FARMYARD MANURE IN SUBMONTANE MEADOW TREATMENT

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Summary, keywords

Fertilizing power of farmyard manure and mineral fertlizers (PKN) were compared on a permanent meadow. Fertilizer components of the 12.5t · ha-1 dose revealed the highest productiveness. At a higher dose of farmyard manure (25 t) the productivity of fertilizer components in terms of increases in dry mass and protein yields was visibly lower and similar to mineral fertilizers.

meadow, farmyard manure, mineral fertilizers, yields, dry mass, crude protein

Introduction - Úvod

Observations have shown that in the mountain regions of Poland organic fertilizers, particularly farmyard manure, occupy an important position in meadow treatment. On animal farms where the production is based on their own fodder using animal manure for treatment is necessary and rational for many reasons. Firstly it solves the problem of grassland treatment ensuring a relatively low-cost fodder production, secondly utilization of own fertilizers on farm creates a specific closed ecological circuit, which undoubtedly positively affects the natural environment. Thus the studies were carried out to determine the fertilizing power of farmyard manure for permanent meadow treatment and to define a level of fertilization possible for optimization of fodder production and maintaining a permanent character of the meadow.

Methods - Metody

The investigations were carried out in 1997-2001 on a meadow situated in a submontane region on brown soil with granulometric composition of medium loam and the following chemical properties: pH_{KCl} = 5.4, available elements: P=1.3 mg, K= 8.2 mg and Mg =14,0 mg per 100 g of soil. Arrhenatherum elatius and Holcus lanatus prevailed in the sward. The studies considered 5 fertilizing variants and control (tab 1-3). Farmyard manure with the following chemical composition: 0.31-0.33%N, 0.07%P and 0.25-0.27%K was applied every year in early spring. Mineral fertilizers were sown as follows: the whole phosphorus dose in spring, potassium and nitrogen in two parts under each regrowth. Mineral nitrogen dose was divided into 60% under regrowth I and 40% under regrowth II. In farmyard manure-and- mineral treatment with mineral fertilizers individual components were supplemented to the dose of fertilizers applied in the variant with mineral fertilization, i.e. $P_{26}K_{66}N_{150}$. The meadow was cut twice every year and botanical composition of the sward was estimated prior to the first cut harvest.

Results - discussion – Výsledky - diskuse

At the outset of the studies the meadow sward was composed mainly of two grasses: Arrhenatherum elatius and Holcus lanatus (tab.1). In the control they constituted 30% of the sward each. However, on fertilized objects an effect of competition was observed already in the first cut and Arrhenatherum elatius gained the advantage over other grasses in yields. It was the most apparent at mineral treatment. In the fifth year of utilization the tendency for changes in the sward botanical composition observed at the beginning of the studies intensified and Arrhenatherum elatius visibly dominated the sward. Its share in the yields ranged between 30% on farmyard manure treatment and 50% on objects receiving farmyard manure-and-mineral treatment to 70% on mineral fertilizer treatments. After four years of fertilization the sward became more diversified. Festuca pratensis, Dactylis glomerata and Poa pratensis increased their shares in the sward constituting between 3-10%. Trifolium pratense development was favoured especially by farmyard manure. At this fertilizer dose of 12.5 t · ha^{-1} its share in the sward yield reached 15% in the first year and 25% in the fifth. On the other hand at farmyard manure dose of 25 t it constituted respectively 5 and 10%.

The meadow productive potential was quite high. The control produced 5.85 t of dry mass on an average for the 5-year period (tab.2). Farmyard manure treatment in the dose of 12.5 t · ha^{-1} increased production of dry mass by 2.18 t and the dose of 25 t raised it by 2.67 t · ha^{-1}. Solely mineral fertilization dosed $N_{150}P_{26}K_{66}$ or organic-and-mineral treatment generated identical yields.

Crude protein output with dry mass yield was the lowest on the control and averaged 573 kg · ha^{-1} (tab.3). Farmyard manure treatments placed next concerning protein yield. In comparison with the control the yields were by 32% higher at a single dose of farmyard manure and by 47% at the double dose. Objects receiving solely mineral and farmyard manure-and-mineral treatment placed third concerning the maximum protein output. They yielded annually by 67-71% more protein than the control sward.

A relatively high productive potential of the meadow was also determined by the sward composition. Arrhenatherum elatius and Holcus lanatus are characterized by a very good utilization of solar energy and fertilizer components (Frame 1989, Folkman 1987, Kasperczyk 1996). Summing up the results two facts should be emphasized, i.e. high fertilizer efficiency of farmyard manure dosed 12.5 t · ha^{-1} and similar productivity of fertilizer components in farmyard manure and mineral fertilizers. In the first case the 26.6 kg dry mass and 2.26 kg increase in protein yields matched each kg of PKN in the farmyard manure. The same indices in relation to the ones obtained at a double dose of farmyard manure (25 t) were higher for the dry mass by 63% and for protein by 39%. Poorer productivity of the farmyard manure dosed 25 t · ha^{-1} might have been due to longer lying and decomposing farmyard manure, which partly choked the plants. In the second case similar productivity of fertilizer components of the farmyard manure and mineral fertilizers were undoubtedly due to good moisture conditions. In other investigations (Jankowska-Huflejt 1996), carried out in Central Poland at relatively lower rainfall total, productivity of farmyard manure fertilizer components was almost 30% lower than these components productivity in mineral fertilizers. A positive effect of farmyard manure on Trifolium pratense development in meadow sward was also reported by other researchers (Jankowska-Huflejt 1996, Mikołajczak, Bartmański 1992).

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Tab. 1: Proportion of more important species in sward (%)

Species	Variant											
	0		$P_{26}K_{66}N_{150}$		FYM (12,5 t)		FYM (25 t)		FYM (12,5 t + $P_{19}K_{33}N_{110}$)		FYM (25 t + $P_{12}N_{70}$)	
	Years											
	I	V	I	V	I	V	I	V	I	V	I	V
Arrhenatherum elatius	30	15	60	66	28	30	36	30	40	50	34	46
Holcus lanatus	30	35	15	10	30	20	36	26	35	15	30	18
Festuca rubra	8	13	-	-	3	5	3	2	2	2	3	3
Dactylis glomerata	1	1	2	6	1	5	1	6	1	7	2	7
Festuca pratensis	1	1	3	2	5	4	5	5	3	5	3	4
Poa pratensis	-	+	1	3	2	5	2	8	1	7	2	10
Trifolium pratense	6	8	-	-	16	25	4	10	3	+	3	3
Lotus corniculatus	3	3	-	-	4	3	4	1	1	-	-	-

Tab. 2: Yields of dry matter ($t \cdot ha^{-1}$)

Fertilization	**Years**					
	1997	**1998**	**1999**	**2000**	**2001**	**X**
0 - control	5,37	6,28	5,70	5,60	6,30	5,85
$P_{26}K_{66}N_{150}$	9,00	10,15	11,26	9,97	10,15	10,11
FYM 12,5 t = $P_7K_{35}N_{40}$	6,53	7,90	9,52	7,61	8,58	8,03
FYM 25 t = $P_{14}K_{70}N_{80}$	6,65	9,59	9,64	7,63	9,09	8,52
FYM 12,5 t + $P_{19}K_{31}N_{110}$	8,32	10,36	11,70	9,84	10,50	10,14
FYM 25 t + $P_{12}N_{70}$	7,62	9,61	12,33	10,53	10,11	10,04
LSD(p=0,05)	0,92	0,87	0,88	0,71	1,12	0,90

Tab. 3: Yields of crude protein ($kg \cdot ha^{-1}$)

Fertilization	**Years**					
	1997	**1998**	**1999**	**2000**	**2001**	**X**
0 - control	489	603	518	594	662	573
$P_{26}K_{66}N_{150}$	822	980	997	1089	1000	978
FYM 12,5 t = $P_7K_{35}N_{40}$	584	882	800	695	827	758
FYM 25 t = $P_{14}K_{70}N_{80}$	614	1054	937	699	900	841
FYM 12,5 t + $P_{19}K_{31}N_{110}$	761	918	1094	985	1045	961
FYM 25 t + $P_{12}N_{70}$	769	876	1166	999	979	958