



March 4, 2011

ASSBT Biennial Meeting, Albuquerque, NM

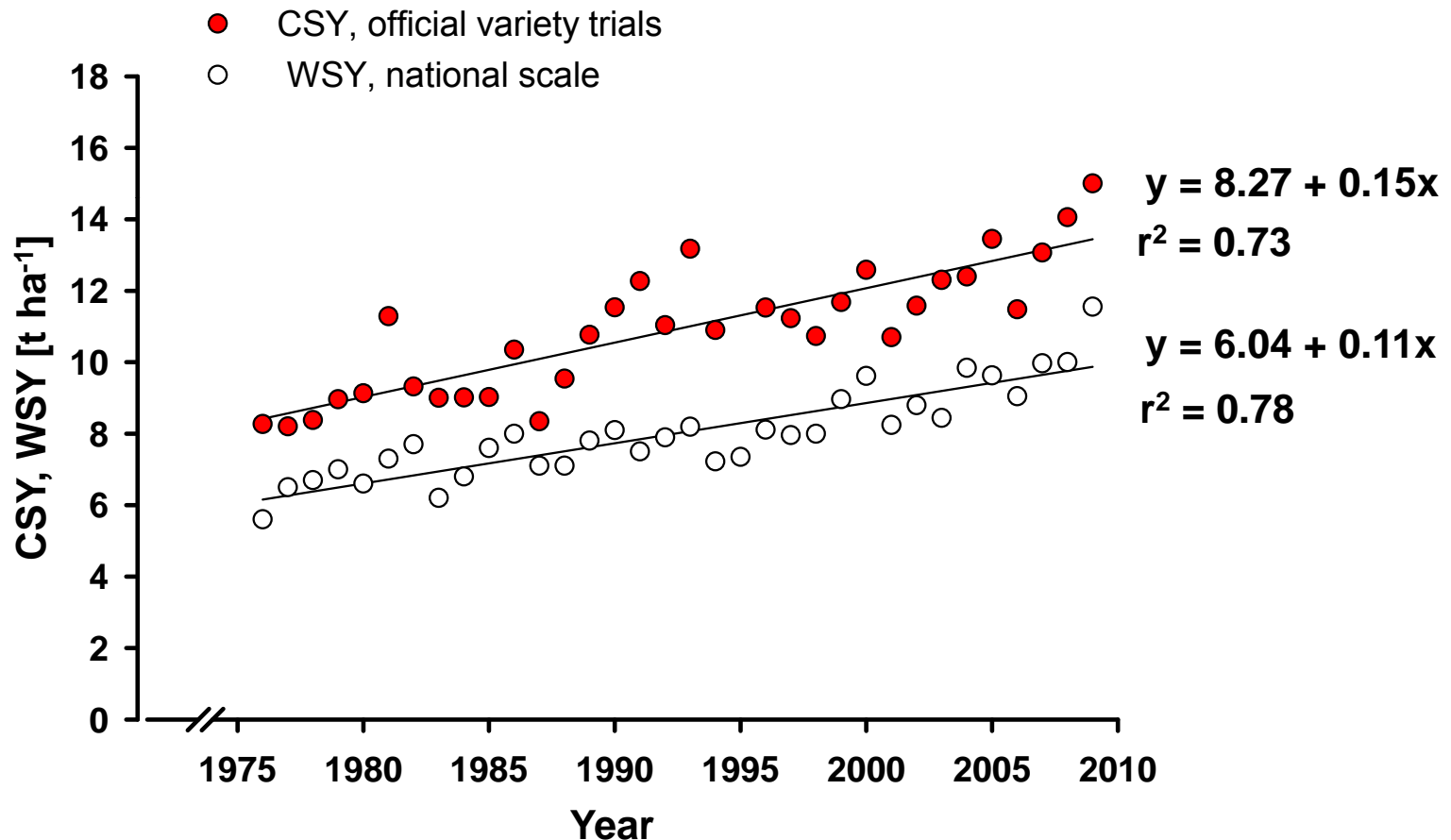
Analysis of Breeding Progress of Sugarbeet

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Corrected Sugar Yield (CSY) and White Sugar Yield (WSY) of New Varieties on National Scale

Official trials, Federal Plant Variety Office, Germany, 1976-2009



Increase of Sugar Yield in EU Member States

Country	Sugar Yield (t ha ⁻¹) 2001-2005	Increase (% p.a.)	Period
F	11.88	>1,5	1983-2004
B	10.74	2,2	1985-2004
NL	10.66	1,4	1950-2004
E	10.58	5	1990-2005
GB	10.35	2	1970-2004
DK	9.96	<1,3	1984-2004
D West	9.50	1,6	1970-2005
S	8.41	>1	1985-2004
D East	8.08	3,5	1990-2005
PL	7.05	7	1994-2004
H	6.78	4	1999-2004
I	6.43	<1	1960-2004
SK	6.26	>5	1999-2005
FIN	5.70	>1	1955-2004

Trials with Sugarbeet Varieties Registered 1964 to 2003



Field Trials near Göttingen, Germany 2008

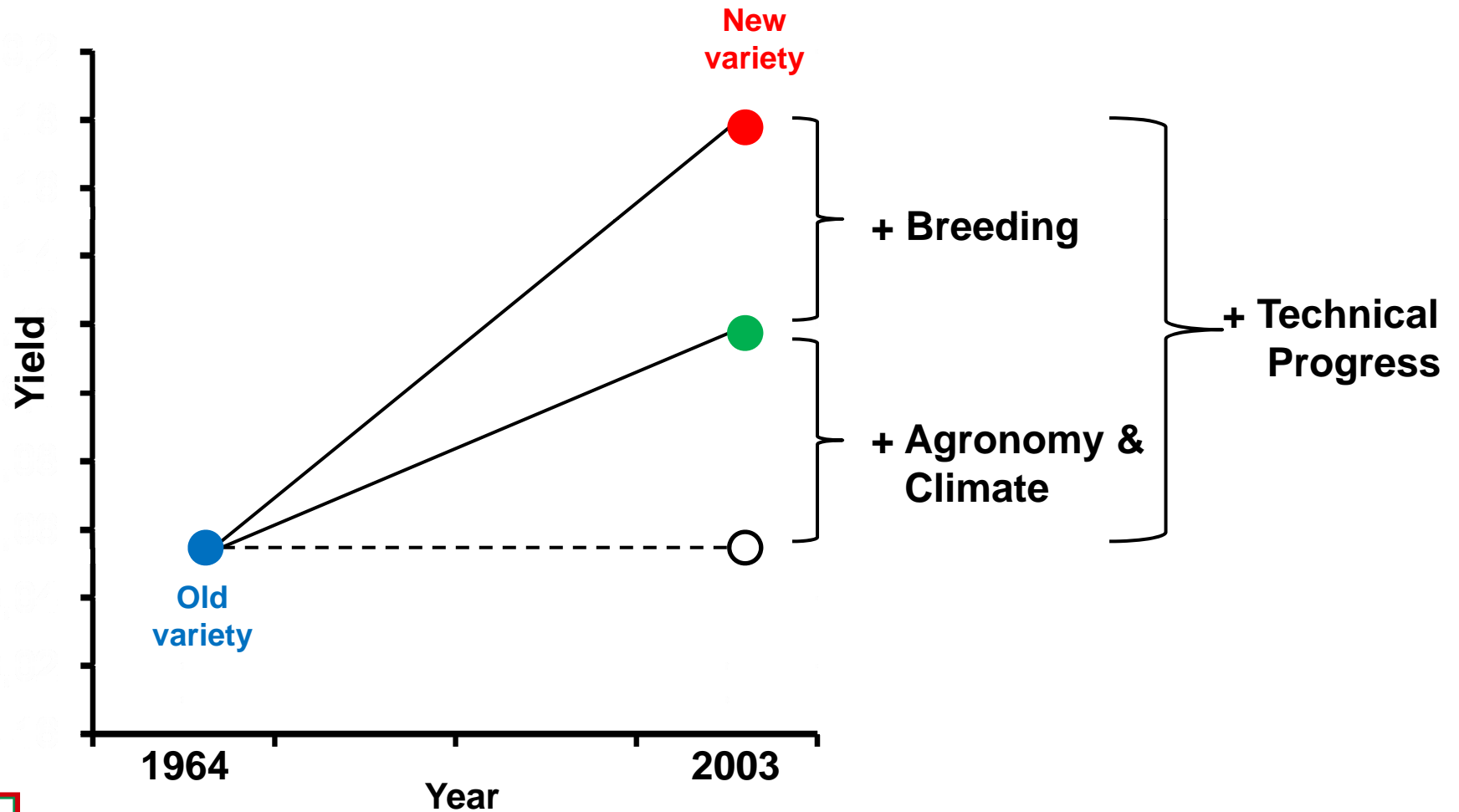
- completely randomized block design
- 11 varieties of different registration years



Greenhouse Trials in Göttingen, Germany 2008

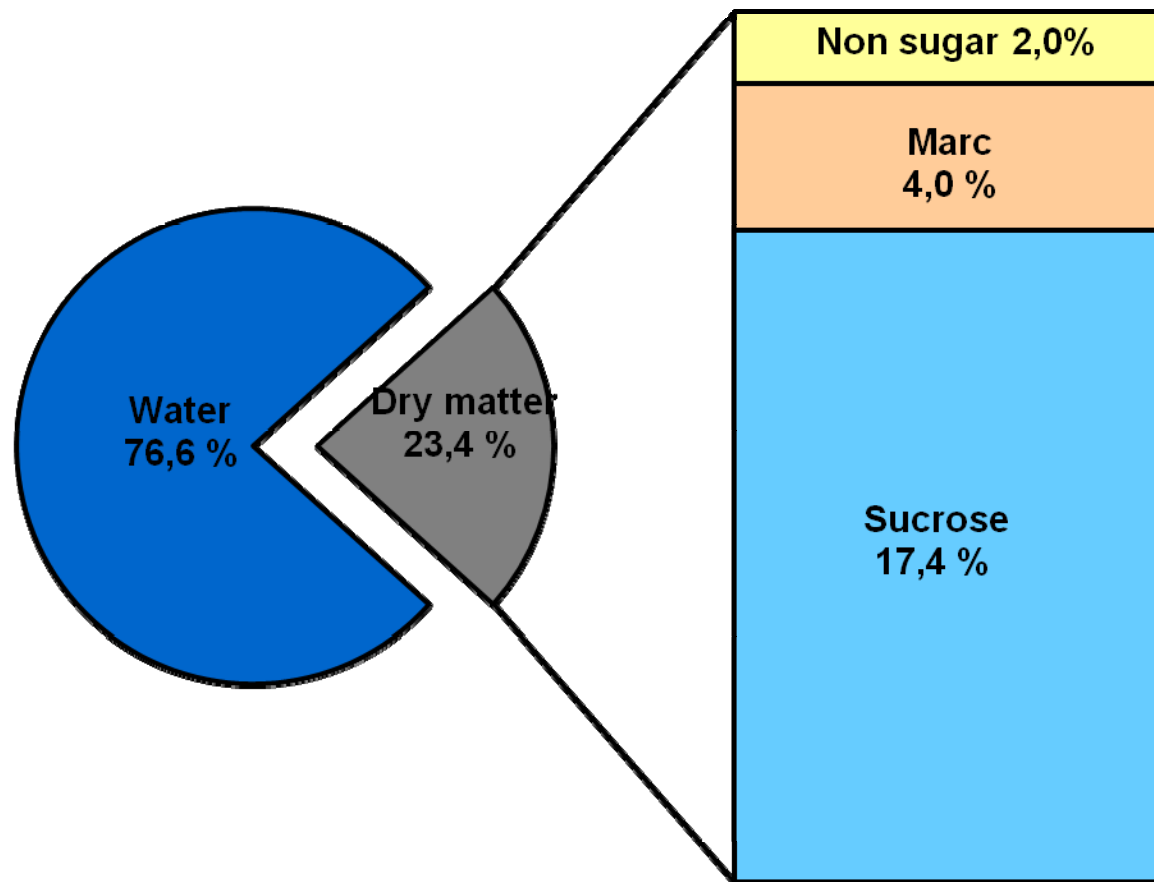
- completely randomized block design
- 17 varieties of different registration years

Technical Progress in yield



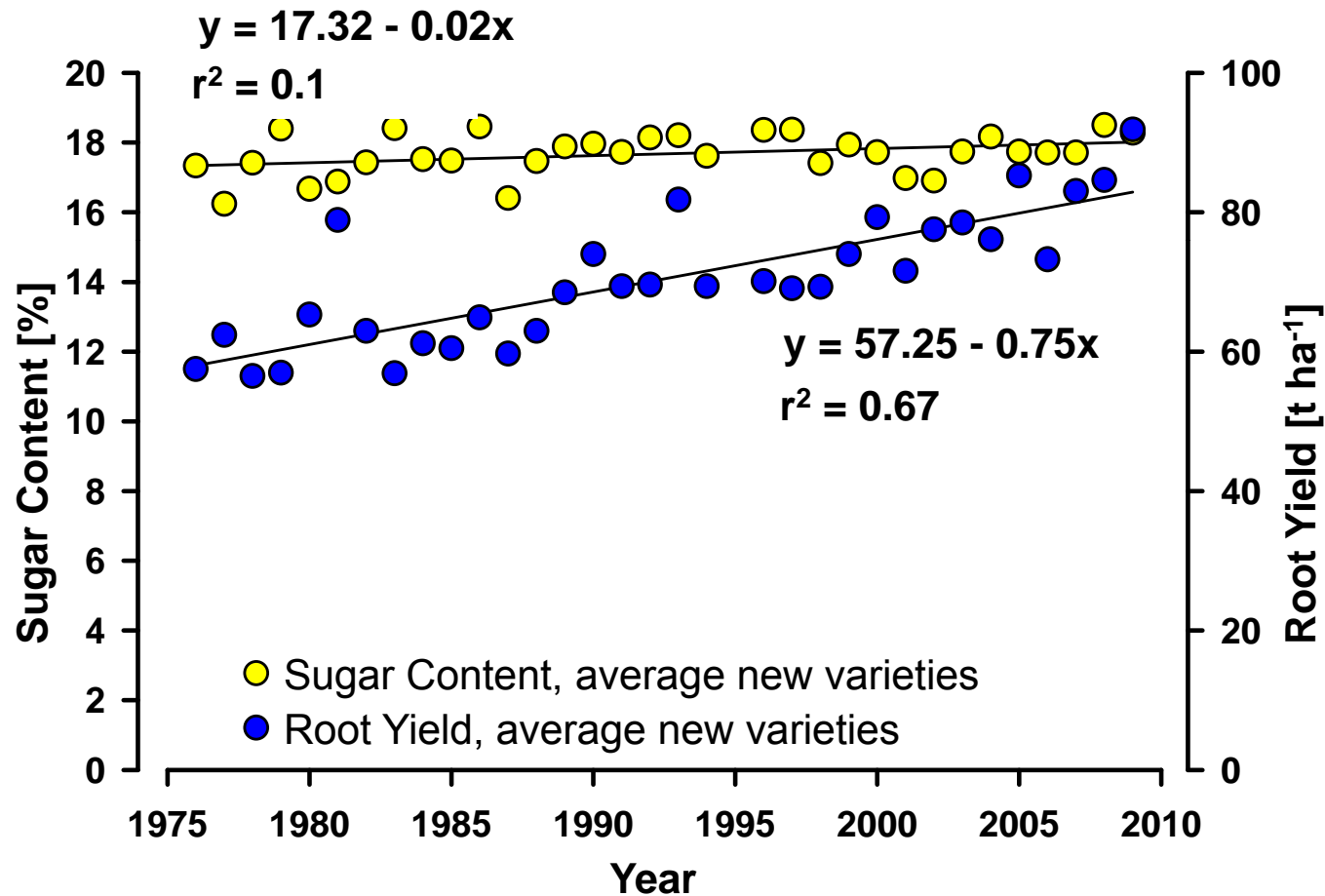
Mean Chemical Composition of Sugarbeet

Germany, 2007



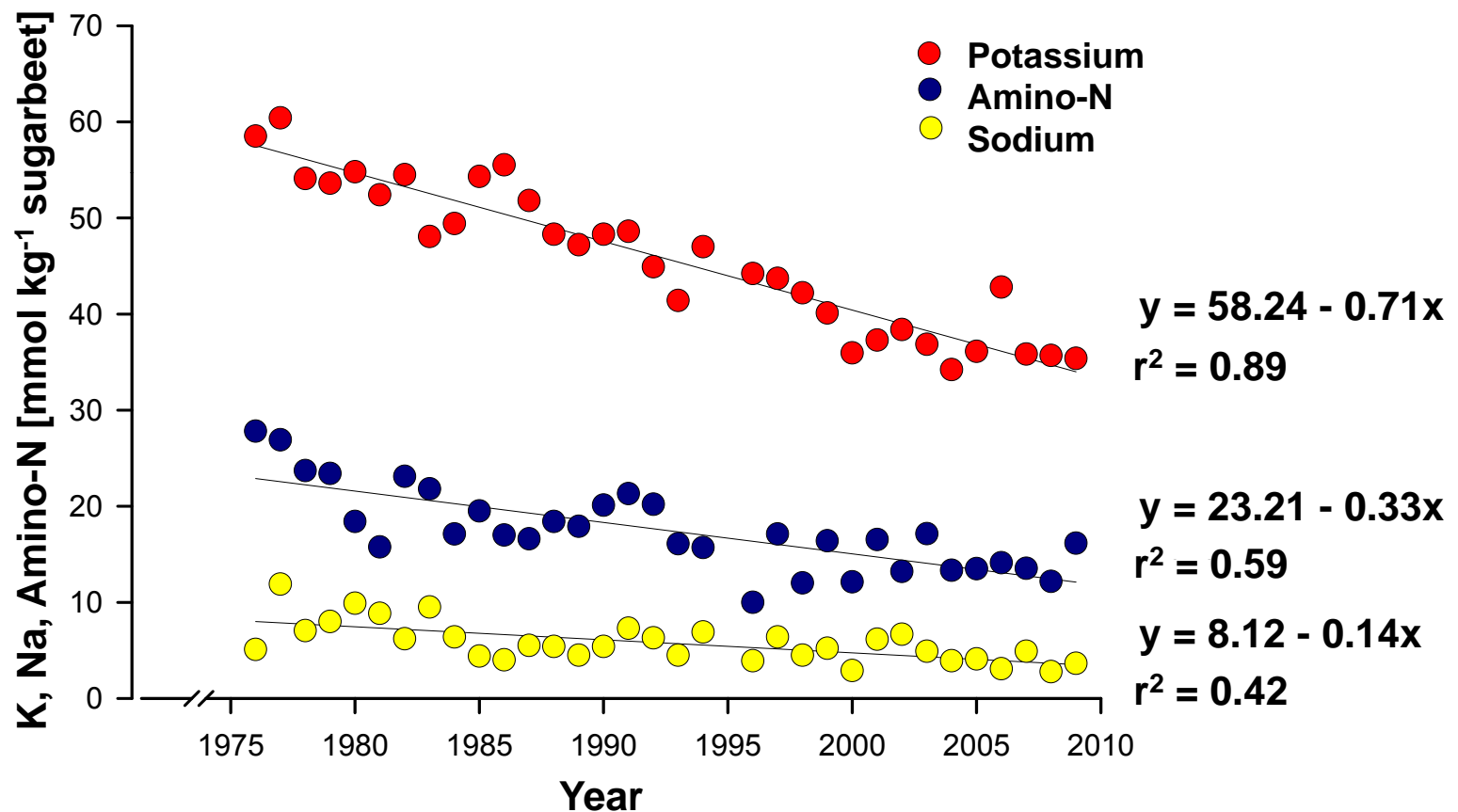
Development of Sugar Content and Root Yield of Sugarbeet

Official trials, Federal Plant Variety Office, Germany, 1976-2009



Development of the Potassium, Sodium and Amino-N Content of Sugarbeet

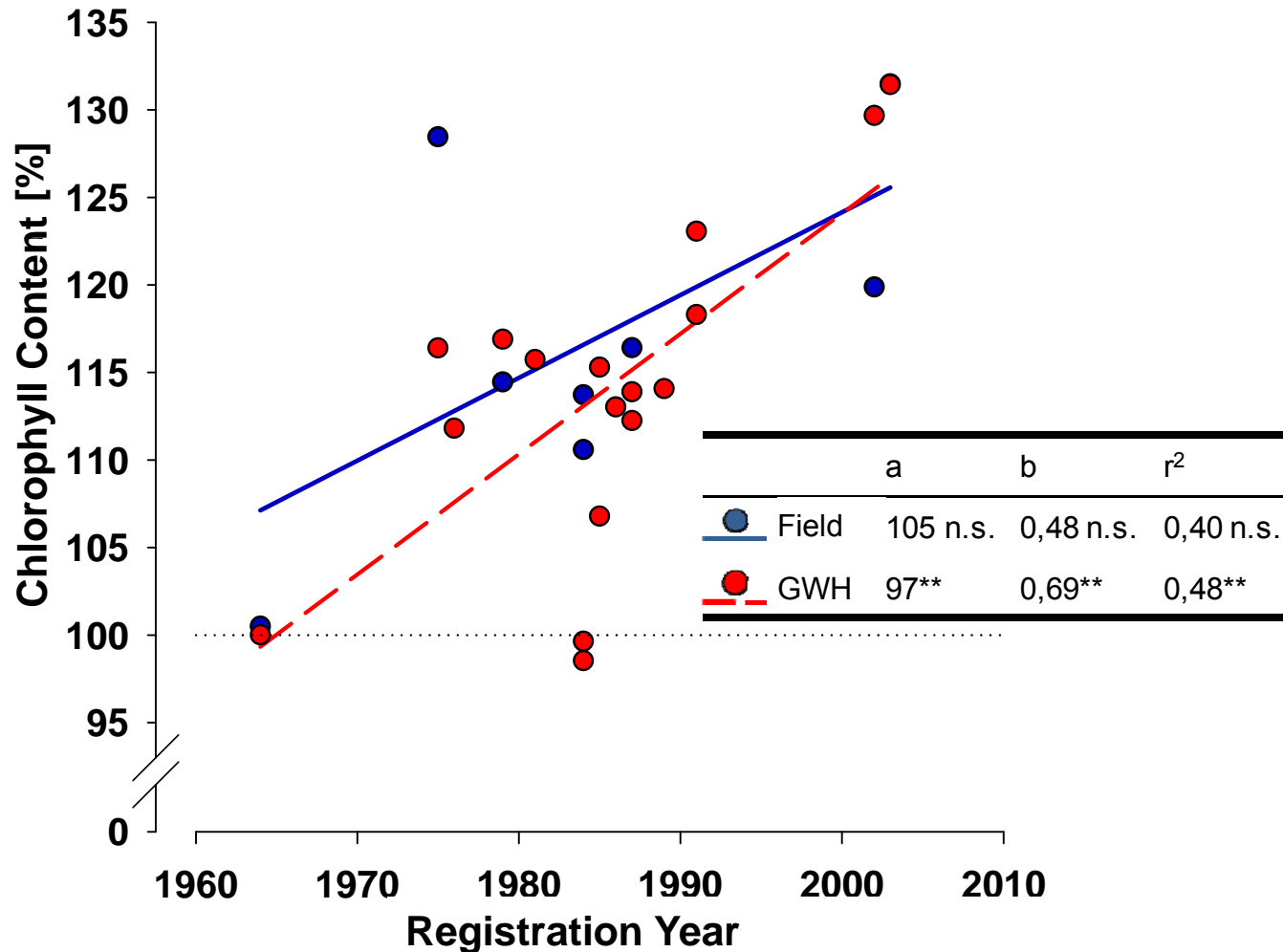
Official trials, Federal Plant Variety Office, Germany, 1976-2009



Relative Chlorophyll Content of Sugarbeet Varieties of Different Registration Years (1964 bis 2003)

Reference variety registered in 1964 = 100%

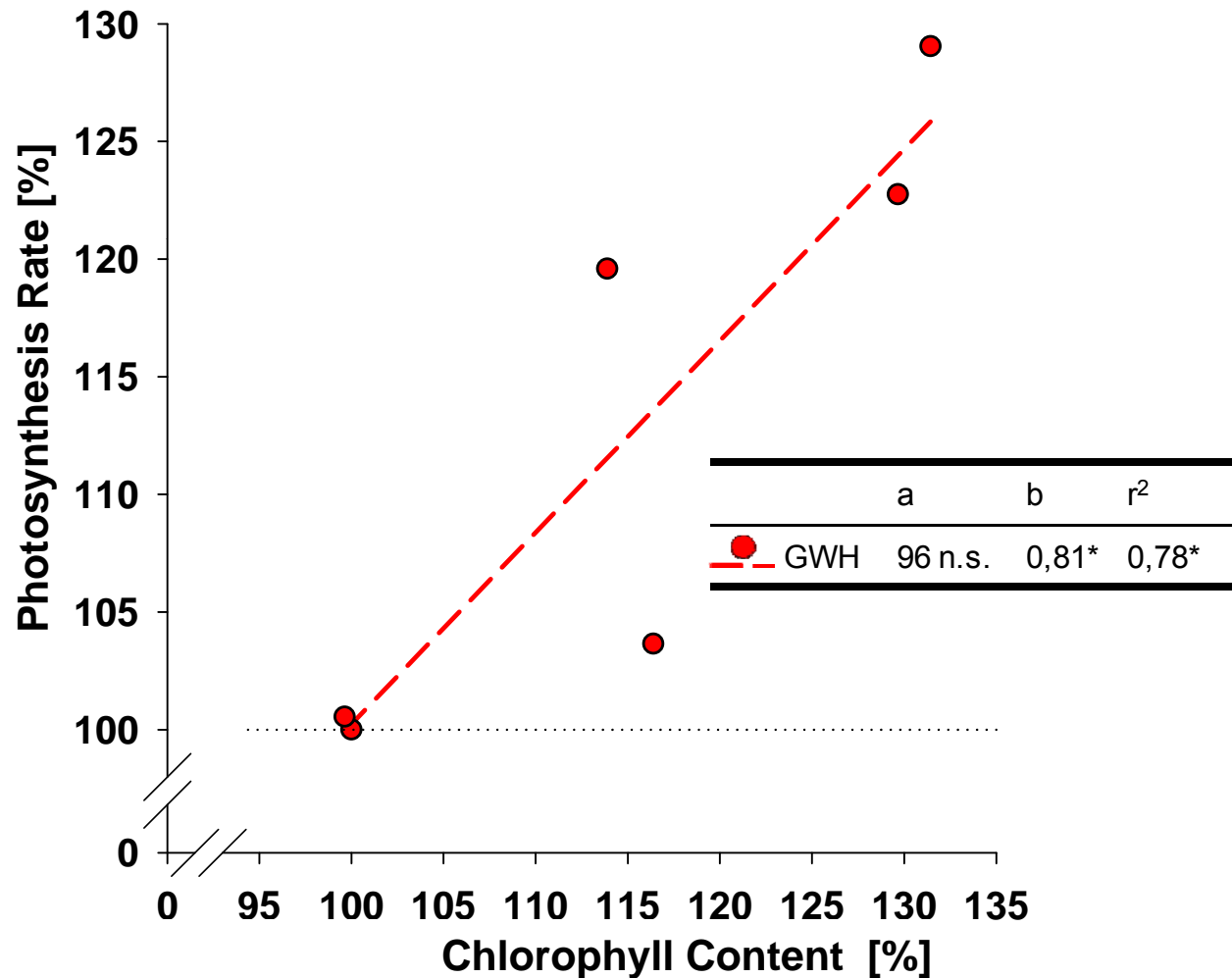
Field trials and greenhouse (GWH) trials, IfZ, Germany 2008



** p<0.01 n.s. not signifikant

Photosynthesis depending on the Chlorophyll Content of Sugarbeet Varieties of Different Registration Years (1964 bis 2003)

Reference variety registered in 1964 = 100 %, greenhouse (GWH) trials, IfZ, Germany 2008

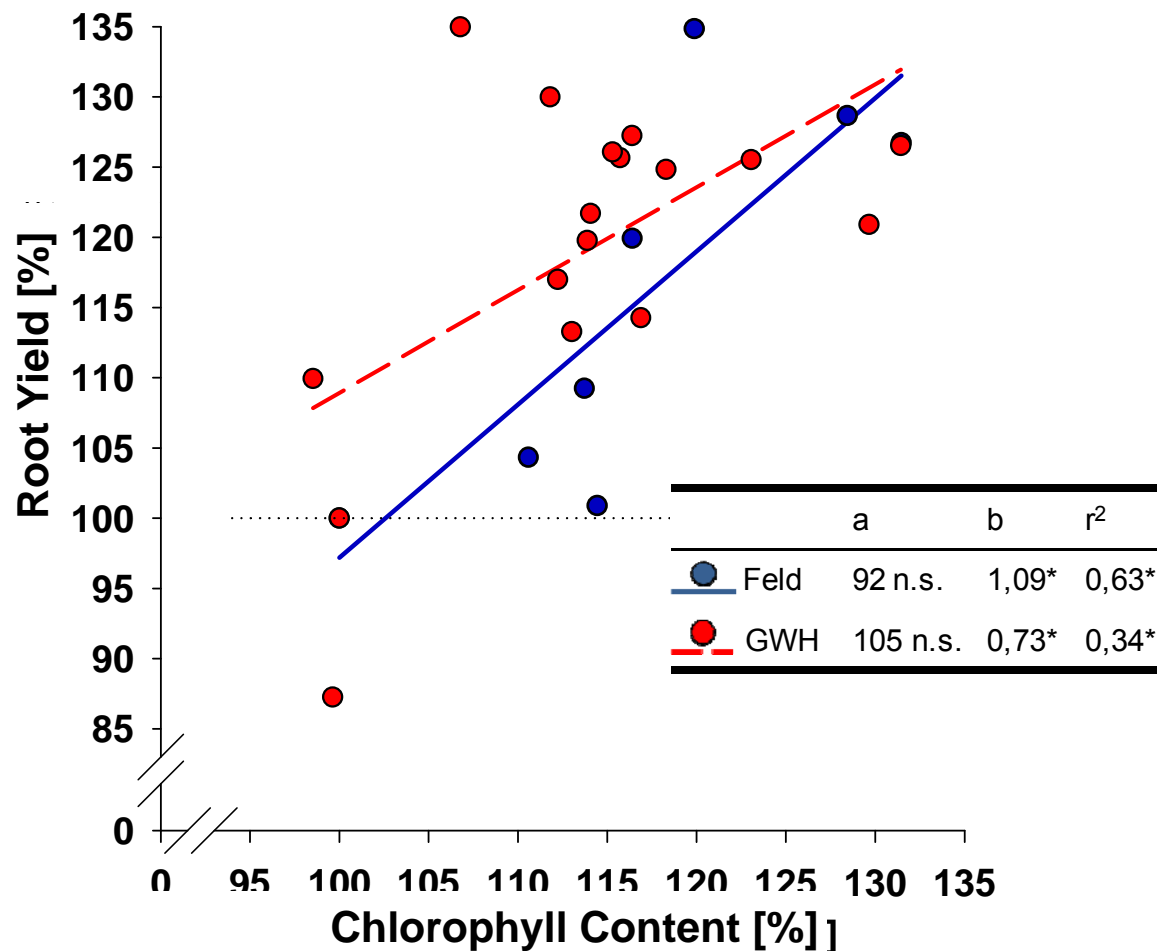


** p<0.01 n.s. not signifikant

Source: Loel et al. 2010

Root Yield depending on the Chlorophyll Content of the leaves of Sugarbeet Varieties of Different Registration Years (1964 bis 2003)

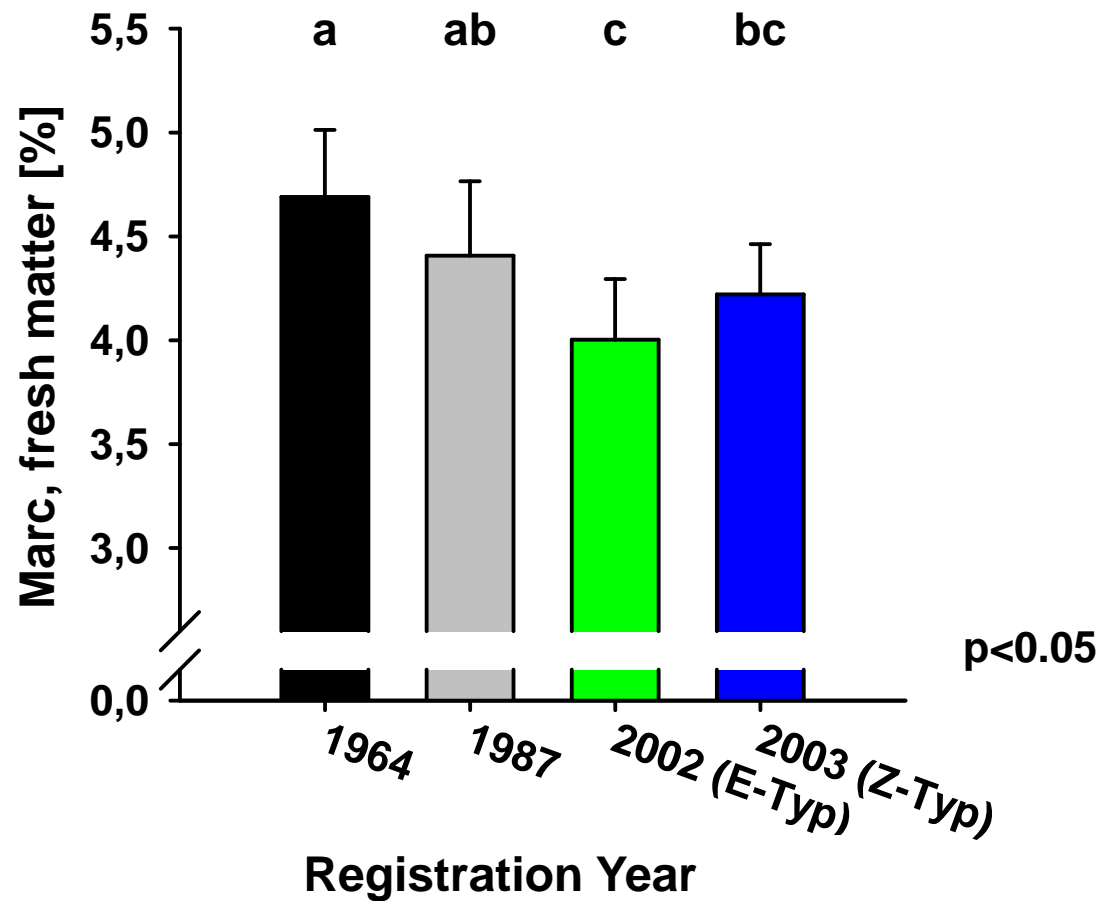
Reference variety registered in 1964 = 100%
 Field trials and greenhouse (GWH) trials, IfZ, Germany 2008



** p<0.05 n.s. not signifikant

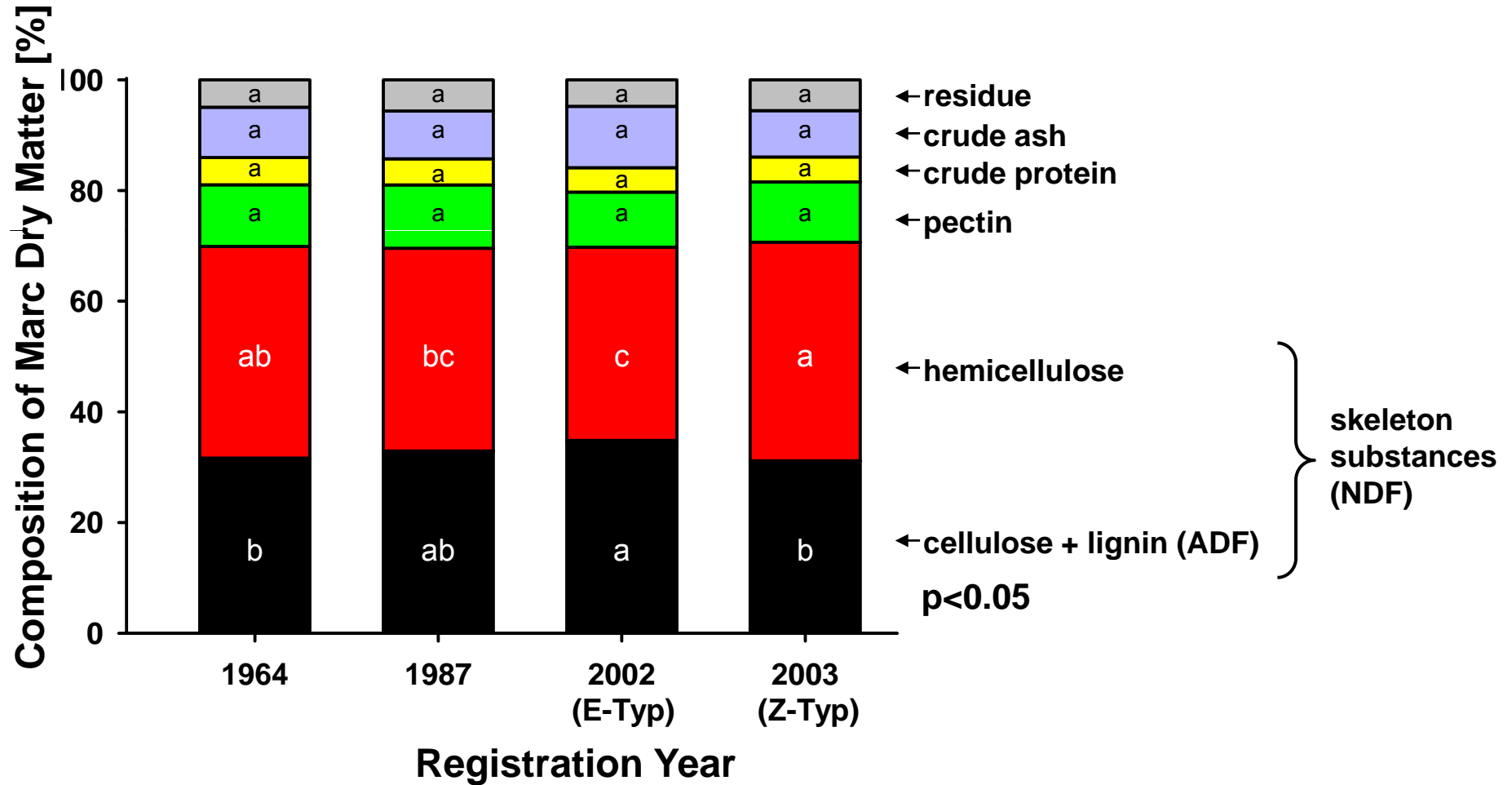
Content of Marc in the Fresh Matter (FM) of Old and New Sugarbeet Varieties

Germany 2006



Composition of Marc Dry Matter of Old and New Sugarbeet Varieties

Germany 2007



Changes in Total Dry Matter Yield and Quality Parameters of Sugarbeet by Breeding Progress

Comparison of different references

	Technical progress per year	Breeding progress per year		Breeding progress in relation to technical progress
		field	greenhouse	
White sugar yield	1.0-2.0%	0.9%	0.6%	40%
Total dry matter yield	0.10-0.17 t ha ⁻¹	0.11 t ha ⁻¹	0.08 t ha ⁻¹	50%
Technical quality	1.21-2.27%	0.46%	0.38%	30-40%



Source: Loel et al. 2010, modified
Märländer 1991, Burba und Jansen 2000, Zimmermann und Zeddies 2000, Jansen und Burba 2001

Summary

Higher technical quality → lower standard molasses loss → increased white sugar yield

$$\text{Dry Matter} = \sum_{\text{Sowing}}^{\text{Harvest}} \text{PAR} \times \text{LAI} \times \text{RUE} \times \text{HI}$$



Increased assimilation by

- increased chlorophyll content
- increased photosynthesisrate

Conclusion

- Breeding progress resulted in a crop well adapted to the demands of sugar manufacturing.
- This was achieved by a decrease of the impurities and a more beneficial relation of short-chain carbohydrates (sugar) to long-chain (cell wall) carbohydrates.
- It has to be tested whether this is a result of higher internal energy efficiency of the plant.
- It is expected that variety improvement in terms of physiological processes will continue further.
- This change of carbohydrate partitioning will hopefully not result in a higher susceptibility against pests and diseases.

A low-angle photograph of green leafy vegetables, possibly chard or spinach, against a bright blue sky. The leaves are vibrant green and show some signs of being eaten, with small holes visible. The perspective is from below, looking up at the plants. The text "Thank you very much for your attention!" is centered in the middle of the image in a bold, black, sans-serif font.

**Thank you very much
for your attention!**

Estimation of Variance Components of the Effect of Genotype, Year, Region and Field Site on White Sugar Yield

New sugarbeet varieties, Federal Plant Variety Office, Germany 1981-2005

Source of the variance	Variance components	%	Standard error
variety	0.0889	3.5	0.015
year	0.5651	22.1	0.228
variety*region	0.0098	0.4	0.005
year*region	0.1180	4.6	0.115
site*region	0.3411	13.3	0.159
year*site*region	1.3022	50.8	0.150
residual error	0.1369	5.3	0.007