



# Biomass Production and Bioenergy Potential of Sweet Sorghum in South Germany

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## Introduction

Plant biomass is an important source of bioenergy and plays a significant role in the renewable energy action plans of Germany. New high yielding energy crops like forage or sweet sorghum are required to supplement existing energy crop rotations. The sugary juice from extruded sweet sorghum can be utilized in bioethanol production, whereas forage sorghum supplies biomass for biogas plants. Sweet sorghum cultivation is not yet done in Germany thus there is a need for information about choice of cultivar, yield potential or cultivation in order to guarantee a successful crop management.



## Material & Methods

- Field trial in South Germany with complete randomized blocks, 4 replications and 8 sweet sorghum cultivars
- Climate conditions ( $\emptyset$ ): 783 mm rainfall, temperature: 8.3°C
- Soil type: silty loam, sowing density: 25 grains m<sup>-2</sup>
- Sowing date: end of May, harvest date: mid of October
- Fertilization: 80 kg N ha<sup>-1</sup> at BBCH 13-15

## Results

- Lodging was a severe problem in most sweet sorghum cultivars, it can result in serious yield losses (Table 1)
- Sweet sorghum was harvested at ideal growth stage between anthesis and milk development (65-75) when usually highest sugar contents occur (Table 1)
- All Cultivars showed very low dry matter contents (below 25 %, Figure 1) that can cause technical difficulties at harvest or increase silage effluent and transportation costs
- Sweet sorghum obtained good dry matter yields (DM), the best cultivar 'Sweet Bee' reached 20 t ha<sup>-1</sup> (Figure 1)
- Sugar contents in total plant biomass ranged from 28.5 to 38.3 %, the maximal calculated sugar yield was 7.7 t ha<sup>-1</sup>
- Ethanol yields, calculated from sugar content and DM, varied from 2087 to 4004 L ha<sup>-1</sup> (best cultivar: 'Sweet Bee', Table 2)

## Conclusion

- Sweet sorghum can be grown in Germany
- The main problems are lodging and low DM contents at harvest → adequate cultivars are not yet available
- Dry matter production was high though calculated ethanol yields are distinctively lower than yields of sugar beet (6250 L ethanol ha<sup>-1</sup> [1]) which is successfully grown in Germany → profitability of sweet sorghum cultivation is uncertain
- Efficient bagasse usage could improve economy of this crop

Table 1: Lodging and growth stage [2] at harvest of sweet sorghum (2011)

Cultivar	Lodging*	Growth stage (BBCH)
Della	8	69
M81E	7	67
Sugar Drip	5	67
Theis	4	68
Millennium BMR	2	75
Top 76	1	73
CSSH45	3	76
Sweet Bee	3	75

\* 1 = no lodging, 9 = total lodging

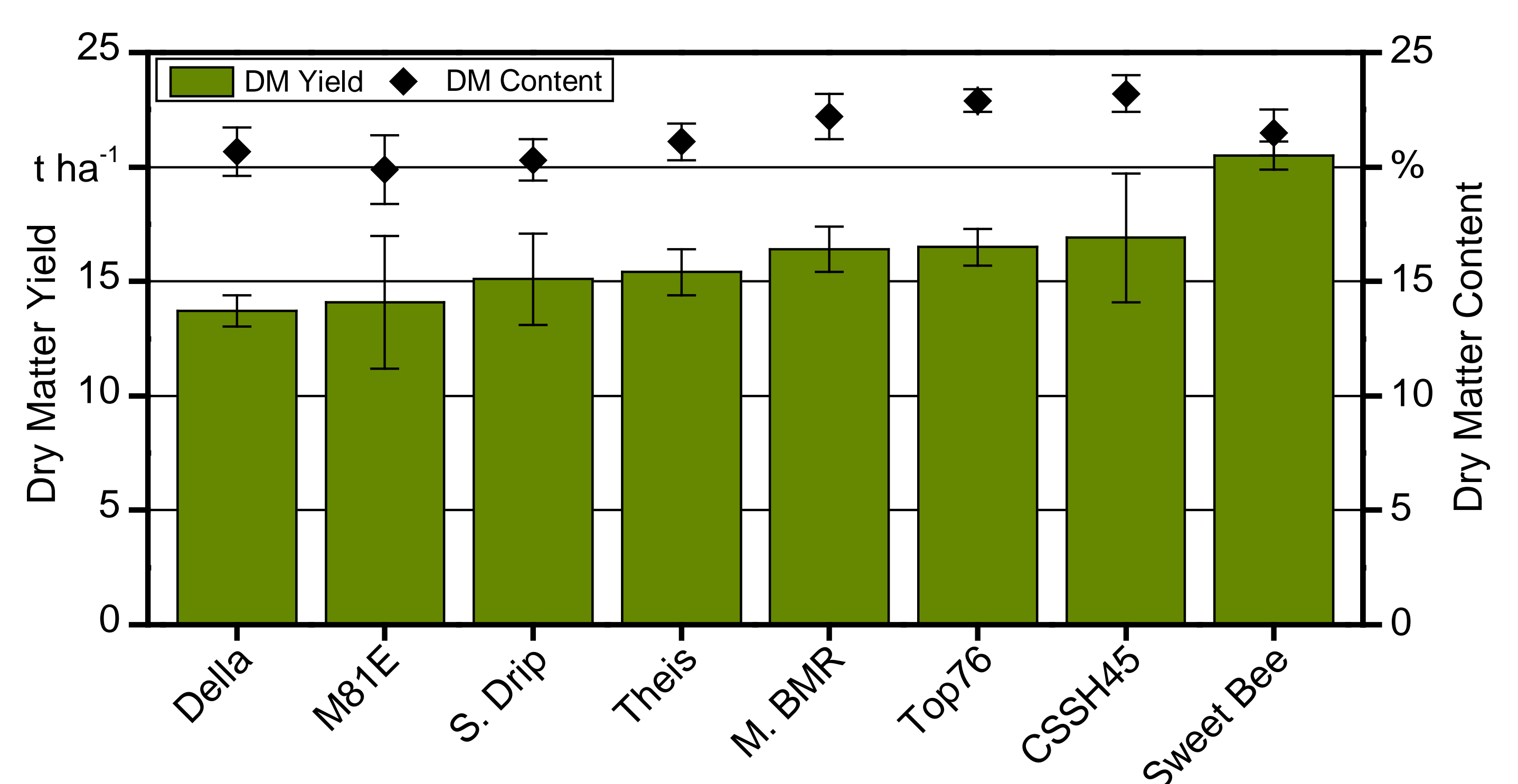


Figure 1: Dry matter yield and dry matter content of sweet sorghum grown in South Germany 2011

Table 2: Sugar content, sugar and ethanol yield of sweet sorghum (2011)

Cultivar	Sugar content %	Sugar yield t ha <sup>-1</sup>	ETOH <sup>#</sup> L ha <sup>-1</sup>
Della	33.0	4.5	2341
M81E	28.5	4.0	2087
Sugar Drip	37.2	5.7	2958
Theis	35.2	5.4	2843
Millennium BMR	35.0	5.7	2993
Top76	38.3	6.3	3314
CSSH45	37.8	6.4	3356
Sweet Bee	37.3	7.7	4004

<sup>#</sup> ethanol

## References

- [1] Fachagentur Nachwachsende Rohstoffe e.V. (2011): Basisdaten Bioenergie Deutschland. Gülzow, 47 Seiten  
[2] Zadoks, J.C.; Chang, T.T.; Konzak, C.F. (1974): A decimal code for the growth stages of cereals. In: Weed Research, 14, S. 415-421.

