Winter beets – Yield formation and quality for biogas production

Jens Loel & Christa Hoffmann

Institute of Sugar Beet Research, Holtenser Landstr. 77, D - 37079 Göttingen

Introduction

There is decreasing acceptance for maize cultivated as biogas substrate. Hence, it is necessary to find alternative substrates. It is known, that sugar beets sown in spring and harvested in autumn have excellent properties for anaerobic digestion because of high concentration of easily degradable substances. Winter beets sown in August might be a possibility to extend the availability of the substrate. But they change after winter from vegetative to generative growth with an increasing lignification of the above-ground biomass. The aims of this study are to investigate the quality of winter beets for biogas production and the yield potential. Furthermore, the effect of a frost protecting straw cover was analyzed.

Material and Methods

- Field trial Göttingen 2010/11
- sowing date: early August
- 3 sugar beet hybrids
- 5 harvest dates (Oct., Mar., Apr., May, Jun.)
- Determination of dry matter of leaves and taproots, Weender feed stuff analysis, survival rate

Results

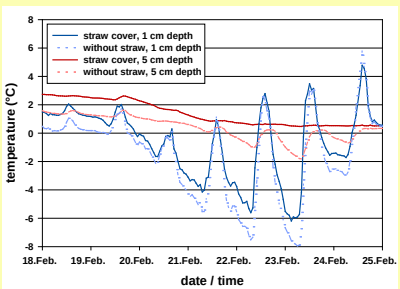

Fig. 1: Temperature in 1 cm and 5 cm soil depth with and without straw cover, 18.02.2011 – 26.02.2011

Tab. 1: Survival rate of sugar beet hybrids with and without straw cover, temperature in 1 cm and 5 cm soil depth with or without straw cover, Göttingen 2010/11

	survival rate	soil temperature Dec. - Feb. (°C)	
	mean (%)	1 cm depth	5 cm depth
without straw	66	1.1	1.6
straw cover	98	1.7	2.6
Δ	+ 32	+ 0.6	+ 1.0

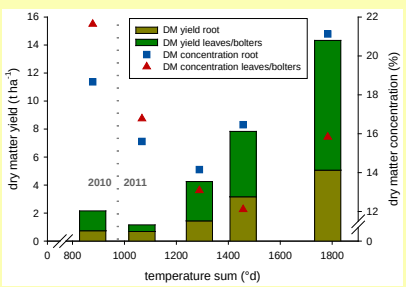

Fig. 2: Dry matter yield and content of root and leaves/bolters as affected by temperature sum, mean of 3 sugar beet hybrids, Göttingen 2010/11

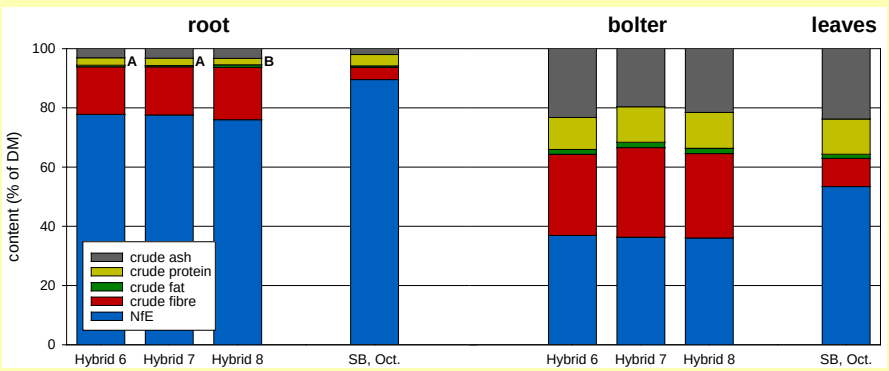

Fig. 3: Content of crude nutrients of root and bolters of 3 winter sugar beet hybrids and sugar beet, Weender feed stuff analysis, harvest date of winter sugar beet June 2010, different letters indicate significant differences between the hybrids at p<0.05

Conclusions

- Straw cover preserve the temperature in the soil → to higher survival rates (98%) of the covered beets after winter
- Winter beets achieve high dry matter yields: 5 t ha^{-1} root + 10.5 t ha^{-1} leaves in June = total dry matter yield up to 15 t ha^{-1}
- Dry matter concentration in root and leaves is relative low → may increase the costs of transport compared to other substrates
- High content of easily degradable substances (NfE = sugars and other carbon hydrates) lead to fast and almost complete decomposition in biogas plants

This project is part of the joint program 'Bioenergie 2021' funded by the German Federal Ministry of Education and Research.

Institute of Sugar Beet Research