# FORAGE PRODUCTION FROM REWETTED PEAT GRASSLAND

Mačuhová, J.[1], Thurner, S.[1]

[1]Institute for Agricultural Engineering, Vöttinger Str. 36, 85354 Freising, Germany

## ABSTRACT

The rewetting of agriculturally used peat grasslands is expected to reduce or prevent greenhouse gas emissions. However, its effects on forage quality and yield remain unclear. This study aimed to evaluate the potential nutritive quality of vegetation from the rewetted part of one plot (plot of interest). In addition, vegetation from an adjacent non-rewetted plot was sampled as a control. Vegetation samples were collected from up to three fixed sampling areas shortly before each planned cut. In recent years, both plots were managed extensively, with up to two cuts per year on the rewetted plot and up to three cuts per year on the control plot. The collected material was dried at 40 °C in a drying box to hay dry matter content and subsequently subjected to extended Weender analysis.

Results indicate that vegetation from the rewetted part of the plot of interest provided acceptable nutritive quality for the intended animal categories, with values comparable to those of the control plot. However, determining an appropriate cutting date is already challenging on grassland on mineral soils and becomes even more difficult on rewetted peatlands. Moreover, even when mowing is possible, harvesting the cut biomass is not always feasible.

Keywords: potential forage quality, rewetted peat grassland

## INTRODUCTION

The use of drained peatlands for food or feed production is one of the sources of greenhouse gas emissions in agriculture (Poyda *et al.*, 2016). In southern Germany as well, drained peatlands are still used agriculturally, for example as grassland for intensive fodder production. Rewetting can reduce or prevent greenhouse gas emissions from drained peat grasslands (Bockermann *et al.*, 2024). Efforts have therefore been made in recent years to rewet peat grasslands where possible. Rewetting should be carried out in such a way that peat grasslands can remain in agricultural use after rewetting, for example as extensive grassland for fodder production or pasture. Nevertheless, it remains unclear how forage quality and productivity will change under such conditions.

The aim of this study was to evaluate the potential forage quality of vegetation from a rewetted part of one plot during the first harvest season after structural measures for controlled rewetting, aimed at maintaining the water table level at up to 10 cm below the soil surface. This plot had not been actively drained for several years prior to the measures. Under wet weather conditions, the water table had previously risen even above the soil surface in some areas, resulting in their temporary inundation. The structural measures were designed to prevent such conditions while also retaining water within the plot during dry periods. Moreover, the potential nutritive quality of vegetation from an adjacent non-rewetted plot was evaluated as a control.

## MATERIAL AND METHODS

Forage sampling was conducted on two plots. The first plot (plot of interest; total 6.0 ha) included a 3.5 ha rewetted area, where structural measures were implemented in September 2023. These measures aimed to enable controlled rewetting of the plot—retaining groundwater and precipitation to maintain an average water table level of approximately between 10 and 20 cm below the soil surface—while also regulating the water table level and lowering it at harvest. The second plot (control plot; 4.2 ha), bordering the plot of interest, was not influenced by structural measures and remained non-rewetted, although it was no longer actively drained. Both plots had been managed extensively in recent years, with up to two cuts per year on the rewetted part of the plot of interest and up to three cuts per year on the control plot. Additionally, at the two cuts (first and third), the non-rewetted part of the plot of interest was sampled at one spot.

Vegetation samples were collected during the year 2024 shortly before planned cuts from up to three previously selected spots at a cutting height of ~8 cm. Samples were dried in a drying box at 40 °C and analysed using classical wet-chemical methods at the Department of Quality Assurance and Analytical Services Laboratory of the Bavarian State Research Centre for Agriculture in Grub. An extended Weender analysis was performed, determining crude ash, crude protein, crude fiber, sugars, aNDFom (ash-free neutral detergent fiber), ADFom (ash-free acid detergent fiber), enzymatically soluble organic matter, utilizable protein, metabolizable energy for ruminants, metabolizable energy for horses, and water-soluble carbohydrates.

Statistical analyses were conducted in SAS 9.4 using PROC MEANS and PROC MIXED, with plot as a fixed factor and planned harvest date nested within plot.

## RESULTS AND DISCUSSION

In the year 2024, weather conditions were generally wet. As a result, not only the rewetted part of the plot of interest but also its non-rewetted areas, as well as parts of the control plot, were partially waterlogged. Moreover, it was not possible to lower the water table level before harvest on the rewetted part of the plot of interest as planned. Consequently, neither of the two plots could be cut uniformly at one time, and the first cutting date was delayed compared to the usual harvest dates (around July 1 for the plot of interest and June 15 for the control plot). The earliest and latest dates of the first cut were July 4 and September 4, respectively. Overall, five cutting dates were required for the first cut considering both plots (three for the rewetted part and four for the non-rewetted part of the plot of interest, and three for the control plot). Only the non-rewetted parts of the plot of interest were cut twice, whereas the control plot (including a small non-rewetted part of the plot of interest) was cut three times. As already mentioned, under normal conditions, the plot of interest is cut at least twice per year, and the control plot at least three times per year. Usually, a strip of old grass of approsimately 0.5 ha is left uncut each year on the rewetted part of the plot of interest. However, in the year 2024, a larger area of the rewetted part could not be cut even once, resulting in a strip of old grass of around 1 ha. This area could not be harvested for forage production in the following year either (due to insufficient vegetation quality), indicating considerably higher instability in forage yield than what can already occur under normal conditions.

https://doi.org/10.11118/978-80-7701-093-1-0134

Potential nutritive values of vegetation from both plots are shown in Table 1. For the rewetted part of the plot of interest, metabolizable energy (ME) for ruminants across the three dates of the first cut varied only slightly, between 9.61 ± 0.25 and 9.71 ± 0.11 MJ/kg DM. In addition, one sample was collected from the non-rewetted part of the plot of interest in the first and third cut, yielding comparable ME values of 9.66 and 10.62 MJ/kg DM, respectively. On the control plot, sampling during the first cut was only possible at the second cutting date, when the largest area was harvested, resulting in a mean ME of 9.52 ± 0.07 MJ/kg DM. In the second and third cut, mean ME values were 10.47 ± 0.29 and 10.96 ± 0.15 MJ/kg DM, respectively. Mean crude protein values were low in samples from the rewetted part of the plot of interest. However, due to acceptable ME content, the utilizable crude protein was notably higher than crude protein content and comparable to values from the first cut of the control plot (114.67 ± 1.54 g/kg DM) and the non-rewetted part of the plot of interest (119 g/kg DM; one sampling point). Similarly, aNDFom and ADFom contents in material from the rewetted part of the plot of interest were comparable to those from the first cut of the control plot (618.00 ± 8.19 and 364.00 ± 17.06 g/kg DM for aNDFom and ADFom, respectively) and the non-rewetted part of the plot of interest (620.00 and 365.00 g/kg DM for aNDFom and ADFom, respectively). These values were expected due to the late first cutting date of the first cut (Andueza *et al.*, 2021). ELOS, an indicator of readily digestible organic matter, remained within recommended ranges for grassland forage, confirming sufficient potential feed quality of vegetation from the rewetted part of the plot of interest.

The low variability in nutritive quality of collected material from the rewetted part of the plot of interest across the planned first cut dates, despite the prolonged harvest period, is likely due to the simultaneous presence of senescent and newly emerging biomass.

**Tab. 1:** Potential nutritive values (mean ± SD) of forage from rewetted and non-rewetted peat grassland plots

| Item | Plot of interest | | Control plot (non-rewetted) (n = 3) |
|---|---|---|---|
| | Rewetted part (n = 3) | Non-rewetted part (n = 2) | |
| Crude protein (g/kg DM) | 79.42 ± 5.88 | 125.00 ± 52.33 | 126.11 ± 49.48 |
| Utilisable protein (g/kg DM) | 117.89 ± 0.54 | 130.00 ± 15.56 | 132.00 ± 15.82 |
| aNDFom (g/kg DM) | 616.94 ± 4.70 | 530.50 ± 126.57 | 499.00 ± 129.95 |
| ADFom (g/kg DM) | 362.67 ± 11.86 | 299.00 ± 93.34 | 282.89 ± 79.01 |
| ELOS (g/kg DM) | 468.00 ± 32.05 | 604.00 ± 104.65 | 629.33 ± 104.04 |
| WSC (g/kg DM) | 104.53 ± 27.82 | 143.90 ±58.83 | 154.08 ± 38.03 |
| Metabolisable energy – ruminants (MJ/kg DM) | 9.67 ± 0.06 | 10.14 ± 0.68 | 10.32 ± 0.73 |
| Metabolisable energy – horses (MJ/kg DM) | 7.71 ± 0.08 | 8.35 ± 1.20 | 8.58 ± 1.26 |

Means did not differ significantly (P > 0.05).

n = number of cut dates for the rewetted part and number of cuts for the non-rewetted part of the plot of interest and the control plot. DM = dry matter; aNDFom = ash-free neutral detergent fiber; ADFom = ash-free acid detergent fiber; ELOS = enzymatically soluble organic matter; WSC = water-soluble carbohydrates.

## CONCLUSION

In the first year after structural measures for controled rewetting, the potentional nutritive quality remained acceptable for feeding of fattening cattle and horses. However, it was not always possible to cut the whole area at the planned date or to harvest all cut biomass. Therefore, even the nutritive quality should stay acceptable, the harvest is not always possible and losses of whole cuts or parts of areas by some cuts has to be considered.

## Acknowledgement

This study was carried out as part of a research project MoLaKlim (No. 67MP004B), supported by the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety of Germany. The authors would like to thank the farmer for participation in the study.

## REFERENCES

Bockermann, C., Eickenscheidt, T., Drösler, M. 2024. Adaptation of fen peatlands to climate change: rewetting and management shift can reduce greenhouse gas emissions and offset climate warming effects. *Biogeochmistry.* 167, 563–588.

Andueza, D., Picard, F., Note, P., Carrère, P. 2021. Relationship between chemical composition, nutritive value and the maturity stage of six temperate perennial grasses during their first growth cycle along an altitute gradiand. *European Journal of Agronomy*. 130, 126364.

Poyda, A., Reinsch, T., Kluß, C. Loges, R., and Taube, F. 2016. Greenhouse gas emissions from fen soils used for forage production in northern Germany. *Biogeosciences*. 13, 5221–5244.

## Contact Information

Juliana Mačuhová: e-mail: juliana.macuhova@lfl.bayern.de