Nutritional Management of The Transhumant Sheep and Goat in Greece

A. Siasiou, I. Mitsopoulos, K. Galanopoulos and V. Lagka

***Abstract*—In Mediterranean countries dairy sheep and goat farming is based on grazing even though production system can vary from extensive, where nutrition is based on the exploitation of natural resources, to intensive, where nutrition can be a combination of grazing and parallel supplementation of feed. Transhumance is an extensive farming system where herds are moved to uplands in order to exploit the mountainous rangelands. Purpose of this paper was to study the nutritional management of transhumant sheep and goat herds in Greece. Non parametric analysis was performed to a sample of 551 transhumant herds. The results revealed differences of the nutritional management performed between different species and breeds of the reared animals. More specifically nutrition of goats and indigenous mountainous breeds was based mainly on grazing even to lowlands while nutrition of sheep and improved dairy breeds tended to be more integrated with combination of grazing to supplementation of feed.**

***Index Terms* — extensive system, grazing, nutrition, sheep and goat farming system, transhumance.**

I. Introduction

Small ruminant farming systems in Mediterranean area are mainly characterized by the dominance of pastoral systems and the wide usage of natural rangelands through grazing. Grazing by small ruminants, besides covering partially or not the nutritional requirements of the animals, can be beneficial to the shape of the landscapes and to ecosystem's conservation, involving the prevention of fires in summer rangelands and, through seed dispersal, to the plant species regeneration. These ways grazing can be characterized as a conservation tool of biodiversity driving to the prevention of genetic and biological loss, allowing wide use of rangelands, when fewer capital goods (accommodation, machinery etc) contrary to other agricultural sectors are needed [1]-[3].

Sheep (78%) and goats (90%) in Greece are mainly reared in less favored areas (LFAs) as they tend to be more adaptive to environments where no other agricultural activity is possible [4]. The grazing areas in Greece receive no agricultural management (fertilizers or agrochemicals) besides grazing and are covered mainly by grass (32%) and scrubs (15%). The rest grazing area (53%) in the country is consisted by forest and scrubs with grass understory (26%) or forests with grass understory (27%) [5].

Transhumance is a traditional pastoral practice that involves the seasonal migration of flocks and grazing in high altitude pastures during summer and autumn and in low altitude pastures or housing of the animals during winter and early spring. In Greece the majority of the transhumant farmers

moves their flocks to their summer domiciles in the second half of May and return to winter domiciles during October [5]-[6]. However, an important number of herders (located mainly on Central Greece) move their flocks earlier on the mountainous rangelands, i.e. the movement takes place in early spring (until 31st of April) [6]-[7]. This is primarily due to the readiness of the grasslands that is associated with the mild climate of the area and the dry summer of the plains [8].

Interesting is also that the number of transhumant sheep and goat farms has been importantly reduced (30%) during the second half of the 20th century, resulting to the decline of grazing pressure to summer rangelands. However, during the last decade, a noticeable increase of the total number of transhumant sheep and goat has been recorded probably linked with the general economic crisis or the form of the payments (headage) payments [6].

According to [9] the latter years new "production systems", based on the utilization of natural pastures have emerged, where producers in order to increase their income rear mainly improved breeds of small ruminants. Analogous findings have been recorded in Greece where the majority of the transhumant sheep and goat farming sector the sampled sheep producers' rare improved dairy sheep breeds while the reared goats belong mainly to indigenous breeds [10]. The latter influences also the way the producers care for their animals, referring to the time spend to the natural pastures, that tend to be lesser, and housing periods, that tend to be longer, for the more "productive breeds" [11].

Purpose of this paper was the study the nutritional management of the transhumant sheep and goat in Greece evaluating the proportion of the nutritional needs covered by the supplemented ratios. Furthermore, differences in nutritional management were identified according to the specie and the breed of the reared animals.

II. Materials and Methods

A. Survey design and administration

A baseline survey using a semi-structured questionnaire was conducted during 2014 through individual interviews while the data were collected by trained enumerators. Because of the complexity of the questionnaire each interview lasted for 60 minutes on average and data affording managerial practices and performance of the animals were collected.

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The survey covered a random stratified sample of 551 transhumant sheep and goat farmers, 218 of who bred both sheep and goat, 252 purely sheep and the rest 81 only goats. The breed standard of transhumant sheep was as follows: 72% belong to crossbreeds or to improved dairy breeds and 28% to indigenous mountainous breeds, while the analogous breed standard of transhumant goats was: 33% belong to crossbreeds or improved dairy breeds and 67% to indigenous mountainous breeds.

B. Data analysis

Descriptive data were summarized using frequency classes, means and cross-tabulations while non-parametric tests were used to perform further analysis as the data violated the normality assumption. More specifically differences between mean values of the studied parameters were estimated using the Mann-Whitney U test.

Furthermore, using linear programming, the degree that concentrates (C) and browse (B) contributes to the coverage of the nutritional needs was calculated. Nutritional requirements of sheep and goats were defined on the basis of the needs on metabolized energy (ME), digestible crude protein (DCP) and dry matter (DM). Four basic productive stages of ewes and does were recorded. These were the last 42 days of gestation, the winter and summer milking periods and the middle of pregnancy, i.e. the interval between the second month and the first half of fourth month of pregnancy.

III. RESULTS

The results revealed that during the accommodation on summer domiciles the majority of the transhumant producers (approximately 70% for sheep and 75% for goats) did not supply animals with any kind of feed and the nutritional needs of the animals were supposed to entirely be covered by grazing (Table 1 and 2).

TABLE 1. SYNTHESIS OF RATIONS OF TRANSHUMANT SHEEP (N) FARMS

	Stage	B*	C**	B&C	G***
		(%)	(%)	(%)	(%)
WINTER	Last 42 days of pregnancy	26	106	306	333
		(5,5)	(22,5)	(65,1)	(70,8)
	Lactation	-	39	394	429
			(8,3)	(83,8)	(91,3)
	2nd-1/24th month of pregnancy (giving birth on winter)	46	124	237	470
		(9,8)	(26, 4)	(50, 4)	100
SUMMER	Lactation	20	46	74	470
		(4,2)	(9,7)	(15,7)	100
	2nd-1/24th month of pregnancy (giving birth on early spring)	42	62	47	470
		(8,9)	(13, 2)	(10, 0)	100

B*: BROWSE, C**: CONCENTRATES, G***: GRAZING UNITS

Grazing was continuous with separation of flocks in two groups (i.e. milking and dry period).

TABLE 2. SYNTHESIS OF RATIONS OF TRANSHUMANT GOAT (N) FARMS

	Stage	B*	C**	B&C	G
		(%)	(%)	(%)	(%)
WINTER	Last 42 days of pregnancy	26	106	117	299
		(5,5)	(22,5)	(39,1)	100
	Lactation	-	39	158	274
			(8,3)	(52, 8)	(91,6)
	2nd-1/24th month of pregnancy (giving birth on winter)	46	124	49	282
		(9,8)	(26, 4)	(16, 4)	(94,3)
SUMMER	Lactation	20	46	34	299
		(4,3)	(9,8)	(11,4)	100
	2nd-1/24th month of pregnancy (giving birth on early spring)	42	62	40	299
		(8,9)	(13, 2)	(13,4)	100

B*: BROWSE, C**: CONCENTRATES, G***: GRAZING UNITS

During the persistence of the herds on winter domiciles the majority of the producers supplied the reared animals with a combination of browse and concentrate with parallel grazing of the animals on winter rangelands. The rations of transhumant sheep were mainly based on the supplementation of forage and crops and less to protein-based feeds as soybean, while the rations of transhumant goats were mainly consisted by cereal (maize, wheat, barley) and in many cases were not supplemented with any kind of browse. Goats' nutritional management was largely based on grazing on natural rangelands, as they are more adaptive to the exploitation of natural resources, especially those that belong to indigenous mountainous Greek breeds (i.e. the majority of reared goats). Even during lactation, the animals exit for grazing but not on a regular basis, while the average hours of grazing range from 3 to 9 hours. Non-productive animals normally graze on natural pastures or forage crops while animals with higher requirements are normally housed and are fed with a combination of concentrates and forage.

These results coincide with the findings of [12], who, quoted that for extensive farming system in Spain supplementation was necessary 100% during winter, while during spring and summer it was limited mainly due to grazing. Similarly, Simos *et al.* [13] reported that the nutritional requirements of extensive breed goats in Metsovo, Greece during summer were exclusively covered though grazing

As can be seen in table 3, during the persistence of transhumant goats on winter domiciles the deficiency on ME, DCP and DM fluctuates from 19 to 67%. Specifically, the lack on DCP that are supposed to be covered though grazing fluctuates in high levels from 38 to 62%.

Analogous results were met studying the nutritional management of transhumant sheep (Table 4). The lack on the basic nutritional requirements in winter domiciles fluctuates from 16 to 70% for transhumant sheep. Similarly, during the persistence on summer domiciles, the lack on basic nutritional requirements comes up to 60 to 90%.

TABLE 3. PERCENTAGE (%) OF COVERAGE OF NUTRITIONAL REQUIREMENTS OF GOATS THOUGH BROWSE, CONCENTRATES AND GRAZING

		Metabolizable energy (ME)			Digestible Crude Protein (DCP)			Dry Matter (DM)		
		B*	C*	G*	B*	C*	G*	B*	C*	G*
Winter	A	12	42	46	16	45	39	12	29	59
	B	21	59	20	18	33	49	17	36	47
	C	8	34	58	12	25	63	9	24	67
Summer	D	1	6	93	<1	2	97	<1	3	97
	E	3	15	82	4	12	84	4	11	85

A: Last 42 days of pregnancy
B: Lactating period
C:2nd-1st half of 4th month of pregnancy (giving birth on spring)
D: Lactating period
E: 2nd-1st half of 4th month of pregnancy (giving birth on winter)
B*: Browse
C*: Concentrates
G*: Grazing

It should be mentioned that the grazing animals expend more energy as when they are in the stall the ratio is provided in a partially possessed form that makes it easier to be ingested but mainly because animals do not have to move to search for feed [14] The high maintenance requirements at pastures that might be due to increased cost due to movement and harvesting the herbage were not taken into consideration to the calculations taking into consideration that the body conditions changes of sheep and goat grazing in stubble conditions exhibit a cyclic pattern consequent with temporal changes in nutritive quality [10]

TABLE 4. PERCENTAGE (%) OF COVERAGE OF NUTRITIONAL REQUIREMENTS OF SHEEP THOUGH BROWSE, CONCENTRATES AND GRAZING.

		Metabolizable energy (ME)			Digestible Crude Protein (DCP)			Dry Matter (DM)		
		B*	C*	G*	B*	C*	G*	B*	C*	G*
Winter	A	29	55	16	23	23	54	23	32	45
	B	31	51	18	29	28	43	30	31	39
	C	25	58	18	17	12	71	18	31	51
Summer	D	4	11	84	4	5	91	4	7	89
	E	8	22	70	6	8	86	6	11	83

A: Last 42 days of pregnancy
B: Lactating period
C:2nd-1st half of 4th month of pregnancy (giving birth on spring)
D: Lactating period
E: 2nd-1st half of 4th month of pregnancy (giving birth on winter)
B*: Browse
C*: Concentrates
G*: Grazing

According to [15] grazing though extensive farming covers 30 to 93% of the nutritional requirements of the animals, while Hadjigeorgiou [2] reported 20 to 70% participation of grazing, analogous to the productive stage of the animals and the availability of adequate pastures.

Comparing the lack on ME, DCP and DM of these two ruminants we detected that are grater for transhumant goats. Goats however according to Morand-Fehr, (2005) are better able than sheep to ingest and digest forage, of low nutritional value etc rich in cell wall and poor in nitrogen, consequently are better able to survive in harsh environments and frequently under water scarcity [17]-[18]. According to Morand-Fehr and Boyazoglou [19] the self-sufficient character of goats is the main reason that this ruminant is extensively bred in dry tropical and subtropical areas with no agricultural potential.

The observations affording nutritional management highlight the importance of grazing on the coverage of the nutritional needs of the reared animals while parallel confirms the role of transportation of the animals being the efficient exploitation of natural resources [19]-[20].

A. Relationships between the studied parameters

The results revealed (Table 5) that the indigenous mountainous breeds (Z=-2.608, p=0.009) and goats (Z=-3.726, p=0.004) spent more time in summer domiciles contrary to the improved dairy breeds and sheep respectively. Specifically, indigenous breeds stay on average 160 days, about 10 days more than the improved on mountainous and semi mountainous rangelands while goats about 7 days more than sheep.

An interesting finding also was that the nutritional needs of the improved or the cross breeders are in a higher degree covered by supplementary feed, named DM and DCP, than those of the indigenous breeds (Z=-2.491, p=0.013 and Z=-2.338, p=0.0019 respectively). This finding implies that the producers rearing improved animals supplement them more consistently during winter, limiting the hours spent on grazing while those rearing mostly indigenous breeds base the nutritional management of the animals on natural rangelands even during winter.

Furthermore studying the daily amount of browse and concentrate supplemented was found that sheep (Z=-4.799, p=0.000 and Z=-8.626, p=0.000 respectively) and genetically improved animals (Z=-4.619, p=0.000 and Z=-3.726, p=0.000 respectively) receive larger amount of feed that goats and indigenous mountainous breeds.

TABLE 4. COMPARISON OF THE MEAN VALUES OF THE VARIABLES

	Grazing days	Browse (kg)	Concntrates (kg)	Own production (kg)	ME	DCP	DM
Z value	-2.60	-3.72	-4.61	-0.51	-1.40	-2.33	-2.49
Sig	0.009	0,000	0.000	0.610	0.16	0.019	0.013
Grouping variable: Breed							
Z value	-2.86	-8.6	-4.79	-0.98	-1.01	-0.88	-1.37
Sig	0.004	0,0	0,0	0.323	0.312	0.378	0.168
Grouping variable: Animal							

IV. DISCUSSION

Based on an extensive, country-wide survey, the nutritional management performed by the average transhumant herd in Greece has been analyzed. The results revealed that in uplands the nutritional management is based mainly on grazing and coincides with the productive stages that have less requirements (dry period, end of lactation, first two months of pregnancy) while the return in lowlands coincides with the starting of lambing/kidding period when nutritional requirements increase significantly. Moving to lowlands provides also better weather conditions allowing continuous or intermittent grazing.

Generally grazing overmasters supplemented feed during the maintenance of the transhumant herds on summer domiciles. During winter however, when the nutritional requirements are higher, and especially during lactation, producers provide a combination of forage and concentrates. Differences of nutritional management were also recorded among different species; 84% of sheep as opposed to only 53% of goats are provided during lactation with a more integrated ration that contains both concentrates and forage.

The results also revealed that goats and indigenous mountainous breeds spent more time grazing while the provided amount of feed is significantly lower than to sheep and improved dairy breeds. Grazing of sheep and improved dairy animals of both species is limited resulting also to the reduction of grazing pressures to summer pastures in some summer regions. It should be noted that Alexandridis [21] noted that pressure to mountainous pastures were under grazed allowing the built up of vegetation to 40% of the mountainous pastures in Greece imputing this to the reduction of the number of transhumant herds. However, the induction of improved breeds also impacts to the grazing pressure as producers limit grazing, supplement feed and increase house periods in order to improve the productivity of the reared animals.

Under grazing of pastures is not the only problem as overgrazing is also an important factor that sometimes compels producers to limit the grazing periods of their herds. Overgrazing as under grazing mentioned above affects directly the quality of grasslands leading the later decades to the gradual degradation that has taken place in many areas of the country as well [21]-[22].

V. CONCLUSION

The current study analyzed aspects of the nutritional management of transhumant sheep and goat herds in Greece focused on grazing periods and the supplementation of feed during four basic productive stages of ewes and does expending previous work of other authors [22]

The results showed mainly that grazing overmasters supplementation of feed in all studied productive stages. However, intensification management practices as crossbreeding or induction of improved dairy breeds, adapted to increase productivity, has driven to the gradual limitation of grazing periods of some herds, especially those that rear sheep. On the other hand, herds consisted by goats or rearing indigenous mountainous breeds base the nutritional management of the animals on grazing even during winter lactation.

Taking into consideration that small ruminants and grazing have an important role in the maintenance of the current state of landscapes the configuration of whom has achieved by centuries of grazing, problems as under or over grazing should be recognized and dealt with so that further degradation of pastures be prevented. Basic is also the recognition of "transformation" of pastoral systems that tend to be highly dependent by external resources naming feed resources and agricultural by products [11]-[21]A solution could be the linkage of payment levels of national or European aid with sustainable grazing patterns, as headage payments performed previously, led to the increase of livestock numbers that encouraged overgrazing.

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