Effect of precipitation on dry-matter production of a meadow with varied cutting frequency

U. Thumm and B. Tonn
University of Hohenheim, Institute of Crop Science, Stuttgart, Germany

Introduction

- Water supply = main growth factor for grassland in most site conditions
- Differences in rainfall considered responsible for year-to-year variation of grassland dry matter (DM) production under constant management

Objective of this study:

Influence of

- varied cutting frequency
- two levels of nitrogen fertilization
- precipitation variability

on botanical composition and DM yield

?

Materials and methods

Field experiment

- Site: Stuttgart-Hohenheim (400 m a.s.l., 8.8°C mean daily temperature, 698 mm annual rainfall, silty loam)
- Seed mixture of 23 species sown on an arable field in 1994
- Plot size 39 m^2, split-plot design, 4 replications

Experimental factors

I. **Cutting frequency**
2, 3, 4 or **5** cuts per year

II. **Nitrogen fertilization**
low (30 kg N ha^{-1} cut^{-1}), **high** (60 kg N ha^{-1} cut^{-1})

Results

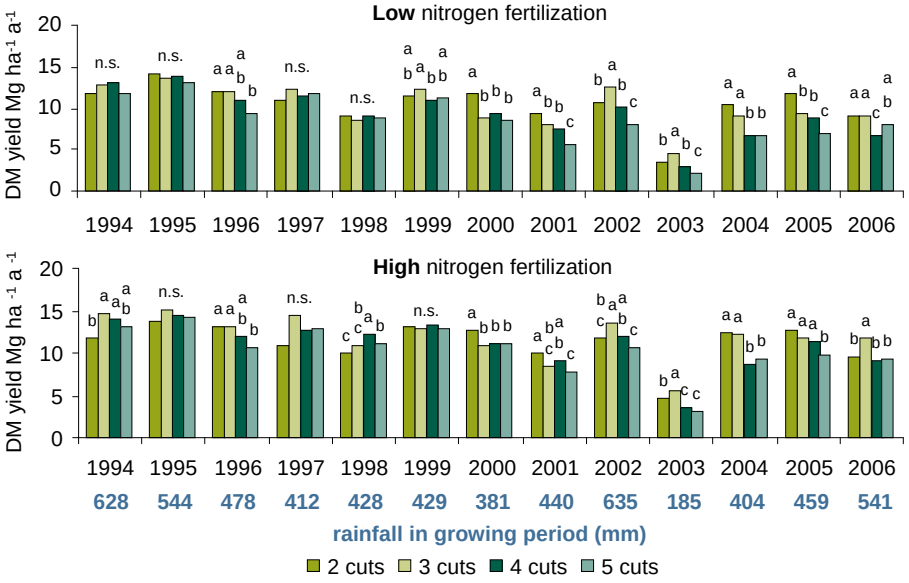
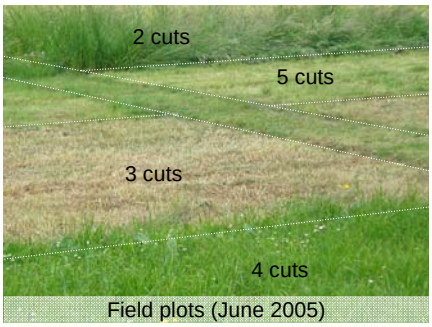


Figure: Annual dry matter yield and rainfall



Field plots (June 2005)

Table: Quotient of dry matter yield per cut and amount of rainfall during the respective growth period (kg ha^{-1} mm^{-1}). Mean of annual data from 13 years.

	Low nitrogen fertilization				High nitrogen fertilization			
	Cutting frequency				Cutting frequency			
	2	3	4	5	2	3	4	5
first cut	29	31	26	23	31	36	30	26
second cut	17	19	26	25	18	22	30	30
third cut	-	15	16	16	-	19	19	19
fourth cut	-	-	15	18	-	-	18	20
fifth cut	-	-	-	12	-	-	-	16
total	23	22	20	19	25	26	24	23

- Within few years typical botanical compositions developed under the different management regimes.
- Maximum DM yield was mostly obtained at 2 cuts per year at low nitrogen fertilization and at 3 cuts at high nitrogen fertilization (Figure).
- Precipitation during the growing period did not influence yield consistently. Yield depression caused by extreme water limitation (2003), however, was evident.
- Highest DM yields per mm rainfall were obtained for the first or sometimes for the second cut (Table).
- Closer relationships between rainfall and biomass production might be detected by considering carry-over effects of soil moisture between regrowth periods.

Conclusions

- Simple basic relationships between DM yield and rainfall were not evident. There are more factors which influence the harvested DM at this site and which have to be considered, like water storage capacity of the soil, rain distribution and water availability at different growth stages of the sward.
- In a next step, the data will be used for modelling DM production as a function of weather conditions and soil water availability.

Contact: Ulrich.Thumm@uni-hohenheim.de , + 49 711 459 23219