. Data were statistically analysed using SAS 9.1.2 software. Quadratic regressions were fitted to describe the pattern of herbage biomass. Data of milk yield were analysed using ANOVA with stocking rate as only factor (LSR, MSR, HSR). Since grazing at HSR was suspended at day 35 of experiment, only data of the first 35 d was analysed by GLM procedure, including in the model the stocking rate, the period of the experiment (9, 21 and 30 days) and their interaction when significant; individual animal variation within SR was used as error term. Means differences were tested by the Student's t test.

**RESULTS AND CONCLUSIONS** – The patterns of biomass during the experimental period (Figure 1) show the higher availability under LSR. Grazing at HSR was suspended before MSR and LSR (35 vs. 53 d), due to the faster reduction of vegetation, attaining a final value of 0,3 t DM/ha. Over the first 35 d of grazing, biomass (4.7, 3.1, 2.4 t DM/ha;  $P<0.001$ ) and sulla height (41, 29, 21 cm;  $P<0.001$ ) decreased from LSR to HSR. The increase in SR led to lower presence of spontaneous grass species (18.9, 8.2, 7.4 % DM;  $P=0.003$ ) and increment in dead matter (7.5, 10.5, 16.6 % DM;  $P<0.001$ ).

The herbage intake of goats at pasture was higher under LSR than MSR and HSR, in terms of DM, CP, NDF and

Figure 1. Effect of stocking rate on herbage mass during the experimental period.



NE<sub>L</sub> (Table 1), whereas chemical composition of intake differed for CP (21.2, 19.9, 20.0 % DM for LSR, MSR and HSR;  $P=0.035$ ). The LSR favoured the intake of spontaneous grass species, more available in this plot and known to be greatly palatable for goats.

Table 1. Effect of stoking rate on intake, botanical composition and digestibility of selected herbage (35 d of experiment).

		Stocking rate (SR) (goats/ha)				P-values (1)			R <sup>2</sup>	Root MSE
		LSR (30)	MSR (50)	HSR (70)	SEM	Period (P)	SR	P*SR		
DM intake	g/goat	1353 Aa	1185 ABb	1069 Bb	39.6	**	+	-	0.59	194
CP intake	g/goat	284 A	237 B	216 B	8.5	***	***	*	0.73	41.5
NDF intake	g/goat	407 Aa	327 ABb	294 Bb	21.3	**	+	*	0.60	105
NE <sub>L</sub> intake	Mkal/goat	2.26 Aa	1.95 ABb	1.74 Bb	0.09	**	**	-	0.54	0.43
Sulla	% DM	50.6 B	72.3 A	75.5 A	3.8	***	*	***	0.67	18.7
Grass	% DM	41.5 A	6.9 B	9.0 B	4.5	***	*	***	0.65	22.1
Other weeds	% DM	7.9 B	20.7 A	15.5 A	1.7	**	*	***	0.80	8.2
DM digestibility	%	73.9	73.7	73.4	0.92	ns	*	**	0.48	4.5

(1) += $P\leq 0.10$ ; \*= $P\leq 0.05$ ; \*\*= $P\leq 0.01$ ; \*\*\*= $P\leq 0.001$ . A, B:  $P\leq 0.01$ ; a, b:  $P\leq 0.05$ .

Over the first 35 days, the mean individual milk yield followed the same increasing trend of DM intake passing from LSR to HSR (1763, 1516, 1361 g/d;  $P=0.049$ ). In the same period, parameters of milk quality did not show changes affected by SR, except for milk urea, higher for LSR (44, 43, 36 mg/dl;  $P=0.016$ ).

This result can not be explained by the available data; an hypothesis could be related to the lower degradable protein, consequent to the presence of condensed tannins in the sulla (Min *et al.*, 2003), or the higher fermentable carbohydrates in the rumen, conditions that both improve N efficiency and reduce milk urea (Moharrery, 2004).

Despite lower milk yield, goats at HSR showed a loss in live weight, in contrast with other groups (+5.0, +4.3 and -1.4 %;  $P=0.01$ ). With regard to the entire grazing period (53 d), the increase in grazing pressure determined a reduction in the total milk yield *per* goat; nevertheless, grazing under the HSR produced the highest daily and total milk amount *per* ha (Table 2).

Table 2. Effect of stoking rate (goats/ha) on milk yield during the experimental period (mean±SE).

		LSR (30)	MSR (50)	HSR (70)	<i>P</i> -values (1)	R <sup>2</sup>	Root MSE
Grazing days	n.	53	53	35			
Daily milk	g/goat	1503±46 Aa	1195±46 Bb	1382±57 ABa	***	0.14	335
Total milk	kg/goat	79.7±2.3 A	63.3±2.3 B	48.3±2.9 C	***	0.35	17.0
Daily total milk	kg/ha	45.8±2.2 C	59.3±2.2 B	97.0±2.7 A	***	0.61	16.2
Total milk	t/ha	2.43±0.11 B	3.14±0.11 A	3.40±0.13 A	***	0.22	0.78

(1) \*\*\*= $P\leq 0.001$ . A, B, C:  $P\leq 0.01$ ; a, b:  $P\leq 0.05$ .

In conclusion, the overstocking was confirmed to negatively affect individual goats productivity. Nevertheless, in opposite to the previous experience (Bonanno *et al.*, 2005), when grazing a mixed sward at a moderate pressure (48 goats/ha) led to the maximum milk yield *per* ha, in this case this result was obtained with a grazing pressure of 70 goats/ha. The cause could be imputable to the fast deterioration of sulla vegetation during the final grazing period under the MSR and LSR, unable to sustain the level of goats milk yield.

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