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EFFICACY OF CATTLE FARMYARD MANURE AS ORGANIC FERTILISER ON UPLAND MEADOWS

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Summary

The meadow treatment comprised the following variants: untreated control, mineral fertilisation dosed $P_{26}K_{66}N_{150} \cdot ha^{-1}$, farmyard manure dosed 12.5 t · ha^{-1}, farmyard manure dosed 12.5 t · ha^{-1} + mineral treatment with $P_{19}N_{110} \cdot ha^{-1}$ as supplementary to $P_{26}K_{66}N_{150}$ dose. Treatment of the meadow favourably influenced its sward botanical composition. Mineral fertilisation itself stimulated mainly *Arrhenatherum elatius* development. The effect of organic-and-mineral fertilisation was similar to mineral treatment. The untreated sward produced yield of about 5.87 dry mass per ha. Treatment only with farmyard manure increased the dry mass output till 8.34 t, i.e. almost by 2.5 t of dry mass. However, mineral and organic-and-mineral treatment effect on dry mass production was almost identical. The low crude protein output was characteristic of the control plot which produced annually on an average of 572 kg · ha^{-1}. The sward fertilised solely with farmyard manure, which was placed second, produced by 90 kg more protein. The utilisation of fertiliser components from farmyard manure was very high, higher than from mineral fertilisers. On an average, per 1 kg of PKN in farmyard manure the increases in dry mass yield was 21.5 kg and in crude protein 1.65 kg as compared to 19 kg dry mass and 1.70 kg crude protein with mineral and organic-and-mineral treatment.

Keywords: meadows, farmyard manure, dry mass, crude protein

Introduction

Prices of agricultural products, which are relatively low in comparison to means of production costs, limit the profitability of agricultural production (Kasperczyk and Radkowski, 1999). Thus farmers seek various ways to lower the costs of production. Especially in fodder production on grasslands many try to reduce expensive mineral fertilisation. Some studies reveal that mineral fertilisation constitutes between 55 and 60% of outlays on hay production (Szaro and Kuczek 1991). In this context farm produced fertilisers, particularly farmyard manure gain in importance. So, the authors undertook investigations to examine fertilising ability of cattle manure for permanent grassland treatment.

Material and methods

Studies were carried out in 1998-2000 on a permanent mountain meadow situated at 330 m above sea level, on brown soil with composition of medium loam. At the outset of experiment the meadow sward was rare revealing poor species diversity. Three species were prevalent, i.e. *Arrhenatherum elatius* – 35%, *Holcus lanatus* – 30% and *Plantago lanceolata* – 15%. The meadow treatment comprised the following variants:

- untreated control
- mineral fertilisation dosed $P_{26}K_{66}N_{150} \cdot ha^{-1}$
- farmyard manure dosed 12.5 t · ha^{-1}
- farmyard manure dosed 12.5 t · ha^{-1} + mineral treatment with $P_{22}N_{110} \cdot ha^{-1}$ as supplementary to $P_{26}K_{66}N_{150}$ dose.

The 12.5 t farmyard manure dose contained 7 kg P, 71 kg K and 40 kg N. The farmyard manure was applied every year in the early spring when snow disappeared. The meadow was cut twice. The first cut was in the initial period of *Arrhenatherum elatius* flowering, the second eight weeks later. In the second and fourth variants nitrogen was divided into two parts: 60% was applied under the first and 40% under the second cut. The sward composition was determined using Klapp's assessment method prior to the first cut gathering. Dry mass was assayed at 105°C and crude protein content using Kjeldahl's method.

Results

Treatment of the meadow favourably influenced its sward botanical composition. Mineral fertilisation itself stimulated mainly *Arrhenatherum elatius* development. This plant proportion in the yield reached between 85 and 93%. On the other hand solely farmyard manure treatment increased mainly proportions of the papilionaceous: from trace amounts to 30% of *Trifolium pratense*, 5% of *Trifolium dubium* and 5% of *Lotus corniculatus*. The effect of organic-and-mineral fertilisation was similar to mineral treatment. The share of *Arrhenatherum elatius* in the yield approximated between 50-60% and the share of legumes between 5 and 7%.

The meadow productive potential was relatively high. The untreated sward produced yield of about 5.87 dry mass per ha. Treatment only with farmyard manure increased the dry mass output till 8.34 t, i.e. almost by 2.5 t of dry mass. However, mineral and organic-and-mineral treatment effect on dry mass production was almost identical. In the first case the yield

reached 10.46 t and in the second 10.63 t · ha^{-1}. In comparison with the control the increase was about 80% and by 25% in comparison to farmyard manure treatment.

Table 1. Yields of dry mass

Treatment	1998	1999	2000	Mean
Unfertilised control	6.29	5.72	5.60	5.87
$P_{26}K_{66}N_{150}$ – mineral fertilisation	10.15	11.26	9.97	10.46
Farmyard manure 12.5 t · ha^{-1} ($P_7K_{71}N_{40}$)	7.90	9.52	7.61	8.34
Farmyard manure 12.5 t · ha^{-1} ($P_7K_{71}N_{40}$) + $P_{19}N_{110}$	10.36	11.70	9.84	10.63

The plant abundance in crude protein was generally low. It was due to two facts: fairly late harvest and high production of dry mass. Generally the control sward and the one receiving mineral treatment were the most abundant in protein. The plants of the two other plots had similar amounts of the component and were on an average by 5 g · kg^{-1} poorer than the sward for the first group.

Table 2. Concentration and yields of crude protein

Treatment	Concentration [g · kg^{-1}]				Yields [kg · ha^{-1}]			
	1998	1999	2000	Mean	1998	1999	2000	Mean
Unfertilised control	95.9	90.5	106.0	96.7	602	520	594	572
$P_{26}K_{66}N_{150}$ – mineral fertilisation	94.6	88.0	109.2	97.3	960	991	1087	1013
Farmyard manure 12.5 t · ha^{-1} ($P_7K_{71}N_{40}$)	104.2	81.9	90.0	92.0	822	780	685	762
Farmyard manure 12.5 t · ha^{-1} ($P_7K_{71}N_{40}$) + $P_{22}N_{110}$	86.7	93.5	99.1	93.1	898	110	974	991

The low crude protein output was characteristic of the control plot which produced annually on an average of 572 kg · ha^{-1}. The sward fertilised solely with farmyard manure, which was placed second, produced by 90 kg more protein. The greatest amounts of this component were collected from plots receiving mineral and organic-and-mineral treatments. The amounts were respectively 1013 and 991 kg · ha^{-1} and were by 441 and 419 kg higher than the control.

Discussion

The utilisation of fertiliser components from farmyard manure was very high, higher than from mineral fertilisers. On an average, per 1 kg of PKN in farmyard manure the increases in dry mass yield was 21.5 kg and in crude protein 1.65 kg as compared to 19 kg dry mass and 1.70 kg crude protein with mineral and organic-and-mineral treatment. Such high utilisation of fertiliser components from the farmyard manure by meadow plants should be viewed in connection with considerable rainfall over the vegetation period, when the many year average for this area was about 700 mm. As may be seen from other investigations of the same problem (Mikolajczak and Bartmanski 1992) conduced in drier areas of Poland the utilisation of fertiliser components from FYM was markedly lower, than with organic-and-mineral fertilisation. However, the results presented in the literature (Wesolowski 1995, Jankowska-Huflejt and Niczyporuk 1996) confirm that FYM treatment favours development of the papilionaceous and decreases meadow sward weed infestation.

References

Jankowska-Huflejt H., Niczyporuk A. (1996); Wplyw wieloletniego nawozenia mineralnego i przemiennego (NPK-obornik) na plonowanie i zawartosc podstawowych składnikow pokarmowych w runi lakowej. Wiad. IMUZ, 18, 7-20.
Kasperczyk M., Radkowski A. (1999); Wartosc gospodarcza uzytkow zielonych w rejonie podgorskim. Zeszyty Naukowe AR w Krakowie, 368, 49-56.
Mikolajczak Z., Bartmanski A. (1992); Obornik jako uzupełniające nawozenie uzytkow zielonych. Nawozy organiczne. Mat. Konf. "Nawozy organiczne".
Szaro L., Kuczek L. (1991); Koszty produkcji pasz na trwalych uzytkach zielonych w terenach gorskich. Biul. Reg. Zakładu Upowszechniania Postepu. Mat. Konf. "Intensyfikacja produkcji na trwalych i przemiennych uzytkach zielonych w rejonach podgorskich i gorskich", 53-64.
Wesolowski P. (1991); Wplyw nawozenia organicznego (obornika) i mineralnego na produkcyjnosc laki polozonej na glebie torfowo-murszowej. Mat. Sem. IMUZ Falenty "Badania i wdrozenia w CPBR-10.2.3", 396-413.