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Botanical and chemical composition of fallow lands grazed by sheep under extensive conditions

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Abstract. The research was conducted on the 50-hectare fallow land in north-western part of Wielkopolskie Voivodeship, Poland, grazed for 12 years and in 2006 by 200 ewes of Polish heath sheep "Wrzosówka". The pasture yield, botanical and chemical composition of herbage in the vegetation period has been analysed. Between June and July the pasture yield and the content of chemical composition in dry matter (except the crude protein only) appeared to be highest. In case of fodder quality, the highest nutritional value was observed at the beginning of the vegetation period in May. Running to the end of the season both the pasture yield and chemical composition (except the micro- and macroelements) have been decreasing, that indicates the need to consider this relationship in proposing of the proper stocking rate.

Keywords. Fallow land – Sheep – Extensive grazing.

Composition botanique et chimique des jachères pâturées par les ovins sous des conditions extensives

Résumé. *En 2006 on a analysé des terres en jachère depuis 12 ans, couvrant une superficie de 50 hectares. Ces jachères ont été pâturées par 200 brebis de race polonaise primitive "Wrzosówka". Ces terres se trouvent dans la partie nord-ouest du pays (Voïevodie Wielkopolskie). On a évalué la productivité de la biomasse et la composition botanique et chimique du pâturage au cours de la saison végétative. En juin et juillet on a trouvé la production la plus élevée et aussi la plus grande teneur en la majorité des composants chimiques dans la masse sèche (sauf albumines). Le fourrage a atteint la plus grande valeur alimentaire au début de la saison végétative c'est-à-dire en mai. Vers la fin de la saison, non seulement la quantité mais aussi les teneurs en nutriments du fourrage diminuent (excepté les oligo- et macro éléments). Il est recommandé de tenir compte de cette relation pour le choix de la charge animale adéquate.*

Mots-clés. *Jachère – Ovins – Pâturage extensif.*

I – Introduction

Increasing amount of proper fallow lands in Poland has reached the level of 10% of all croplands. To protect the fallow lands against the undesirable invasion of bushes and trees the extensive sheep breeding (especially native sheep breeds) may be helpful for proper land management, therefore this kind of activity needs rational management and the better knowledge of real nutritional value of fodder from the fallow lands (Groberek *et al*., 2004a,b; Chrupek *et al*., 2006).

II – Materials and methods

Botanical and chemical composition of herbage was monitored in the northwestern Poland on proper fallow lands grazed for 12 consecutive years and in 2006 by 200 ewes of polish heath sheep. The sheep had free access to the pasture during the whole day throughout the growing season. Samples of herbage were taken four times a year (May, June/July, August and September/October) from five quadrates (total 5 m^2) per ha of the fallow lands. Approximately 5%

of the 50 ha area was investigated in total. Herbage samples from each hectare were bulked and the collective sample was analyzed to determine pasture biomass, dry matter, crude protein, ether extract, crude fiber, N-free extracts, ADF, NDF and selected macro- and microelements (Heilrich, 1990). Identification of individual plant families and individual species was done using the standard botanical key (Szafer, 1959). Due to collected information the analysis of pasture nutritional value as well as the stocking rate were shown (Kostuch, 1994). The percentage of plants groups: grasses (*Poaceae*), legumes (*Fabaceae*), compositae (*Asteraceae*), other species of *Dicotyledoneae*, horsetails (*Equisetaceae*) as well as sedges and rushes (*Cyperaceae, Juncaceae*), were determined on the examined area.

Data of biomass availability, chemical composition of the different botanical families were tested using the least square mean method of SPSS software for Windows v. 12.0 (Anonymous, 2004) to test the constant effects of sampling place and sampling period (months).

III – Results and discussion

The botanical composition of examined herbage was shown in Fig. 1 and Table 1. On studied area the grasses (58.09%) dominated over families of Compositae (15.14%), legumes (13.01%) and other species of Dicotyledoneae (11.74%). The contents of horsetails (0.70%) as well as sedges and rushes (1.32%) were relatively low.

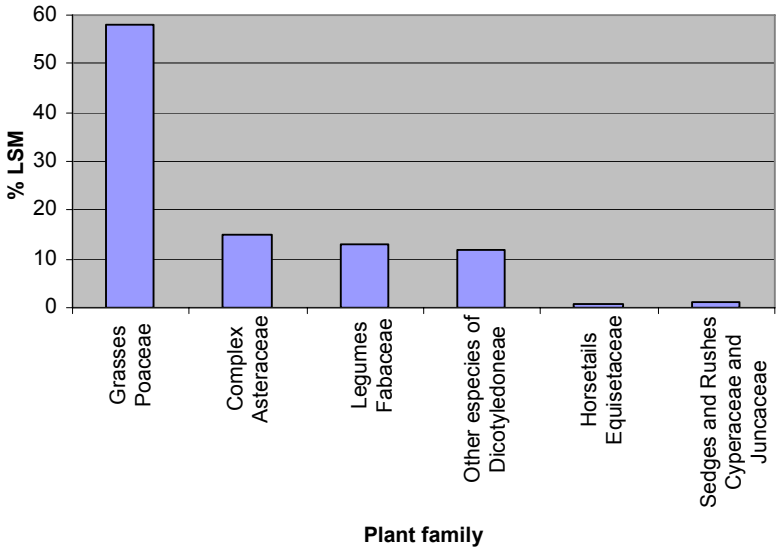

Fig. 1. Content of plant families observed in herbage on the studied fallow lands (%).

The influence of selected factors on the examined traits was shown in Table 1. Generally, the sampling place, except the other species of Dicotyledoneae and horsetails, did not affect the level of examined traits. On the other hand the sampling period affected statistically ($P \leq 0.05$ or $P \leq 0.01$) the contents of legumes and the other species of Dicotyledoneae in the herbage. Similar influence of mentioned factor was observed in the dry matter content as well as in the chemical composition of herbage, except the ash content and selected micro and macroelements.

Table 1. Influence of sampling place and period on biomass, botanical and chemical composition of herbage on fallow lands

Traits	Effect of		N	LSM	SE
	Sampling place	Sampling period			
Biomass (kg/ha) in dry matter	NS	*	16	5233	762
Grasses Poaceae (%)	NS	NS	8	58.09	0.43
Complex Asteraceae (%)	NS	NS	8	15.14	0.24
Legumes Fabaceae (%)	NS	*	8	13.01	0.16
Other species of Dicotyledoneae (%)	**	**	8	11.74	0.12
Horsetails Equisetaceae (%)	**	NS	8	0.70	0.05
Sedges and Rushes Cyperaceae and Juncaceae (%)	NS	NS	8	1.32	0.11
Dry matter (%)	NS	*	16	31.15	1.75
Ash (% DM)	NS	NS	16	3.46	0.71
Crude protein (% DM)	NS	**	16	3.64	0.10
Ether extract (% DM)	NS	*	16	0.80	0.05
Crude fibre (% DM)	NS	**	16	8.02	0.51
N-free extracts (% DM)	NS	**	16	14.86	0.74
ADF (% DM)	NS	**	16	11.20	0.65
NDF (% DM)	NS	*	16	17.51	1.06
Ca (% DM)	NS	NS	12	0.90	0.08
P (% DM)	NS	NS	12	0.25	0.02
Mg (% DM)	NS	NS	12	0.21	0.03
Cu (mg/kg)	NS	NS	12	7.11	0.41
Zn (mg/kg)	NS	NS	12	35.72	1.64
K (% DM)	NS	NS	12	1.27	0.12
Na (mg/kg)	NS	NS	12	738.08	215.26

Differences at: *P ≤ 0.05; **P ≤ 0.01; NS – not significant.

Also in the study of Groberek *et al.* (2004a,b), the facts of diversity of chemical composition in the pasture herbage on the fallow lands as well as its changes within the vegetation period were reported. Other cited studies emphasized that these changes affect the differentiation of nutritional value in examined fodder what is very important to the sheep nutrition and determines the technique of sheep pasturing under this kind of conditions.

Changes in pasture yield were shown in Table 2. The lowest pasture yield was observed in May in contrary to obtained results from June/July and August. The level of pasture yield in the common period of June and July was the highest and the declining trend in pasture yield within following months was observed despite the lack of statistical importance. On the other hand, the content of dry matter was highest at the turn of June and July and the lowest at the turn of September and October. The crude protein content was the highest in May in comparison to decreasing trend in the following months of vegetation getting the lowest crude protein level in the turn of September and October. Generally, the very low crude protein level was observed, which was typical for this habitat (Groberek *et al.*, 2004a).

The lowest content of ether extract in dry matter was observed at the turn of June/July, whereas the contents of crude fibre and N-free extracts increased at the turn of June/July in comparison to May, but in later months these values decreased. Similar trends of traits values were observed in case of ADF and NDF fractions.

Demonstrated tendencies concerning the changes in chemical composition and pasture yield of pastures located on fallow lands shows vast differentiation of their productivity and nutritional values within the vegetation period, that was also reported in other scientific studies (Groberek *et al.*, 2004a,b). This situation might have an influence on sheep behavior on pastures (Chrupek *et al.*,

2006) as well as on the productivity of sheep themselves (Groberek *et al*., 2004a). However, these factors might be marginalized at lower stocking rate of sheep and start to be very important when the stocking rate is increasing (Groberek *et al*., 2003).

Table 2. Influence of the month of vegetation period on pasture yield and chemical composition of herbage

Traits	May (A)	June/July (B)	August (C)	September/October (D)
Pasture yield (kg/ha) in dry matter				
LSM	1243	8950	6518	4223
SE	1523	1523	1523	1523
*	Bc	A	a	
Dry matter (%)				
LSM	32.11	40.45	30.43	21.61
SE	3.50	3.50	3.50	3.50
*		D		B
Ash (DM %)				
LSM	2.73	2.95	6.02	2.14
SE	1.41	1.41	1.41	1.41
Crude protein (DM %)				
LSM	4.77	3.66	3.18	2.92
SE	0.19	0.19	0.19	0.19
*	BCD	Ad	A	Ab
Ether extract (DM %)				
LSM	0.92	1.01	0.81	0.47
SE	0.11	0.11	0.11	0.11
*	D	D	d	aBc
Crude fibre (DM %)				
LSM	7.50	12.74	7.73	4.12
SE	1.03	1.03	1.03	1.03
*	Bd	ACD	aBc	aBc
N-free extract (DM %)				
LSM	16.18	20.08	12.69	10.50
SE	1.48	1.48	1.48	1.48
*	D	CD	B	Ba
ADF (DM %)				
LSM	10.20	16.85	10.07	7.68
SE	1.30	1.30	1.30	1.30
*	B	ACD	B	B
NDF (DM %)				
LSM	17.37	24.31	16.83	11.50
SE	2.13	2.13	2.13	2.13
*		D		B

Differences at: a, b, c, d – $P \leq 0.05$; A, B, C, D – $P \leq 0.01$.

IV – Conclusions

The research on the fallow lands monitored the definitely highest content of grasses over families of complex, legumes and other species of *Dicotyledoneae* in the pasture herbage, whereas the contents of horsetails, sedges and rushes were minimal, what indicates its usefulness in sheep pasturing on this area. The pasture yield was the lowest in May increasing at the turn of June/July and then decreasing in later months of vegetation period. Content of majority of chemical ingredients in the pasture fodder (except the crude protein) changed due to the month of vegetation period showing highest values at the turn of June/July and then decreasing. The content of crude

protein was decreasing within the vegetation period. Due to the selected micro- and macroelements in fodder, no changes were observed within the vegetation period. Generally, the turn of June/July was characterized by the highest pasture yield and the highest content of majority of chemical ingredients in dry matter (except the crude protein level). In the case of fodder usefulness, the highest nutritional value was expected at the beginning of vegetation period in May. The closer end of the vegetation period was, the amount of pasture herbage as well as the content of nutrients (except the micro- and macroelements) decreased, that should be considered this in proposing of the proper stocking rate.

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