

# Frost hardiness of winter sugar beets - Pre-winter development of different hybrids

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## Introduction

High dry matter yields and the excellent quality of sugar beet may result in an important economic relevance as a bioenergy crop. It is expected that winter beets, sown at the end of summer, will gain higher yields than spring sown sugar beets. For that purpose winter sugar beets have to survive the frost periods during winter.

Plants have developed several mechanisms to overcome frost periods. One mechanism is the accumulation of osmotic active substances, therefore, in sugar beet high contents of potassium, sodium, amino-N or sugar may indicate an improved frost hardiness.

The aims of this study are to identify possible differences between sugar beet hybrids concerning the frost hardiness. Differences in the content of osmotic active substances between the hybrids were studied.

## Sowing, Aug./09



## Sep./09



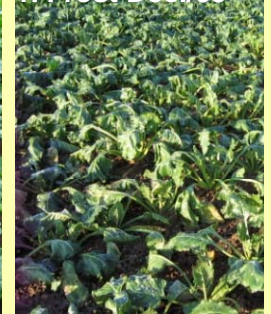
## Material and Methods

- Field trials in 2009/10: Göttingen, Warberg, Kiel (sowing date: early August)
- 5 sugar beet hybrids
- 3 harvest dates (Oct., Dec., Mar.)
- Determination of dry matter of leaves and taproots, sugar content, content of potassium, sodium, amino-N

## 1. Harvest Oct./09

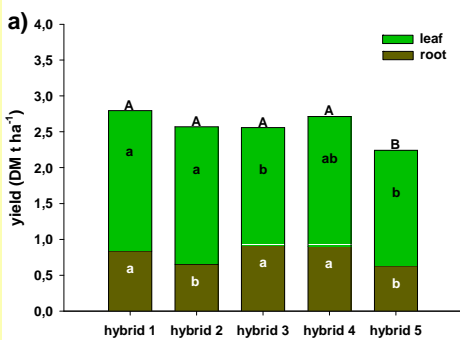


## 1. Frost Dec./09

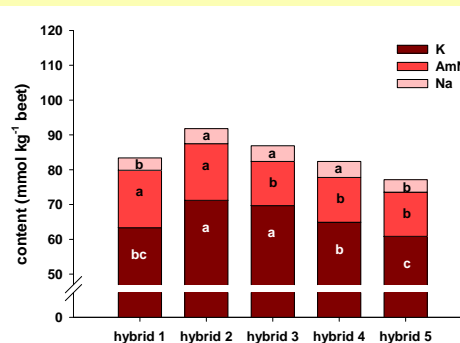
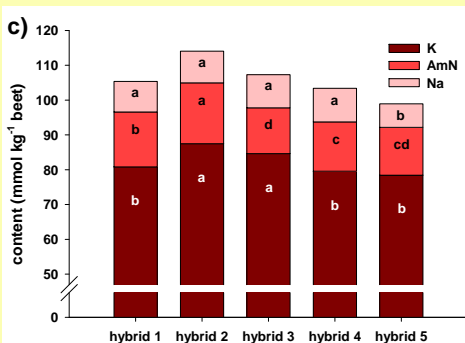
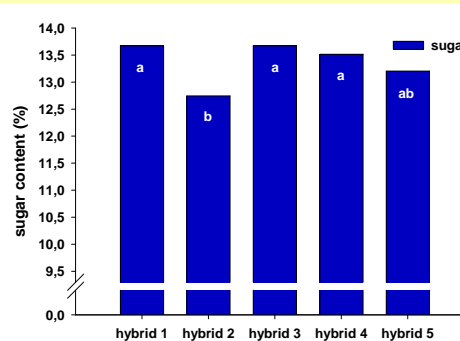
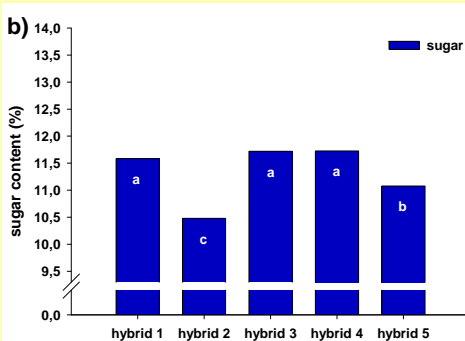
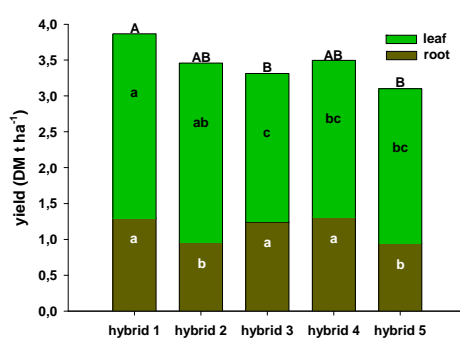


## Results

### October 2009



### December 2009



## Conclusions

- The increase of yield and sugar content and the decrease of potassium, sodium and amino-N are typical changes during the growing period of sugar beets.
- The sugar content in December was higher than expected for young sugar beets. That indicates that plants probably accumulate sugar as an osmotic active substance to overcome frost periods.
- There are differences between the 5 hybrids concerning dry matter yield, sugar content and content of potassium, sodium and amino-N. The differences in the content of osmotic active substances may result in an improved frost hardiness.
- Whether these changes affect the frost hardiness cannot be answered yet. Because of the hard winter in 2009/10 there were very low survival rates of the winter beets. Thus it was not possible to correlate the survival rate with the yield or content of osmotic active substances. Further trials are necessary to investigate the frost hardiness of sugar beets.

Fig. 1: Dry matter yield of roots and leaves (a), sugar content (b), content of potassium, amino-N and sodium (c) of 5 different sugar beet hybrids, means of 3 locations (Göttingen, Warberg, Kiel), 2009, different letters indicate significant differences between the hybrids at  $p < 0.05$ .