

Potential of leaching to optimise fuel quality of semi-natural grassland biomass

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Introduction

- Combustion for energy production an alternative use for species-rich semi-natural grasslands no longer needed for forage production
- Fuel composition limits suitability for combustion:
 - high N, Cl → emissions of NO_x , HCl, PCDD/F
 - high ash → fine particulate matter emissions
 - high Cl, K → boiler corrosion
 - high K, low Ca → ash melting → furnace slagging
- Precipitation during the field period leaches harmful compounds (K, Cl, N, ash) from rice and cereal straw



Semi-natural grassland:

- Harvest of living, not dead biomass: Same leaching efficiency?
- Field period limited by regrowth of sward: Sufficient leaching possible?

Material and methods

Grassland biomass samples

- Five semi-natural grassland sites in southwest Germany
- Harvested at 2 and 3 July (at seed maturity of grasses)

Leaching method

- Standardised laboratory method; compared to the leaching effect of artificial precipitation events in previous studies
- Grass samples of 30 g DM each weighed into 1 l wide-neck PE bottles, filled with tap water and placed on laboratory shaker; four replication per treatment

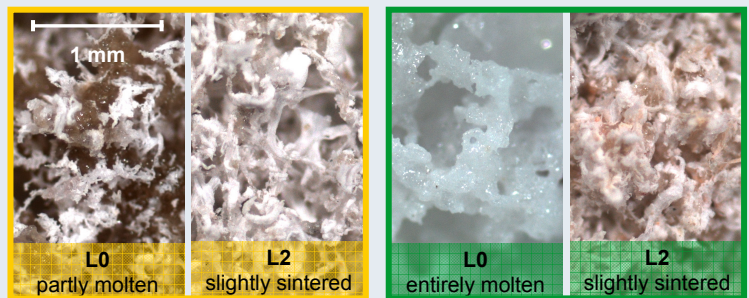
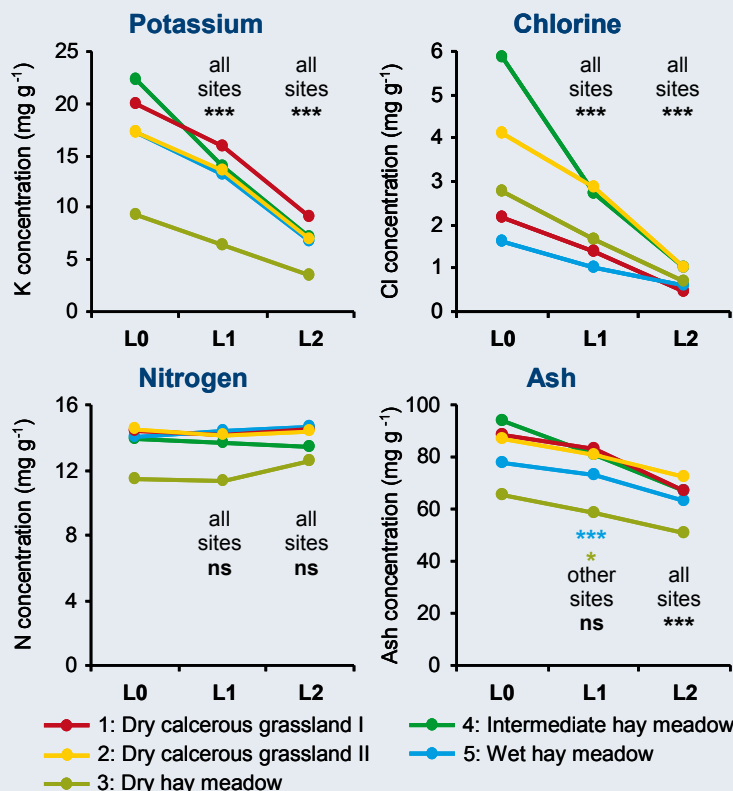
Treatments

- L0** unleached control
- L1** 10 min of leaching (\approx 30-40 mm precipitation)
- L2** 120 min of leaching ($>$ 70 mm precipitation)

Ash melting behaviour

- Ash samples heated to 1000 °C for four hours

Results



Ash structure after heating to 1000 °C for unleached (L0) and leached (L2) grassland biomass of site 2 and site 4.

- K, Cl:** leaching as effective as for other herbaceous biofuels
- Ash:** moderate reduction by leaching
- N:** no reduction by leaching
- Ash melting behaviour:** improved by leaching

Conclusions

- Leaching reduces K and Cl concentrations and improves ash-melting behaviour of grassland biomass
- To leach K and Cl sufficiently, high amounts of precipitation are necessary
- Leaching as a strategy for fuel quality optimisation is strongly tied to the likelihood of suitable weather conditions