Diet selection of sheep and goats grazing on cereal stubble in northern Greece

M.D. Yiakoulaki and V.P. Papanastasis
Department of Range Science, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece

SUMMARY – Stubble grazing of small ruminants after cereal harvesting is a widespread feeding practice in Mediterranean countries during the summer season. In this paper, diet selection of sheep and goats grazing on cereal crop residues was studied in northern Greece. Diet samples were collected by hand picking and categorized as cereal stubble (head, leaf, stem and seed), forbs, grasses and woody species. Even though sheep and goats grazed together they displayed different foraging styles. The herbaceous species were the main component of diet selected by sheep and goats (78.3% and 64.4%, respectively) while cereal stubble contribution was significantly (P≤0.05) higher for sheep (21.3%) than for goats (11.9%). Goats selected significantly (P≤0.05) higher amounts of woody species but sheep preferred greater amounts of grasses.

Keywords: Diet composition, stubble grazing, small ruminants.

RESUME – *"Sélection du régime par des brebis et des chèvres au pâturage sur des chaumes de céréales au nord de la Grèce". Le pâturage des chaumes par les petits ruminants en été est une pratique courante dans les pays méditerranéens, en particulier au Nord de la Grèce. L'objectif de ce travail est d'étudier la composition de la ration prélevée par les moutons et les chèvres qui pâturent les chaumes. Des échantillons d'aliments ont été prélevés à la main directement sur parcours puis répertoriés en catégories : chaume de céréales (épis, feuille, tige et graine), 'forbs', plantes herbacées et espèces ligneuses. Les moutons et les chèvres pâturaient ensemble, pourtant ils avaient des préférences différentes pour les catégories d'aliments étudiés. La ration de ces animaux était composée essentiellement par des plantes herbacées (78,3% et 64,4%). La proportion des chaumes dans la ration était (P≤0,05) plus élevée chez les moutons (21,3%) que chez les chèvres (11,9%). Par ailleurs, les moutons consommaient plus de végétation herbacée que les chèvres. En revanche, les chèvres consommaient plus d'espèces ligneuses que les ovins (P≤0,05).*

Mots-clés : *Composition de la ration, pâturage des chaumes, petits ruminants.*

Introduction

The cereal stubble after harvesting is an important feeding resource for small ruminants in the Mediterranean basin countries during summer. In that period forage of natural pastures is dormant and depleted, and shepherds are forced to lead their flocks for grazing to barley and wheat stubble. At the lowest elevation zone of northern Greece, such grazing takes place from the middle of June till early October (Yiakoulaki *et al.,* 2002). During the last few years, research has focused on cereal stubble composition and production (Rihani *et al.*, 1991; Guessous, 1992; Rosilio *et al.*, 1998; Landau *et al.*, 2000), nutritive value and intake (Treacher *et al.,* 1996; Brand *et al.*, 2000; Landau *et al.,* 2000) and grazing behaviour (Yiakoulaki *et al.,* 2003) of small ruminants. It is known (Guessous, 1992; Treacher *et al.,* 1996; Brand *et al.*, 2000) that there is a clear pattern in the removal of different fractions from cereal stubble by grazing sheep. However, data concerning the botanical composition of the diet selected by goats and sheep grazing together in the same flock on cereal crop residues are limited. The aim of this paper was to study diet selection of sheep and goats grazing on cereal stubble in northern Greece.

Material and methods

The study was conducted in the municipal department of Kolchiko in Lagadas county of Thessaloniki, northern Greece, during summer 2002. A cereal (wheat and barley) stubble field of 6 ha at a low elevation zone (<200 m above sea level) was used as an experimental area. A mixed flock of 70 goats and 50 sheep, both of them composed of local breeds, was placed on stubble three days

after cereal harvesting. At the beginning of the experiment forage cover was measured with the loop method (Cook and Stubbendieck, 1986).

A direct observation and simulation method (Altmann, 1974) was used to determine the botanical composition of the diet consumed by sheep and goats and to obtain representative samples. Four 2 year-old female animals (two sheep and two goats) were used as experimental animals and were marked with large numbers for identification. The animals were followed continuously by two observers for two consecutive days. Each experimental animal was observed for a 30 minute period and representative samples of the ingested species were taken by hand plucking (Cook, 1964). This was done at certain distance from the animals in order not to affect their behavior. The animals grazed for more than four hours during the grazing days (Yiakoulaki *et al.,* 2003). A total of 16 individual observation periods of 30 minutes were obtained. The animals were allowed to get settled for 30 minutes before observations were initiated. The collected diet samples were botanically recognized and were categorized in four groups: stubble, forbs, grasses and woody species. The morphological parts of the stubble consumed (heads, leaf and stem components and fallen seeds) were also recorded.

All measurements were subjected to an analysis of variance (Steel and Torrie, 1980). The LSD test was used for detecting mean differences ($P \leq 0.05$).

Results and discussion

Forage composition

Mean forage botanical composition (%) of stubble (standing and fallen down), herbaceous plants (grasses and forbs) and woody species is presented in Table 1. The stubble represented more than 50% of the forage species while the woody ones were the smallest component. Grasses were dominated by *Cynodon dactylon, Avena fatua* and *Phleum phleoides* while forbs were dominated by *Polygonum aviculare* (a common summer plant on cereal stubble in Greece), *Echinofora tenuifolia* and *Silybum marianum.* The woody species were present at the edges of the field.

Dietary selection

Forbs were the main component of the diet selected by sheep and goats while cereal stubble contribution was significantly ($P \leq 0.05$) higher for sheep than for goats. Goats selected significantly ($P \leq 0.05$) greater amounts of woody species than sheep, which preferred to consume grasses (Table 2).

The selection pattern in utilizing the stubble resource was almost the same for sheep and goats but involved different percentages (Fig. 1). First, residual heads (standing and fallen down) were consumed, followed by leaf and stem components. These findings are in agreement with the results of Guessous (1992) and Brand *et al.* (2000) for grazing sheep. Sheep and goats selected greater amounts of standing heads (11.9% vs 9.0%) than fallen down (3.5% vs 1.9%), respectively. Sheep consumed significantly ($P \leq 0.05$) more leaf and stem components (6.6%) compared to goats (1.0%) and small amounts of the fallen seeds on the ground (0.2%).

Forbs appeared to be the most important forage class in both animals' diet. The main selected forb species was *Polygonum aviculare* followed by *Echinofora tenuifolia* (Table 3). The contribution of the above species in the diet of sheep and goats was not significantly different ($P \leq 0.05$).

Goats also consumed small proportions of *Centaurea* spp. (2.0%), *Cichorium intybus* (1.1%), *Silybum marianum* (0.5%), *Verbascum* spp. (0.3%), *Marubium peregrinum* (0.1%) and *Cardus* spp. (0.1%) while sheep consumed *Chenopodium album* (0.4%) and *Convolvulus elegantissimus* (0.3%).

In the present study, goats selected a broader forbs' diet than sheep. Eight forb species were included in their diet while the diet of sheep comprised only four species.

Table1. Mean forage botanical composition (%) of stubble, forbs, grasses and woody species

Categories	Percentage
Stubble	53.36
Standing	18.57
Fallen down	34.79
Forbs	29.23
Polygonum aviculare	23.42
Echinofora tenuifolia	2.28
Silybum marianum	2.09
Cichorium intybus	0.50
Convolvulus elegantissimus	0.37
Chenopodium album	0.15
Verbascum spp.	0.11
Centaurea spp.	0.11
Eryngium spp.	0.10
Marubium peregrinum	0.10
Grasses	14.20
Cynodon dactylon	7.34
Avena fatua	3.44
Phleum phleoides	1.42
Lolium perenne	0.75
Hordeum murinum	0.64
Vulpia ciliata	0.28
Dactylis glomerata	0.11
Poa bulbosa	0.11
Poa annua	0.11
Woody species	3.21
Ulmus campestre	1.82
Rubus idaeus	1.08
Rosa canina	0.21
Quercus coccifera	0.10
Total	100.00

Table 2. Percentage (%) of stubble, forbs, grasses and woody species in sheep' and goats' diet grazing on cereal stubble in northern Greece

Forage class	Goats	Sheep
Stubble	11.9 a	21.3 b
Forbs	63.6 a	72.4 a
Grasses	0.8 a	5.9 a
Woody species	23.7 b	0.4 a

a,b: Means within the same row followed by a common letter were not significantly different ($P \leq 0.05$).

Both animal species preferred to consume first the flowers and leaves of *Polygonum aviculare* and later the stems. Goats also preferred to eat the flowers and fruits of *Centaurea* spp*., Cichorium intybus* and *Silybum marianum.* It is known that these plant parts are often rich in nutrients (Pfister and Malechek, 1986; Everitt and Alaniz, 1981) and may be important to animals' nutrition when they graze on cereal crop residues, which are unpalatable and of low nutritive value (Sundstol and Owen, 1984).

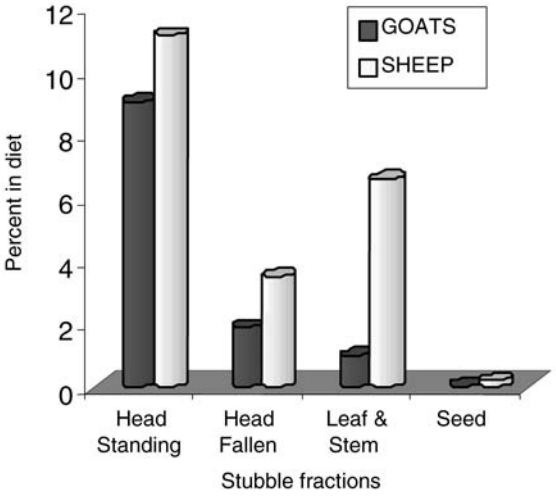

Fig.1. Stubble fractions in the diet of sheep and goats.

Table 3. Herbaceous composition (%) of sheep and goats' diet grazing on cereal stubble

Herbaceous species	Goats	Sheep
Forbs		
Polygonum aviculare	57.2 a	70.7 a
Echinofora tenuifolia	2.3 a	1.0 a
Other forbs	4.1	0.7
Grasses		
Cynodon dactylon	0.8 a	4.9 b
Dactylis glomerata, Phleum phleoides (dry grasses)	0.0	1.0
Total herbaceous species	64.4	78.3

Means within the same row followed by a common letter were not significantly different ($P \leq 0.05$).

Grasses were a significantly ($P \leq 0.05$) smaller fraction of goats' diet compared to sheep'. *Cynodon dactylon* was the most often selected grass species. Sheep consumed additionally small amounts of other grasses (dry), e.g. *Dactylis glomerata* and *Phleum phleoides.*

According to our results, sheep behaved as typical grazers selecting more herbaceous species in their diet (Table 3). Although the contribution of herbaceous species in goats' diet was equally important as in sheep, woody species represented the second major component of their diet (Table 2).

The observed dietary differences probably follow from differences in foraging behavior. Goats are more agile and forage with their heads raised, while sheep tend to graze with their heads down (Bartolomé *et al.,* 1998). This behavioral difference is an advantage for goats in prehending more attractive but less accessible feed items in the woody vegetation, while sheep prefer the feed items on lower herbaceous vegetation.

Woody species were a negligible component of sheep' diet (Table 2) and *Ulmus campestre* was the only selected species. Goats consumed more woody species (23.7%) than grasses (0.8%) despite the low availability of them in the botanical composition (Table 1). This means that goats, to a considerable extent, search for woody plants even when grazing on cereal crop residues. The main woody species (Fig. 2) in their diet were *Ulmus campestre* and *Rubus idaeus,* accounting for 17.0 and 4.7%, respectively, of the total percentage of the diet. *Quercus coccifera* and *Rosa canina* were also present but in small amounts (1.1% and 0.9%, respectively).

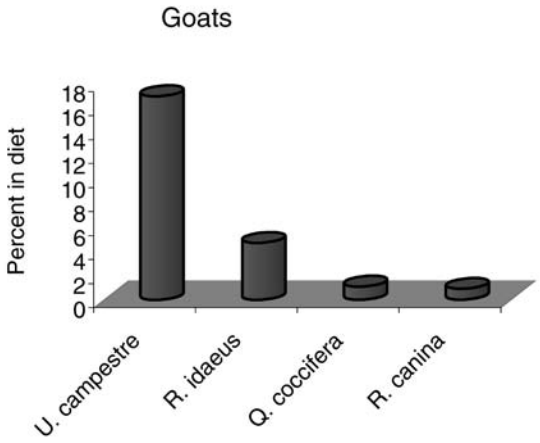

Fig. 2. Woody composition (%) of goats diet.

Conclusions

Sheep and goats faced with similar opportunities for choice when grazing on cereal stubble after harvesting, selected similar forage categories, but in different proportions. Sheep behaved as typical grazers while goats as opportunistic foragers.

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