

EFFECT OF MEADOWS CUTTING FREQUENCY ON THE AMOUNT OF DRY MASS YIELDS AND THEIR ABUNDANCE IN TOTAL PROTEIN

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Investigations were conducted on two meadow communities: orchardgrass type meadow and tall oat-grass type meadow. Studies aimed at determination of the effect of two and three cuts on the amount of dry mass yields and their contents of total protein on permanently fertilized meadows. Three cuts slightly increased yield abundance in total protein as compared to two cuts but the result was achieved at the cost of dry mass yield. With three cuts only 2% more protein were yielded but between 7–10% less dry mass per area unit than with two cuts. It proves that an improvement of hay abundance in protein through more frequent meadow cutting is little efficient and a highly unprofitable measure from the economic point of view.

meadows types; cut frequency; fertilizing; dry mass yields; content of total protein

INTRODUCTION

A rapid decrease in fertilization noted in early nineties and its low level observed since have negatively affected not only grassland yield but also the produced quality of fodder. In the eighties, when 150–200 kg N.ha⁻¹ was applied on a majority of acreage, it was estimated that about 5 million tones of grain was needed to provide a source of energy necessary to balance the removed excess of protein in feeds (Mościcki, 1982). At present with an average application of only 46 kg N.ha⁻¹ (Mazur, Filipek-Mazur et al., 1998) a considerable protein deficit is observed in feeds. On meadows dominated by high grasses even their yearly nitrogen treatment with 100 kg N.ha⁻¹ does not ensure sufficient protein content in feed from the point of view of animal nutritional requirements (Kasperczyk, 1996; Rutkowska, Szczygielski, 1978).

It seems that an increase in meadow feeds abundance in protein may be achieved though more frequent meadow cutting. Thus the author thought justified to undertake investigations on the influence of meadow cutting frequency with permanent treatment on dry matter yield abundance in total protein and its amount.

MATERIALS AND METHODS

Investigations were conducted on two mountain meadows from full sowing done in 1982: orchardgrass type meadow (*Dactylis glomerata*) and tall oat-grass meadow (*Arrhenatherum elatius*). The species constituted between 90–92% of the sward yield. The communities were located on acid brown soil with $pH_{KCl} = 4.3$ and the following contents of available components: 4.2 mg P_2O_5 ; 10.0 mg K_2O and 5.8 mg Mg . 100 g^{-1} soil. 60 kg P_2O_5 was used for meadow treatment once in spring, 80 kg K_2O in two equal parts was applied under the first and second re-growth, and 120 kg N . ha^{-1} . With two cuts the nitrogen dose was divided proportionally: 50% under the first and 40% under the second cut, while with three cuts 40% under the first and 30% under each of the next two cuts. In case of two cuts the first one was gathered at the beginning of tall oat-grass flowering and the orchardgrass was fully eared at that time. The second cut was gathered c.a. 9 weeks later. With three cuttings the first cut fell during the oat-grass full earing stage, while the orchardgrass was only just entering its earing stage. The following two cuts were 6 weeks apart.

RESULTS AND DISCUSSION

Dry mass yield

Three cuts of communities of orchardgrass or tall oat-grass type negatively affected their yield as compared to two cuts (Table I). A decline in dry matter yield was on average 0.6 t on the first type meadow and 0.47 t. ha^{-1} on the second meadow. Although the average differences over the three years were statistically insignificant, still they occurred in all the years and assumed values about 10% of yield.

The second cut had the greatest share in both a yearly yield from communities (Table II). With two cuts it constituted on an average 70% for orchardgrass and 76% for the tall oat-grass. With three cuts this cut yield contained 67% of orchardgrass in the sward and in the tall-oat-grass sward 74% of yearly yield. The share of the second cut yield in the yearly yield was respectively: 23% and 19%, whereas the third cut constituted 10% and 7%.

I. Yields of dry mass (t/ha)

Type of meadow	Number of cuts	Years			X
		1993	1994	1995	
<i>Dactylis glomerata</i>	2	5.63	5.58	5.98	5.73
	3	4.80	4.97	5.63	5.13
<i>Arrhenatherum elatius</i>	2	6.88	6.77	7.46	7.04
	3	6.59	6.14	6.98	6.57
NIR (LSD) $p + 0.05$		0.87	0.75	0.73	0.78

II. Proportion of cuts in annual yield (%)

Type of meadow	Number of cuts	Cut		
		I	II	III
<i>Dactylis glomerata</i>	2	70	30	–
	3	67	23	10
<i>Arrhenatherum elatius</i>	2	76	24	–
	3	74	19	7

III. Content and yields of crude protein (mean for 3 years)

Type of meadow	Number of cuts	Content (%)			Yield (kg/ha)
		Cut			
		I	II	III	
<i>Dactylis glomerata</i>	2	9.8	12.5	–	600
	3	11.4	11.9	14.5	611
<i>Arrhenatherum elatius</i>	2	9.0	12.8	– 698	
	3	10.1	12.1	15.1	711

Dry mass yield of the third cut was very small in both communities and approximated 0.5 t. ha^{-1} . It should be emphasized that with three cuts the totals of the second and third cut yield were almost identical with the amount of the second cut yield with two cuttings. It proves that with three cuts the total 2 week growing period was used by the plants to recompense the additional third re-growing. The distribution of yield over the summer period shows that weaker yielding of thrice cut sward as compared to twice cut was

mainly determined by a lower yield of dry matter in the first cut due to the plant growing period shorter by two weeks.

Contents and yield of protein

Twice cut plants as compared to thrice cut was more total protein deficient only in the first cut (Table III). The difference in this component content was 1.5% in the orchardgrass sward and 1.1% in the tall oat-grass sward. The difference resulted from 14 day growing period. It proves that a 0.11% decrease in total protein in orchardgrass sward and 0.08% in the tall oat-grass sward fell on each day of prolonged grass growing. However, in the second cut the plants harvested twice were slightly more abundant in this element than those cut three times, despite the fact that the latter were growing shorter. Such dependency might have been due to the fact that the more rarely cut plants received more fertilizer nitrogen.

In the first cut, irrespective of the harvest date, the orchardgrass sward was always more abundant in protein than the tall-oatgrass sward. However, in the second and third cuts tall oat-grass plants slightly exceeded the orchardgrass sward as to the protein content. A higher protein production per hectare was characteristic of the tall oat-grass. It supplied on an average $100 \text{ kg} \cdot \text{ha}^{-1}$ protein more than the orchardgrass. Three cuts of meadows increased this element amount on an average only by 2% as compared to two cuts, which gave 11 kg difference in the orchardgrass and 15 kg in the tall oat-grass sward.

Orchardgrass predominance over the other grass concerning the yield amount was often attributed to its rich rhizosphere (Bis, 1990). In the present investigations the orchardgrass revealed clearly worse productivity than the tall oat-grass. The phenomenon, which is difficult to explain may be caused by two reasons. The tall oat-grass begins its vegetation very early and has a well developed and deep root system which allows to utilize nutrients from deeper layers of the soil profile. Under the influence of more frequent meadow cutting a decline in dry mass yield and an increase in protein content are consistent with a common opinion concerning the problem. However, an only 2% increase in protein yield accompanied with a 10.5% decrease in dry mass yield on the orchardgrass meadow and 7% decrease on the tall oat-grass meadow does not fully justify the advisability of three cuts.

It should also be considered that tall oat-grass has been described in literature as a species quite sensitive to utilization in its earlier stages, i.e. to frequent utilization. It reacted to the switch from two to three cuts with a lower decline in dry mass yield than the orchardgrass normally considered little sensitive to frequent utilization. Also after 3-year investigation period no differences were generally detected in the development of both species depending on the amount of yield.

Summing up it should be stated that an improvement of hay abundance in protein through more frequent cutting and limited nitrogen treatment is little efficient and highly unjustified from the economic point of view.

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KASPERCZYK, M. (Polska Akademia Nauk, Uniwersytet Jagielloński, Kraków, Polska):

Vplyv frekvencie kosenia lúk na výšku výnosov sušiny a ich obsah celkových proteínov.

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Výskumy sa robili na dvoch trávnych komunitách: lúka typu reznáčky laločnatej a lúka typu ovsíka obyčajného. Predmetom výskumu bolo určenie účinku dvoch alebo troch kosieb na výšku výnosov sušiny a na obsah celkových proteínov na permanentne hnojených lúkach. Tri kosby nepatrne zvýšili obsah celkových proteínov v porovnaní s dvoma kosbami, ale výsledok sa dosiahol až pri vyššom výnose sušiny. Pri troch kosbách sa dosiahol len o 2 % viac proteínov, ale sušiny sa získalo o 7 až 10 % menej na jednotku plochy než pri dvoch kosbách. Dokazuje to, že zvýšenie obsahu proteínov v sene prostredníctvom častejších kosieb lúk je málo účinné a vysoko nevýhodné opatrenie z ekonomického hľadiska.

lúčne typy; frekvencia kosieb; hnojenie; výnos sušiny; obsah proteínu

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