Technologie- und Förderzentrum
im Kompetenzzentrum für Nachwachsende Rohstoffe

TFZ

Exploitation of biogas digestates to meet nutrient demands of different cultivars in a crop rotation

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Issues and experimental set-up

- Can stable yields and economic benefits be achieved with biogas digestates as organic fertilizer while arranging them with ecological aims?
- Is a mixed fertilization (50 % miner.-N + 50 % digestate-N) going to show up more practice-oriented, through exploitation of short- and long term N-availability to maximize yields?

Figure 1: Slurry barrel with computer controlled drag hoses in Ascha

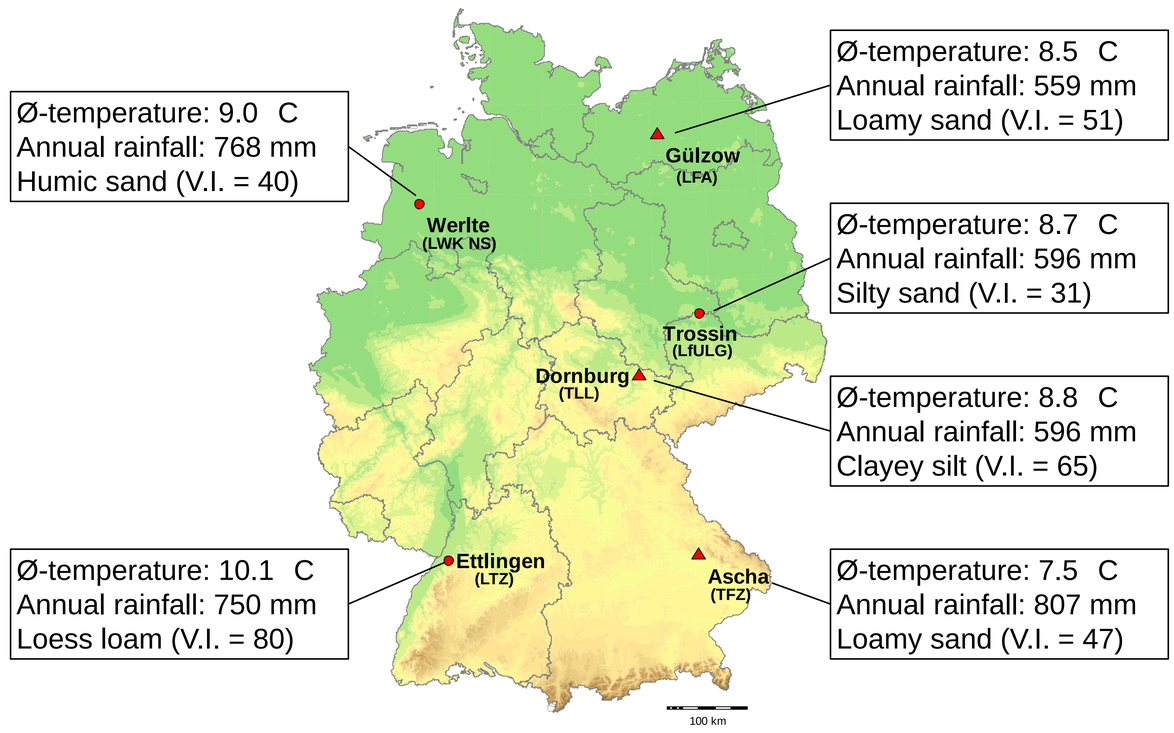

Figure 2: German study sites and their key data. Locations with a triangle represent GHG-assessment sites

Cultivars in crop rotation A and B	
Rotation A:	Maize – w.rye – sorghum – w.triticale – ryegrass – w.wheat
Rotation B:	W.wheat – maize – w.rye – sorghum – w.triticale – ryegrass – w.wheat

N-Treatments
min: 100 % mineral-N mix: 50 % mineral-N + 50 % digestate-N org: 100 % digestate-N

Figure 3: Cultivars and treatments (mineral fertilizer equivalent = 70 % of total N content)

Results, discussion and conclusions

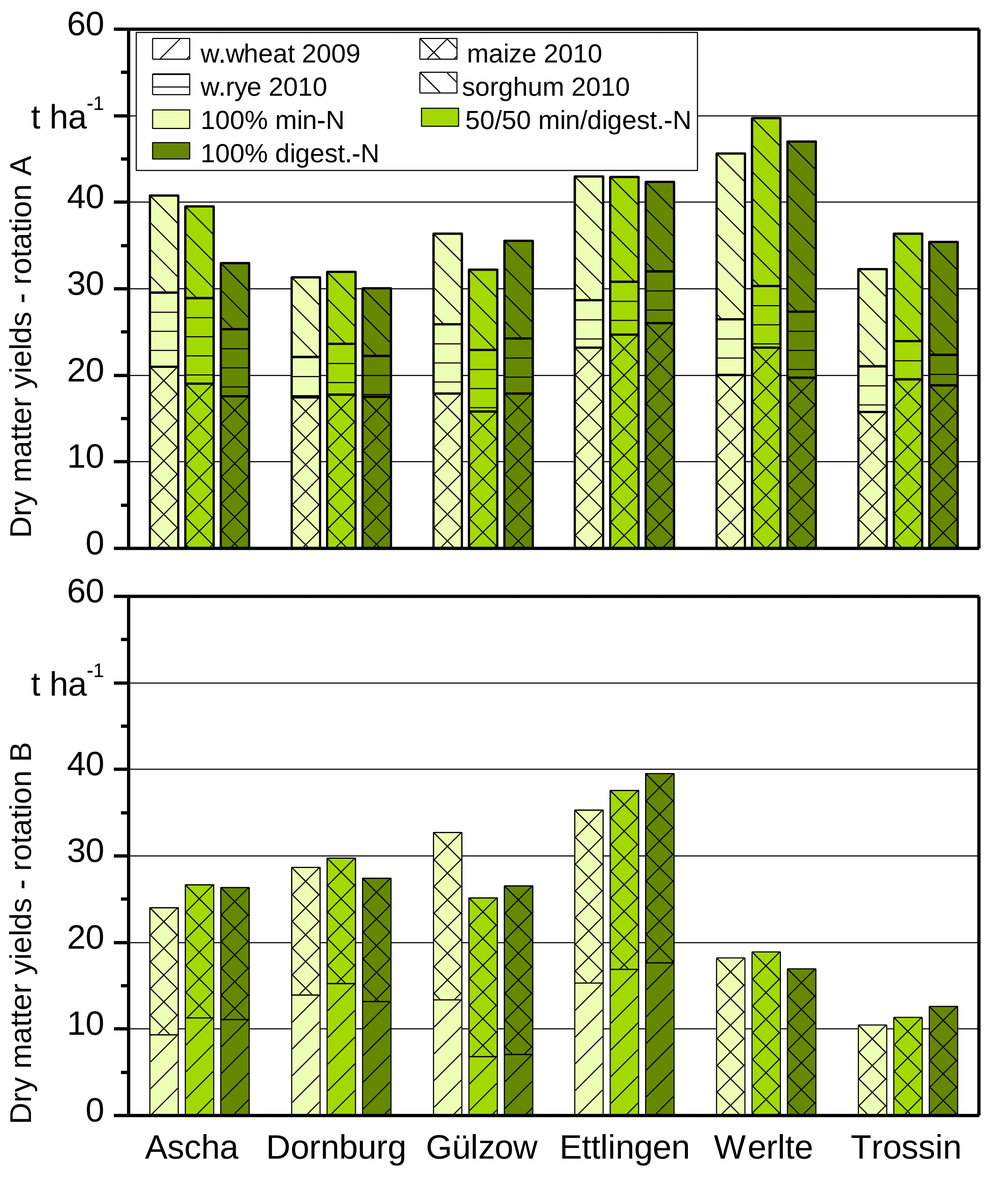

Figure 4: Sum of dry matter yields of rotation A (above) and B (below)

Table 1: Yield and protein content of winter wheat per N-treatment in 2009

sites	Ascha			Dornburg			Gülzow			Ettlingen		
variants	min	mix	org	min	mix	org	min	mix	org	min	mix	org
Grain [t ha^{-1}]	6.5	7.9	7.4	7.8	7.7	7.0	9.5	5.3	5.3	8.7	8.8	8.4
Straw [t ha^{-1}]	3.8	4.5	4.7	7.2	8.6	7.1	5.2	2.3	2.4	7.9	9.4	10.4
Protein [% DM]	14.9	14.7	13.3				13.5	11.4	10.3	14.9	16.8	16.4

Discussion

- Provision of N over the whole vegetation period in 50/50-variant ⇨ directly available N (min.-N + digestate-N) plus slowly and gradually released N (digestate-N)
- No incorporation of digestates into the soil when applied to winter crops in spring ⇨ higher risk of volatilization losses
- Higher N use efficiency of directly available N after fertilization in spring through winter crops ⇨ already established vegetation
- General plant growth (e.g. w.wheat in Gülzow) and activity of microorganisms (reduced nutrient mobilization from organic material) were negatively influenced by a drought period
- Difficulties to apply planned amounts of nitrogen due to occasionally strong variations in nutrient contents of digestates

Conclusions

- Digestates can serve as an adequate alternative to mineral fertilizer ⇨ Optimal fertilization especially in 50/50-variant possible
- Without continuous monitoring of nutrient contents difficulties to apply the planned digestate-N-amounts
- High digestate application rates without achieving expected yields carry a higher risk of nitrate leaching after harvest

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