

Produkčný potenciál poloprírodných, prisievaných a dočasných trávnych porastov

Yielding potential of seminatural, oversown and established grasslands

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Abstract

The production of total biomass was assessed in three grassland ecosystems: seminatural (SG), overdrilled (OG) and sown (TG) at Radvaň site over six research years. The plant biomass at different fertilisation levels and the root biomass in 0 – 100 mm depth were evaluated. The objective of this research was to study the production at below-ground biomass, tillering zone and above-ground biomass (averaged over 3 cuts) and to measure amounts of these components in the total grassland biomass. The highest amounts of root biomass (8.52 t ha⁻¹), tillering zone (5.72 t ha⁻¹) and total biomass (16.35 t ha⁻¹) were found in SG. The lowest production of root biomass but the highest amount (2.18 t ha⁻¹) of above-ground biomass was recorded in OG. The root biomass production was considerably influenced by fertilisation. The lowest effect of fertiliser on the root biomass production (7.20 t ha⁻¹) was found at nil application treatment. The highest amount of root biomass (8.43 t ha⁻¹) was recorded at 180 N + PK kg ha⁻¹ fertiliser rate.

Keywords: grassland, ecosystems, grassland roots, tillering zone, yield, total biomass

Introduction

Grassland is of great importance in the production of good quality forage locally available to cattle and sheep, especially in upland and mountain regions. Moreover, the non-production functions of grassland are vital and performed mainly through roots and sward.

Materials and methods

The production of total biomass (CB) was investigated in three grassland ecosystems: seminatural (SG), over-drilled (OG) and sown (TG) at Radvaň site (Banská Bystrica, altitude 460 m) over six years (1993-98). Soil type was cambisol (pH 4.3). Seminatural grassland (*Poa-Trisetum*; *Arrhenatherium*) was over-drilled with grass/legume mixture. All three grassland types were fertilised in the same pattern: 1- no fertilisers; 2- P₃₀K₆₀; 3- P₃₀K₆₀+N₉₀ and 4- P₃₀K₆₀+N₁₈₀ kg ha⁻¹, respectively. The following measurements were made on a dry matter (DM) basis: production of above-ground biomass (NB) under a 3-cut regime; production of the tillering zone (ZO) which was defined as the biomass on the soil surface boundary and comprised two parts: below-ground biomass to the depth of 1.5 – 2.0 cm and above-ground biomass to the height of 2.0 – 3.0 cm; production of root biomass (Ko) to the depth of 10 cm. The sum of these components (CB) represents the total biomass. Nutrient uptake (N, P, K, Ca and Mg) levels in the components were also calculated from standard analysis of the elements.

Results and discussion

The data on the production of Ko and ZO (mean of 5 samplings over the growing seasons in 1993-98), NB (mean of 3 cuts over the growing seasons in 1993-98) and of CB as well as the nutrient uptake by grassland are given in Table 1.

Table 1. The total biomass structure and nutrient uptake by grassland.

Parameters	Swards	SG				OG				TG			
	Treatment	1	2	3	4	1	2	3	4	1	2	3	4
Primary Production (t ha ⁻¹)	NB	1.50	1.70	2.50	2.70	1.80	1.80	2.40	2.80	1.40	1.60	2.20	2.60
	ZO	5.10	5.30	6.00	6.50	4.30	5.00	5.60	5.50	4.90	4.90	5.60	6.30
	Ko	7.90	8.50	8.30	9.40	7.10	7.70	8.10	8.20	6.60	7.50	7.30	7.70
	CB	14.50	15.50	16.80	18.60	13.20	14.50	16.10	16.50	12.90	14.00	15.10	16.60
N in DM (kg ha ⁻¹)	NB	111.10	125.20	180.20	219.60	123.80	128.30	171.60	216.90	90.90	110.10	159.20	204.30
	ZO	97.50	96.40	107.60	120.00	83.50	93.20	101.40	101.70	85.60	89.30	91.00	98.80
	Ko	109.60	116.30	117.20	131.70	105.90	120.20	115.80	118.80	92.70	104.10	98.80	114.50
	CB	318.20	337.90	405.00	471.30	313.20	341.70	388.80	437.40	269.20	303.50	349.00	417.60
P in DM (kg ha ⁻¹)	NB	14.30	18.00	25.10	26.00	16.60	18.20	22.70	26.00	10.40	14.30	19.80	22.20
	ZO	9.90	10.50	12.00	12.70	9.30	10.60	11.30	11.60	8.10	9.80	10.30	9.80
	Ko	12.00	13.80	13.60	14.60	13.80	12.20	12.10	13.10	7.70	9.50	9.10	9.50
	CB	36.20	42.30	50.70	53.30	39.70	41.00	46.10	50.70	26.20	33.60	39.20	41.50
K in DM (kg ha ⁻¹)	NB	109.60	134.80	182.80	198.60	125.00	134.20	170.70	199.00	96.60	121.40	172.00	180.70
	ZO	37.40	35.90	41.40	43.90	36.30	37.20	40.50	40.70	40.80	41.30	43.70	41.20
	Ko	58.60	65.70	58.50	63.50	59.10	65.20	61.30	62.00	50.40	61.00	56.00	58.50
	CB	205.60	236.40	282.70	306.00	220.40	236.60	272.50	301.70	187.80	223.70	271.70	280.40
Ca in DM (kg ha ⁻¹)	NB	53.00	51.80	64.60	67.60	56.40	53.40	63.70	70.20	44.20	48.40	53.80	57.80
	ZO	32.60	31.60	32.30	34.10	24.50	27.40	26.00	29.90	29.80	28.70	31.10	30.10
	Ko	24.60	31.30	29.40	28.40	33.00	33.80	30.10	30.40	24.50	26.00	26.90	25.10
	CB	110.20	114.70	126.30	130.10	113.90	114.60	119.80	130.50	98.50	103.10	111.80	113.00
Mg in DM (kg ha ⁻¹)	NB	14.40	15.00	21.10	23.70	17.00	14.70	20.30	24.60	13.20	12.90	18.60	22.30
	ZO	13.20	12.50	15.40	16.10	11.10	13.10	13.90	13.90	12.40	12.20	14.40	15.10
	Ko	17.90	17.10	18.30	17.20	18.10	19.90	19.40	19.50	15.70	17.20	18.00	18.30
	CB	45.50	44.60	54.80	57.00	46.20	47.70	53.60	58.00	41.30	42.30	51.00	55.70

The highest Ko recorded at TG was 7.308 t ha⁻¹ and at SG it was 8.515 t ha⁻¹. However, the production of Ko was significantly higher at OG and especially at SG than at TG. The higher decrease in root biomass at the established temporary sward (TG) than in seminatural grassland (SG) was found also by other authors (Gáborčík *et al.*, 1999). The lowest Ko was found at the control treatment (7.203 t ha⁻¹).

Conclusions

Considering the data (averaged over 1993-98) from the research on the production of plant biomass and nutrient uptake by grassland ecosystem at different fertilisation, it was concluded that the production of roots was markedly influenced by the type of grassland ecosystem (namely by the effects of different techniques of sward establishment and management). The lowest Ko production was found at TG (7.38 t ha⁻¹) followed by OG and the significantly highest Ko (8.515 t ha⁻¹) was recorded at SG.

References

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