Stability of the marc content of sugar beet varieties in different environments

Christa M. Hoffmann[1], Martijn Leijdekkers[2], Joakim Ekelöf[3], Françoise Vancutsem[4]

[1] IfZ, D-Göttingen; [2] IRS, NL-Dinteloord; [3] NBR, S-Borgeby; [4] IRBAB, B-Tienen

Introduction

Recent studies point to a relation of the marc content of varieties to their storability. However, information is lacking about the impact of environmental conditions on the marc content of varieties.

The COBRI study thus aimed at analyzing the stability of variety differences in the marc content under various environmental conditions. Furthermore, the relation to other yield and quality parameters was quantified.

Material & Methods

- 10 sugar beet varieties, chosen with regard to their marc content
- Field trials in 2015: at 8 locations in D, 1 in NL, 1 in B, 1 in S, 1 in MD
- Field trials in 2016: at 8 locations in D, 1 in NL, 1 in B, 1 in S
- Randomized block design with 4 repl.
- Determination of root yield, sugar content, invert sugar content and marc content (= insoluble cell wall compounds)

Results

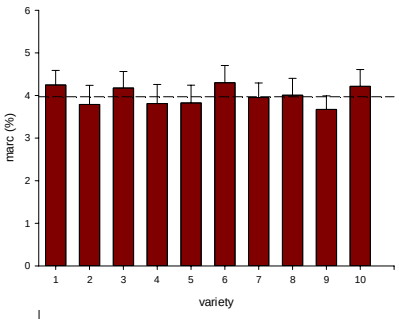

Fig. 1: Marc content of different sugar beet varieties; mean of 23 locations in D, NL, B, S, MD in 2015, 2016

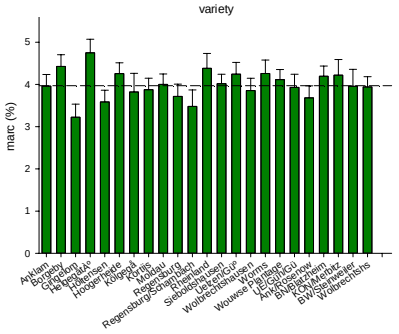

Fig. 2: Marc content of sugar beet in different locations 2015 and 2016; mean of 10 varieties

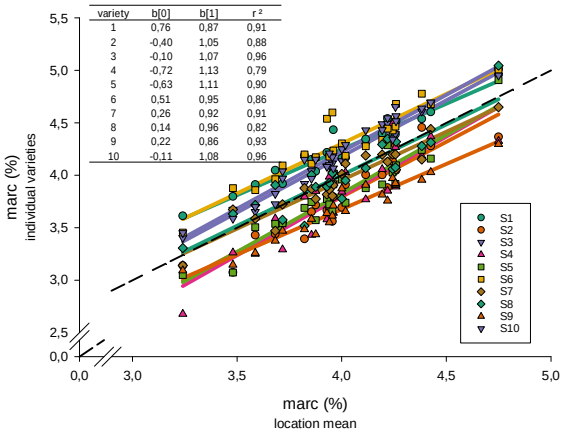

Fig. 3: Variety by environment interaction for the marc content of sugar beet; 10 varieties, 23 environments/locations in D, NL, B, S, MD in 2015, 2016

Tab. 1: Characterization of the sugar beet varieties in yield and quality at harvest: 10 varieties, mean of 23 environments/locations in D, NL, B, S, MD in 2015, 2016; varieties sorted according to their marc content

variety	marc content		sugar content		root yield		sugar yield		invert sugar content	
	(%)		(%)		(t ha^{-1})		(t ha^{-1})		(mmol kg^{-1})	
9	3.67	e	17.17	g	85.2	b	14.5	cd	3.3	e
2	3.79	d	17.60	f	88.3	a	15.5	a	3.6	de
4	3.81	d	17.79	e	83.3	bcd	14.7	bc	3.3	de
5	3.82	d	17.56	f	83.9	bcd	14.6	bcd	4.6	ab
7	3.95	c	17.87	e	82.2	cde	14.6	bcd	3.6	de
8	4.01	c	18.37	c	80.8	de	14.8	bc	3.6	de
3	4.18	b	18.09	d	76.7	f	13.8	e	4.4	bc
10	4.22	ab	17.52	f	81.2	de	14.1	de	4.2	c
1	4.25	ab	18.86	a	80.2	e	15.1	ab	3.6	d
6	4.30	a	18.61	b	69.3	g	12.8	f	4.9	a
mean	4.00		17.94		81.1		14.5		3.9	
HSD	0.09		0.15		2.77		0.51		0.35	

Tab. 2: Variance components estimation for root yield and quality of sugar beet at harvest; 10 varieties, 23 environments/locations in D, NL, B, S, MD in 2015, 2016

	root yield	sugar content	sugar yield	marc content	invert sugar content
	(t ha^{-1})	(%)	(t ha^{-1})	(%)	(mmol kg^{-1})
environment	82.6 ***	62.6 ***	86.0 ***	47.7 ***	64.0 ***
variety	16.0 ***	36.1 ***	12.3 ***	50.4 ***	33.1 ***
env*var	0.6 ***	0.6 ***	0.8 ***	0.8 ***	1.7 ***
repl(env.)	0.7 ***	0.7 ***	0.9 ***	1.1 ***	1.2 ***

Conclusions

- Distinct differences in the marc content of varieties.
- Positive correlation of marc content with sugar content (r^2 0.74), negative with root yield (r^2 -0.80) of varieties.
- Variety effect for marc was 50% of the total variance.
- Variety differences in marc content were very stable under various environmental conditions (very low GEI).
- Therefore, only few environments are necessary to determine genotypic differences.