SESVANDERHAVE
sugar beet seed

Old Threats- New perspectives

Torun's conference 02-06-2016

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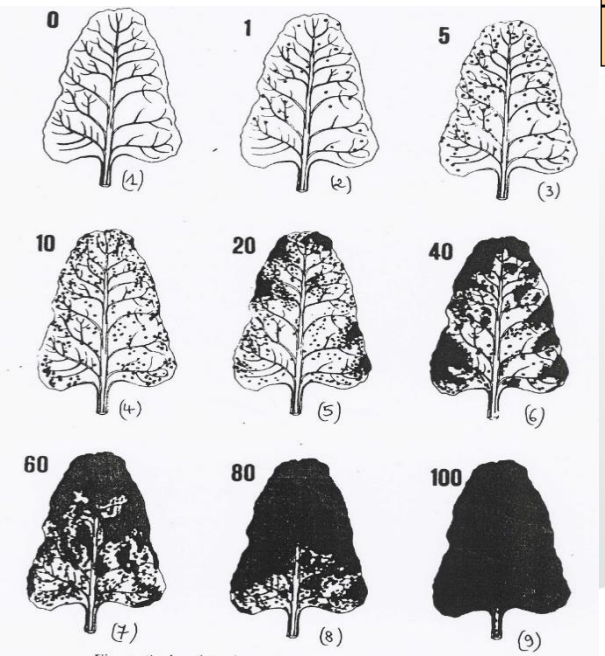
Old Threats-New persepectives

Cercospora

Phenotyping : scoring method

SCALE	Description (whole plant)	% decayed
1	No infection	0
2	Spots on one or two leaves	1
3	Spots on most leaves easely visible	2
4	Distinct spots on most leaves but not coalescing	5
5	First coalescing spots on one or two leaves	10
6	Spots coalesce to patches	20
7	First leaves up to 50% decayed	40
8	The 3, 4 remaing leaves with 50% decayed; others dead	80
9	Entire defoliation	100



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Observation trials: artificial inoculation

Observation trials: artificial inoculation

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Old problem, modern approach

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Figure 1: le champ expérimental « cercosporiose »

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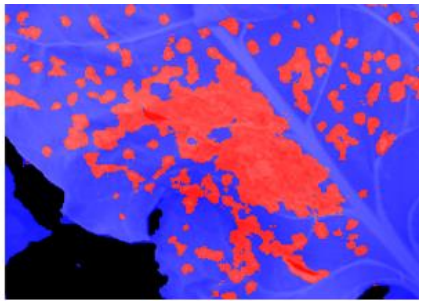

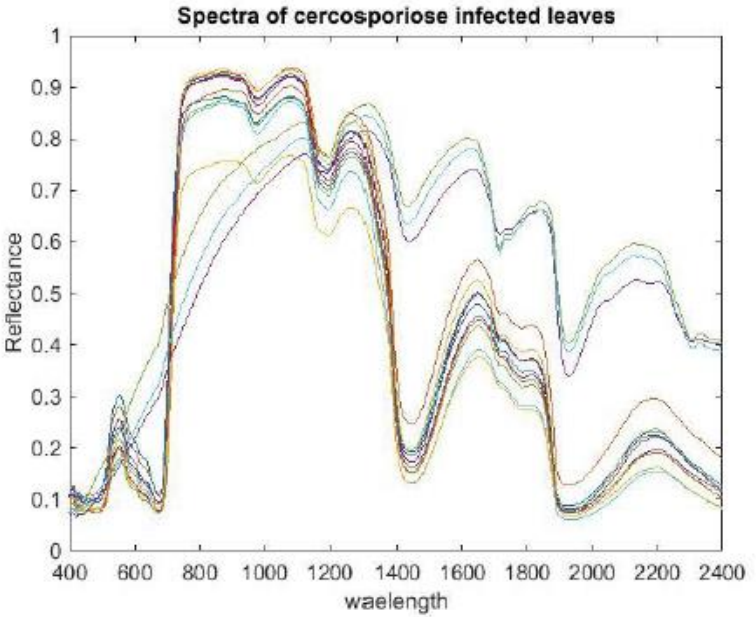

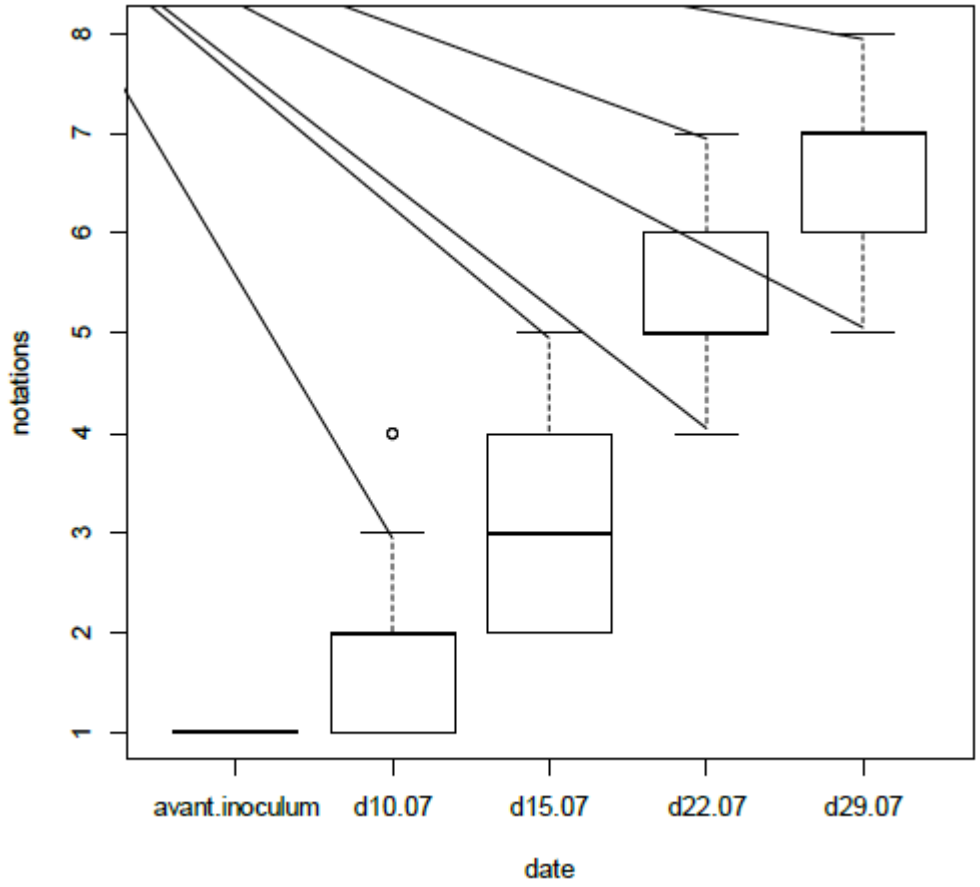

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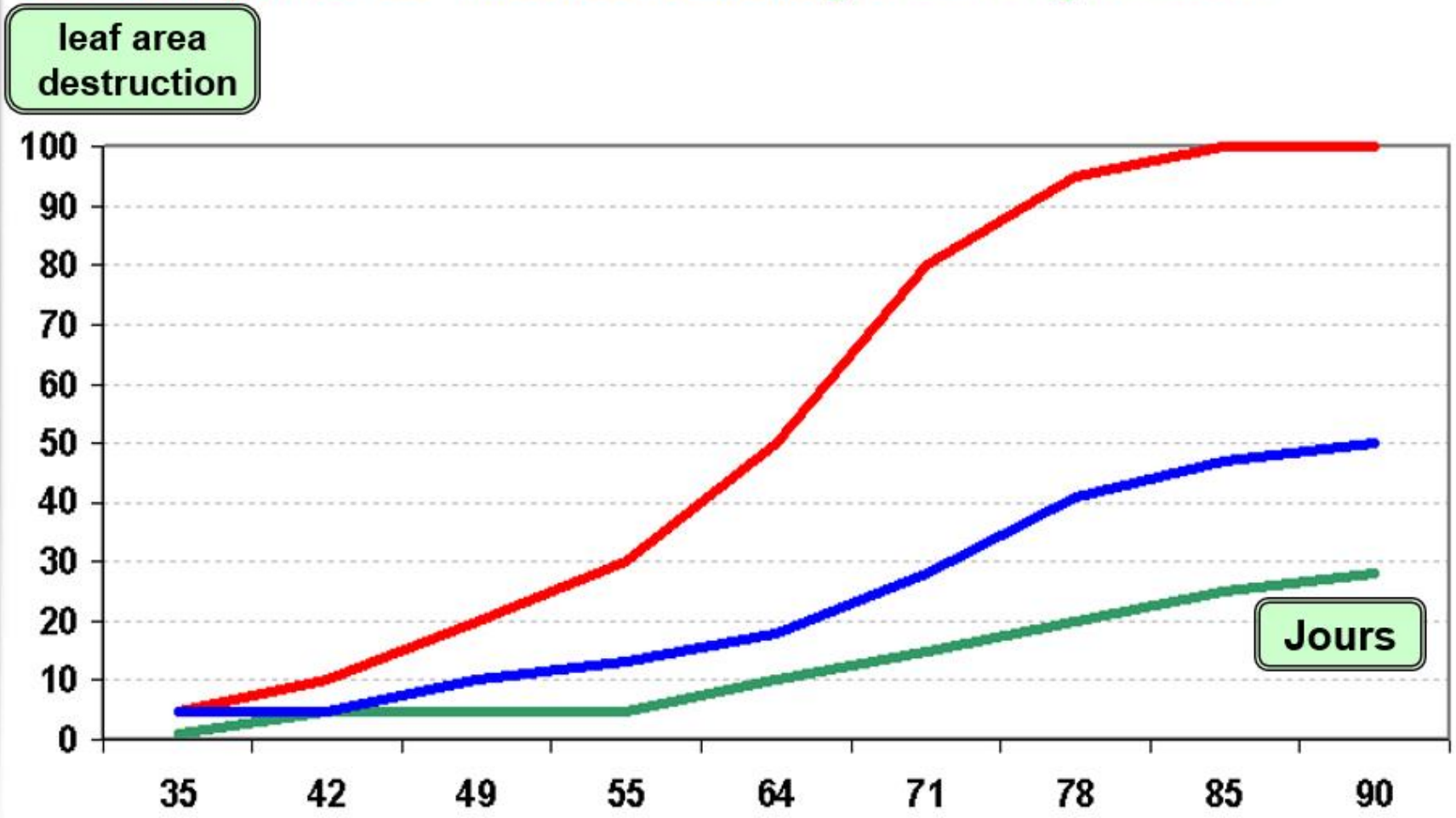
Differential epidemy progress: slope for hybrids

red = susceptible blue=moderate resistant green=strong resistant



$$X = X_o \cdot e^{(r \cdot t)}$$

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Artificial inoculation in GH: high humidity/temperature contro

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Image analysis of necrotic spots

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Chlorophyl fluorescens technique

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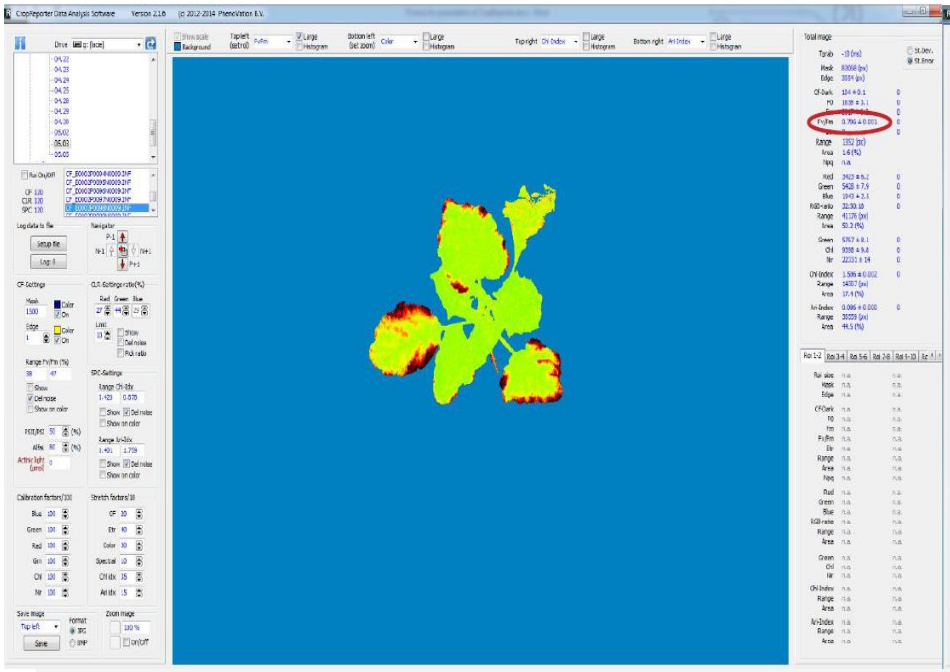
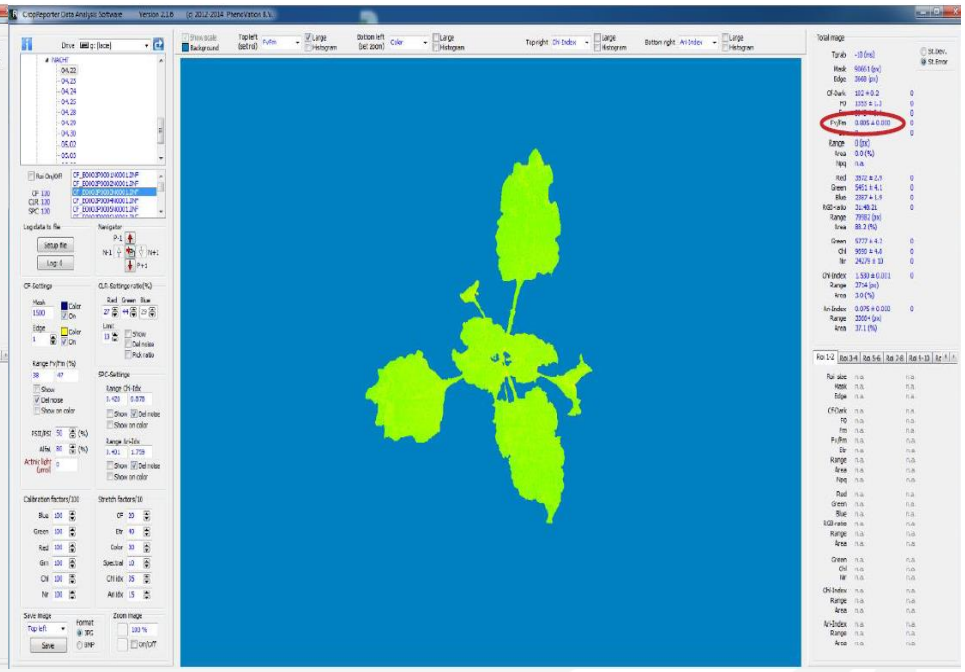
Dark: Fv/Fm = (Fm-F0)/Fm ≈ 0,7 (stressed)





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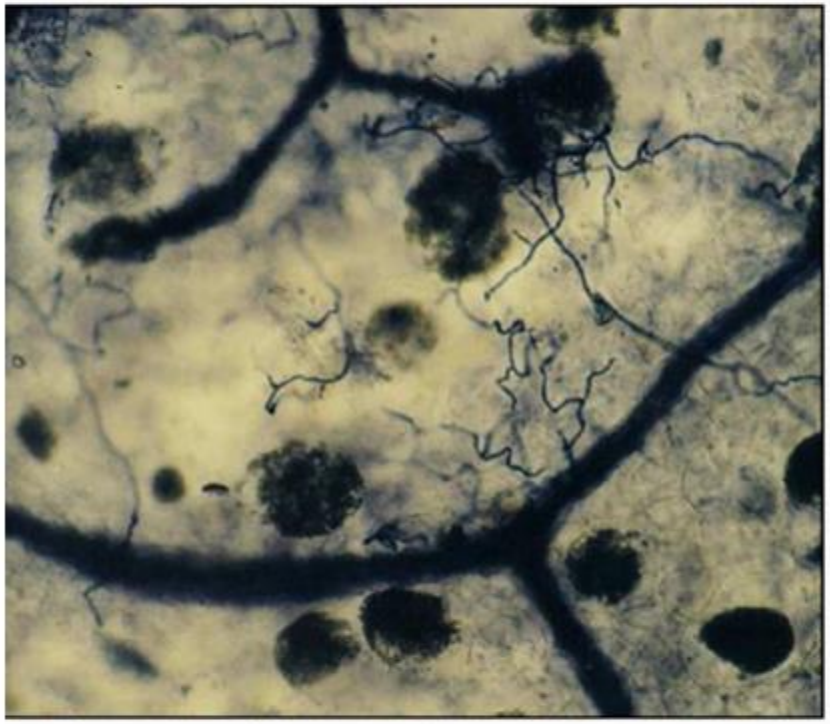
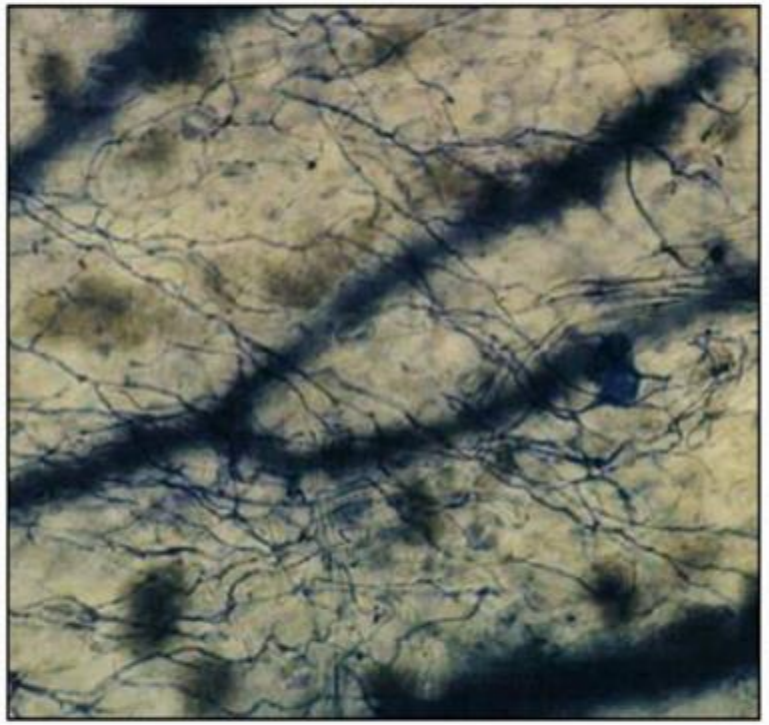
Resistance mechanism: mycelium growth

Resistant variety



Susceptible variety



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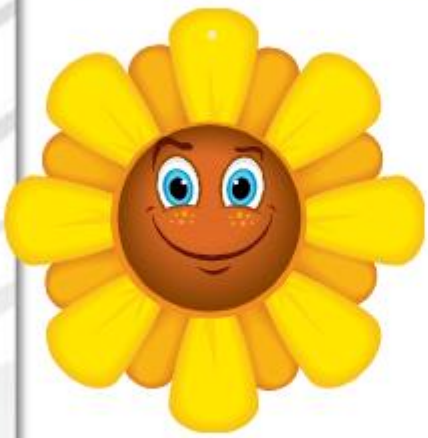
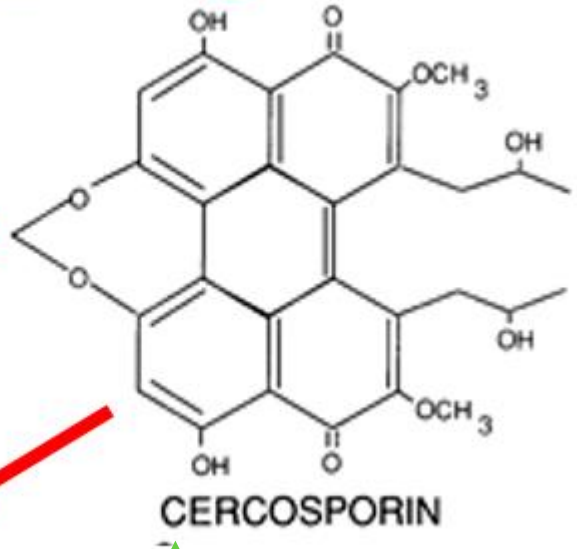
Investigate for resistance to toxins: cercosporin





CERCOSPORIN

photo-oxydative stress

tolerance?

Destruction of cell membrane
phospholipids membrane

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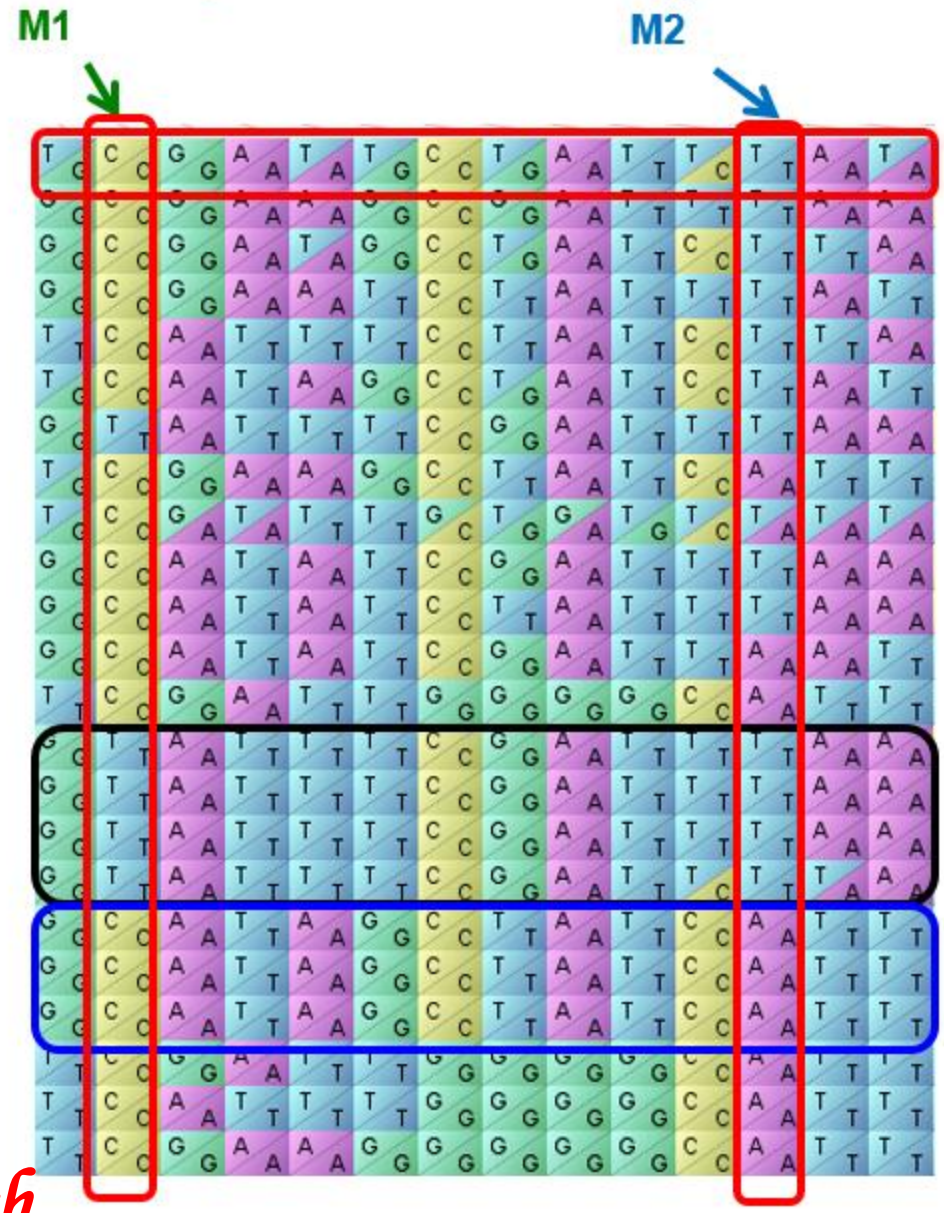
Molecular markers: resistance genes M1 & M2



D.N.A

Code:

A or T

C or G

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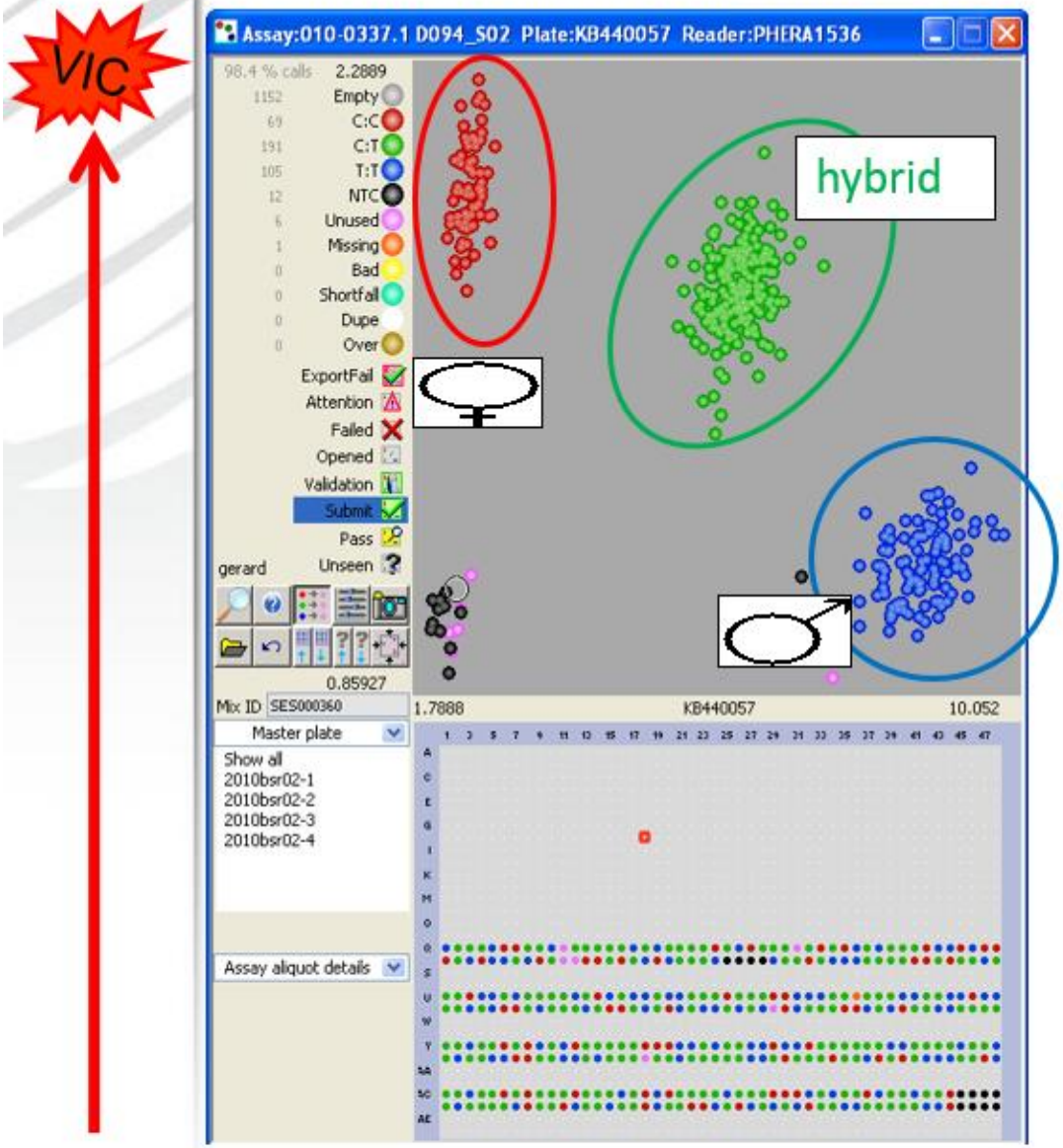

Molecular markers: resistant alleles

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Introduction of new resistance genes from exotic germplasm

Wild beets

Fodder, garden beets & old varieties

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Old problem, modern approach

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New Breeding strategy: "re-enginering" varieties for CLS resistance

- NBS-LRR genes (candidate genes)
- tolerance against cercosporin cell destruction
- Limit mycelium growth
- Reduce sporulation of cercospora
- Optimal canopy development ("ideotype")
- Optimal leaf surface to reduce first infection steps
- Introduction of "exotic germplasm"

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Old Threats-New persepectives

Drought stress tolerance

Drought tolerance

- What is drought tolerance?
- Strategy of the plant (wilting, non-wilting..)-> what is best?
- More drought tolerant varieties: # G x E
  - > smaller relative yield loss under drought conditions
- Water Use Efficiency

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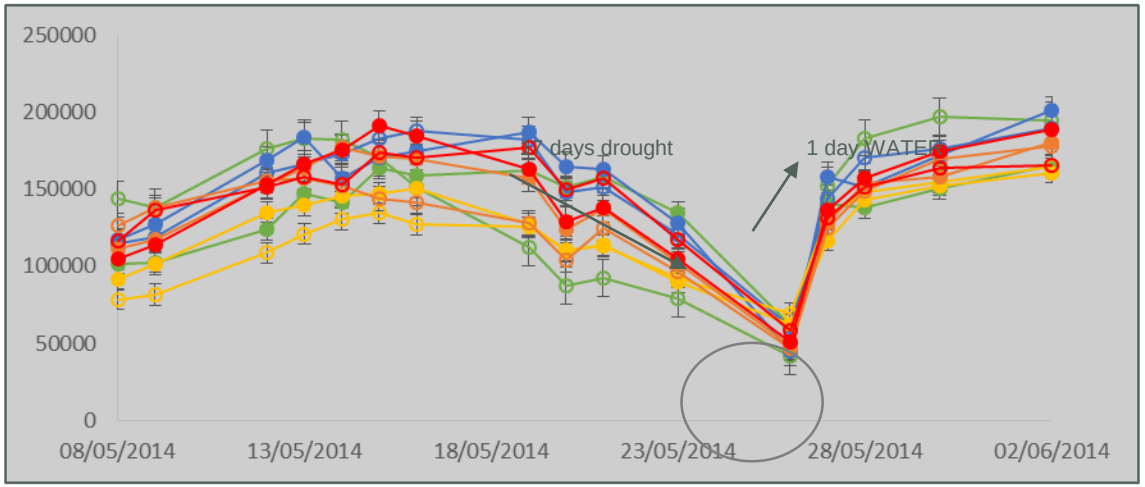
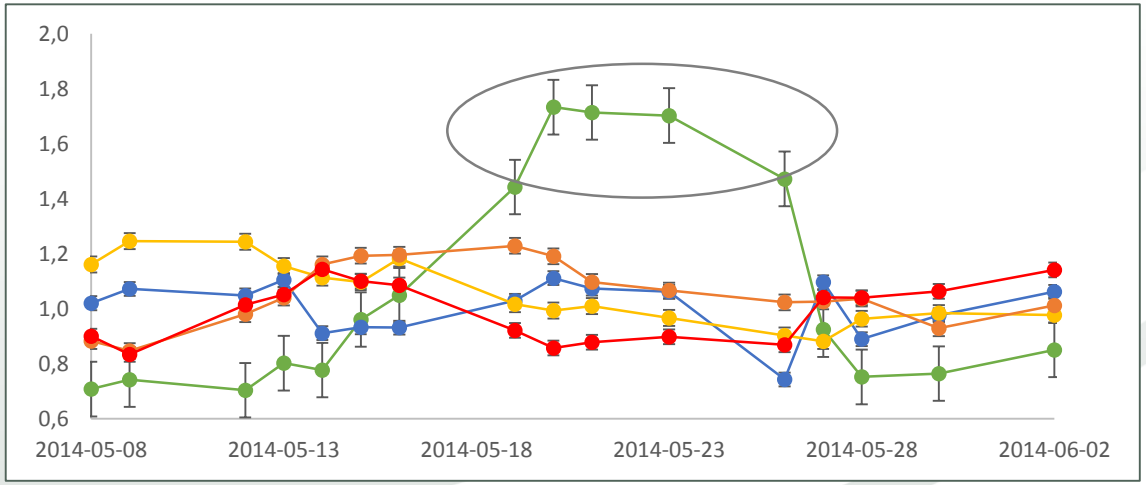
Drought stress

- *Leaf surface*
  - *Trait* (point = average of 10 plants)



Wilting
+
Fast recovering

  - *Trait ratio*



Trait
=> *Later wilting*

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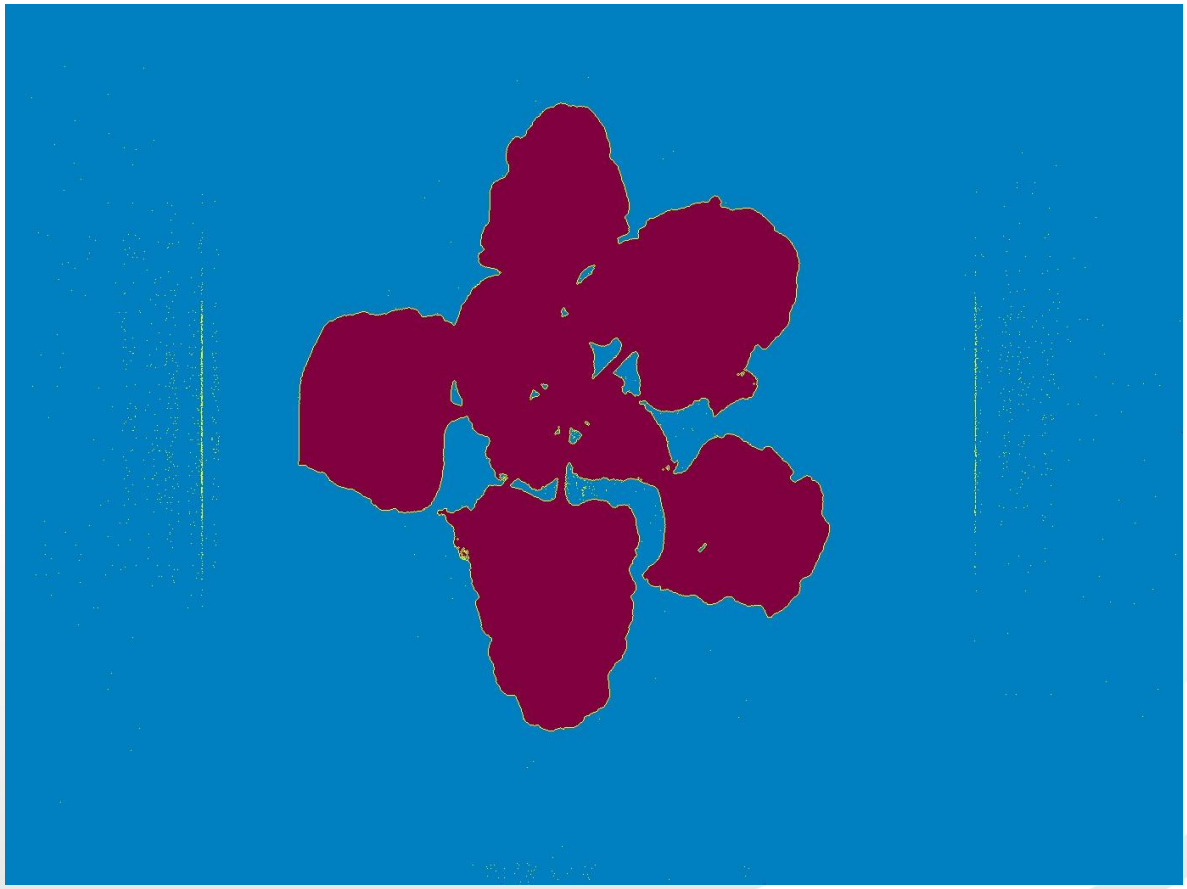
Drought stress

- *Leaf area (day 14 of drought)*



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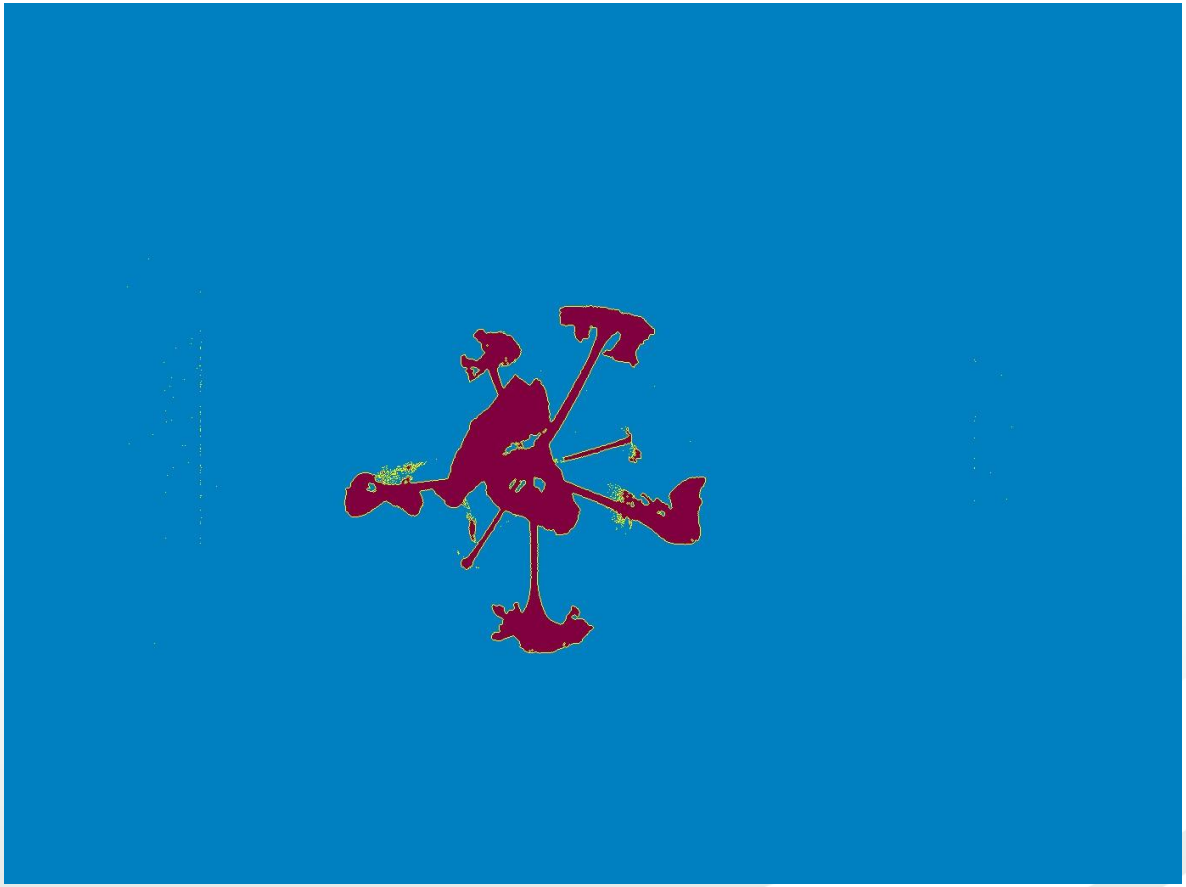
Drought stress

- *Leaf area (day 17 of drought)*



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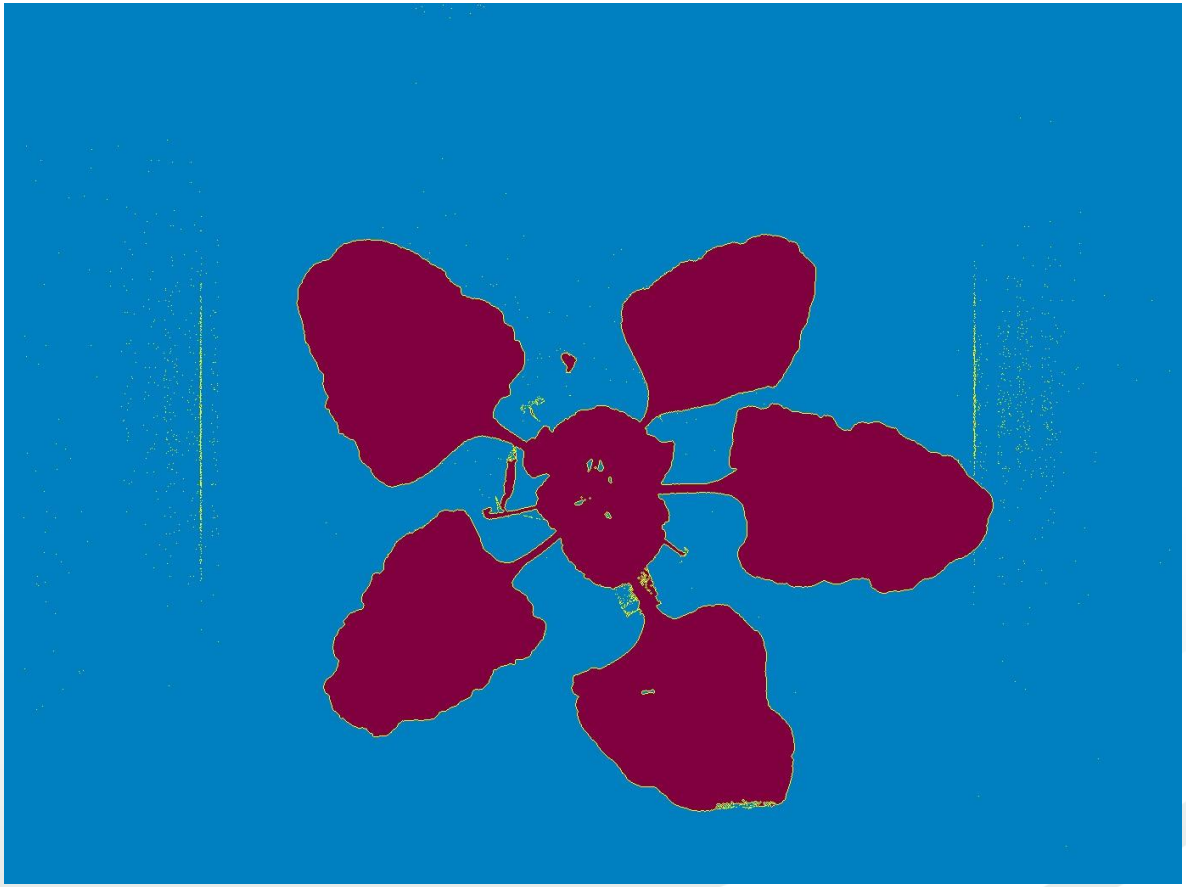
Drought stress

- *Leaf area (day 1 after recovery)*



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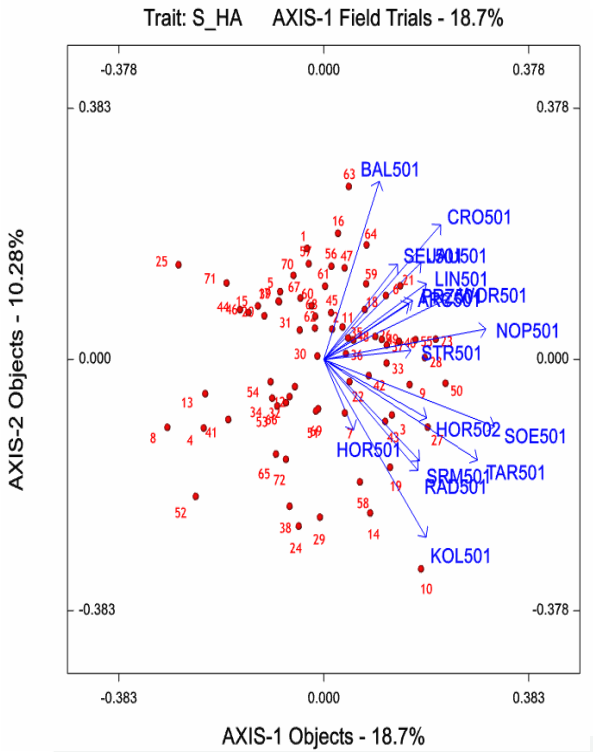
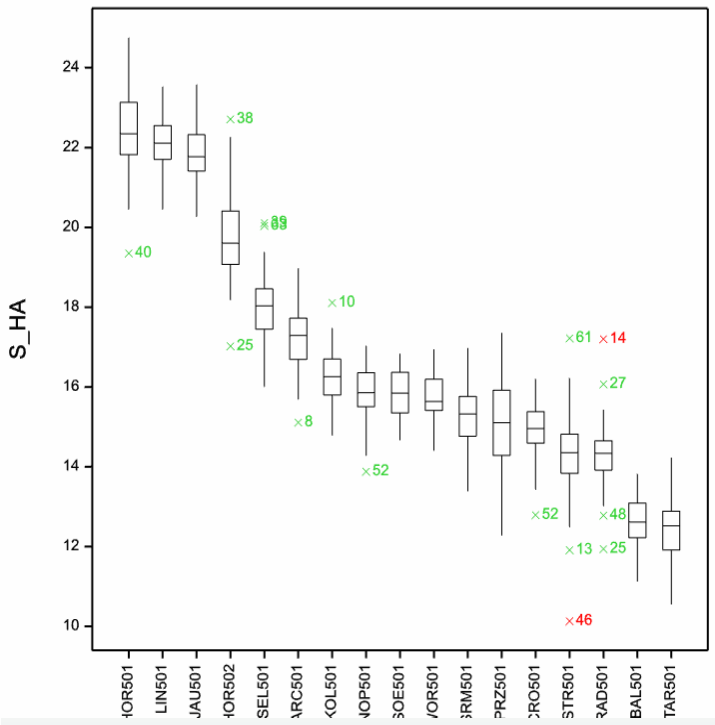
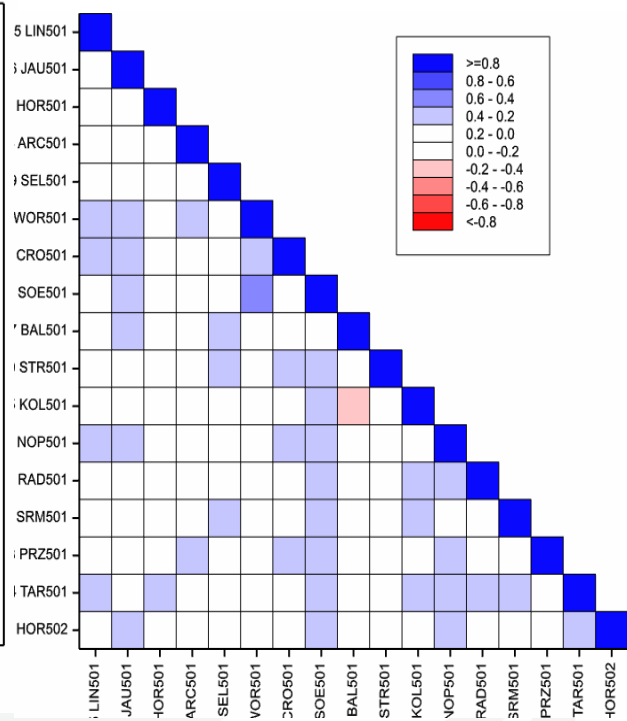
Drought tolerance: classifying environments







Statistical analysis of our trial network allow to select varieties performing better under dry conditions

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Drought stress tolerance: our experience in Spain

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Drought stress tolerance: our experience in Spain

Table 1. Water regimes applied in years 2014 and 2015 (mm o L/m^2).

YEAR	2014		2015	
WATER	NORMAL	STRESS	NORMAL	STRESS
Rain (1)	315	315	356	356
Rain (2)	108	108	21	21
Treatment	598	465	635	505
Total	1.021	888	1.012	882

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Drought stress tolerance: our experience in Spain

Table 2. Statistical analysis of the differences for root yield, sugar content and sugar yield for trials in years 2014 and 2015.

ANOVA	Root Yield (t/ha)	Sugar Content (%)	Sugar Yield (t/ha)
Varieties	< 0,001**	0,001*	<0,001**
Treatments	< 0,001**	< 0,001**	<0,001**
Varieties x Treatments	< 0,001**	0,040*	0,011*
Variance error	62,11	0,26	1,84

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Table 3. Effects of the water stress applied on the different varieties for root yield sugar content and sugar yield. (– loss and + gain). Averages values from years 2014 and 2015.

VARIETY	ROOT YIELD (t/ha)	SUGAR CONTENT (%)	SUGAR YIELD (%)	D.S.I.
JULIETTA	- 18,1	+1,5	-1,2	0,55
BRAHMS	-12,7	+1,0	-1,1	0,36
ALGAR	-22,7	+1,3	-2,5	0,82
SETENIL	-6,1	+0,7	-0,1	0,24
JARHAMA	-16,3	+1,4	-1,2	0,48
PORTAL	-19,5	+1,0	-2,4	0,74
HELLA	-25,4	+1,6	-2,3	0,73
SARAMAGO	-28,4	+1,7	-2,9	0,94
MALU	-21,3	+2,0	-1,3	0,57
INDRI	-18,8	+1,7	-1,1	0,39
VEJER	-22,9	+1,6	-2,0	0.68
VALLE	-18,1	+1,6	-1,4	0,63
Average	-19,2	+1,4	-1,8	0,61
F Calculated	2,89**	1,39 NS	2,34**	0.76 NS
M.D.S (0,05)	10,8 t/ha	-	1,6 t/ha	-

New Breeding strategy: "re-enginering" varieties for Drought stress

- reduction 20 % water input resulted in
  - loss of 19,2 t/ha,
  - gain of 1,4 % sugar, and finally loss of 1,8 t/ha sugar.

- SV variety **SETENIL** was the most W.U.E. variety in this study (lowest sugar yield loss).

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Drought stress tolerance: our experience in Poland (index hybrids, COBORU trials)

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New Breeding strategy: "re-enginering" varieties for Drought stress

- R.O.S. against leaf tissue destruction
- Optimal canopy development ("ideotype")
- Optimal leaf surface to reduce leaf tissue destruction
- Introduction of "exotic germplasm"

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Sun burn tolerance: Resistance to oxydative stress

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Drought stress tolerance: our experience in Poland (index hybrids, COBORU trials)

Parents	MS SV1	MS SV2	MS SV3	MS SV4	MS SV5	MS SV6	MS SV7	MS SV8	MS SV9
Pol SV1	2.3	2.5	3.0	2.5	2.5	2.8	3.0	3.0	4.8
Pol SV2	2.5						3.3		4.0
Pol SV3		3.8	3.7	3.0	3.0	3.2		3.3	4.3
Pol SV4				5.0		4.5	4.0		5.0

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Introduction of new resistance genes from exotic germplasm

Wild beets

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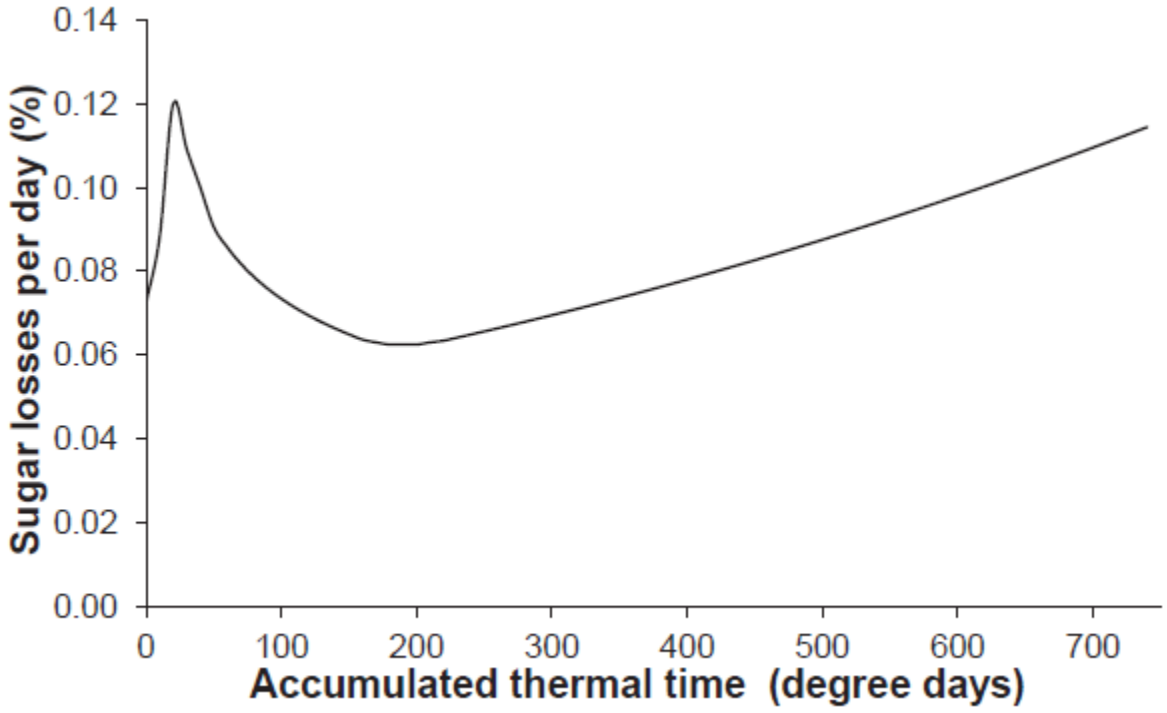
Old Threats-New persepectives

Storability

STORABILITY

- Trend is to go for longer beet campaigns
- Sugar losses at beet storage➔ Growing importance



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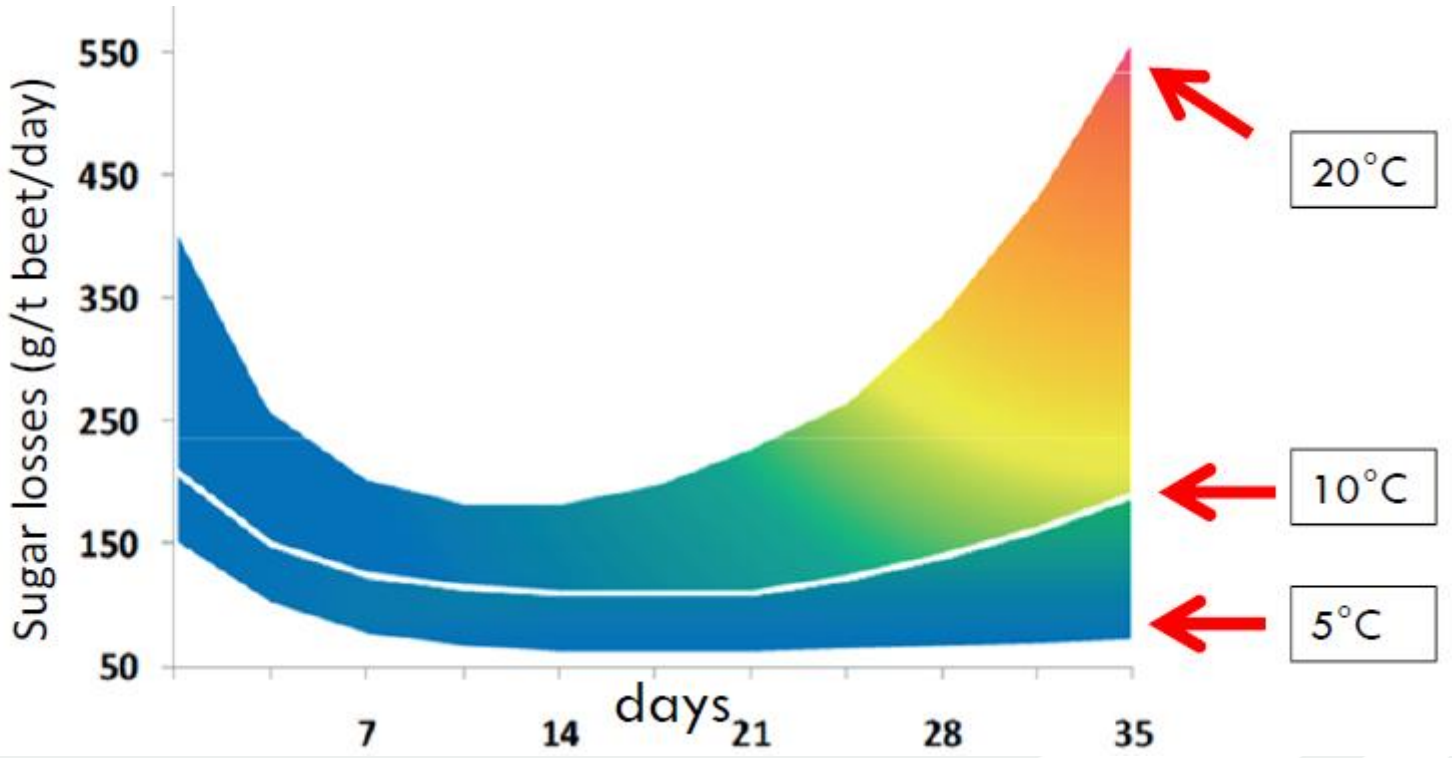
Influence of Temperature on Sugar Losses



IRBAB

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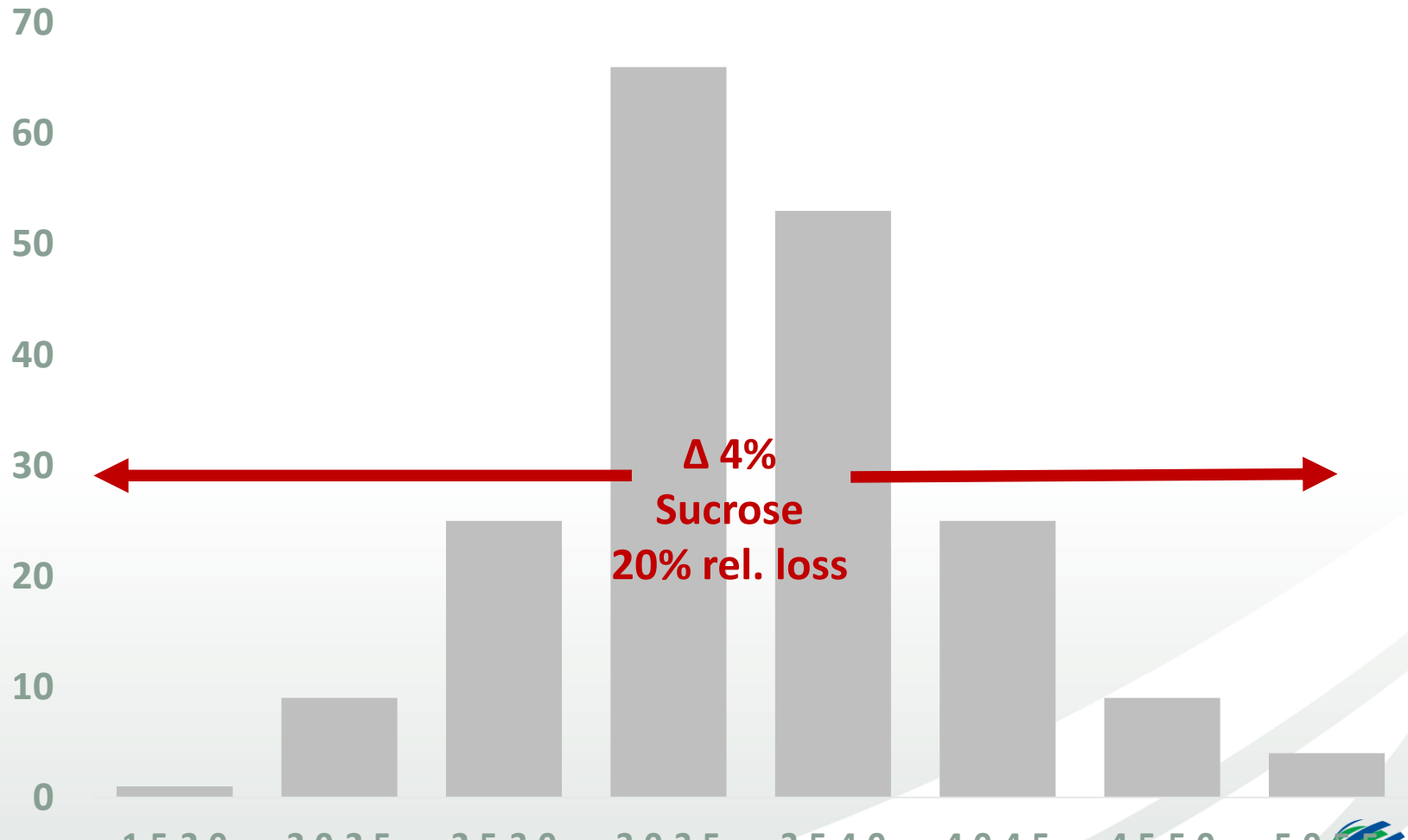
Important differences in Germplasm



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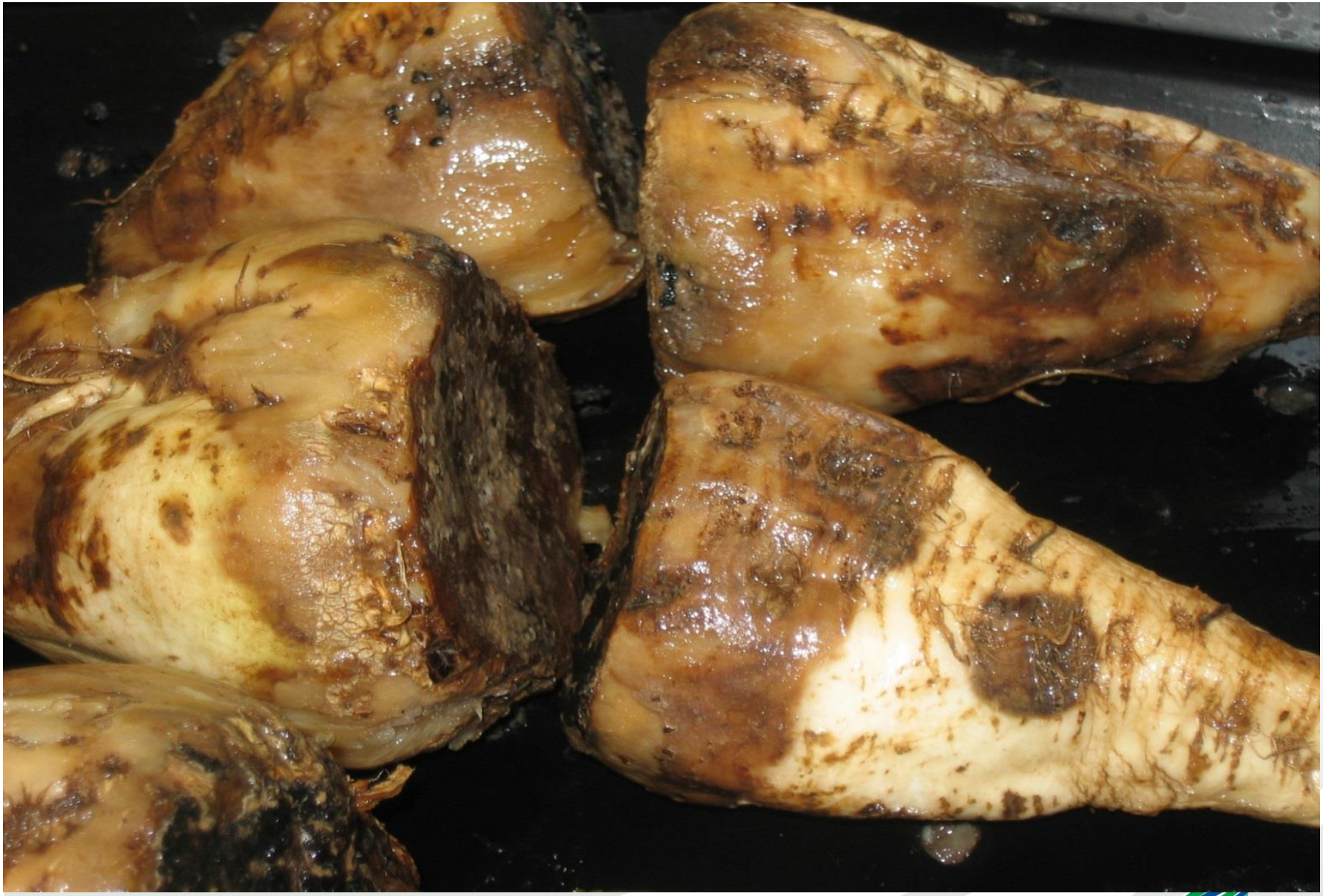

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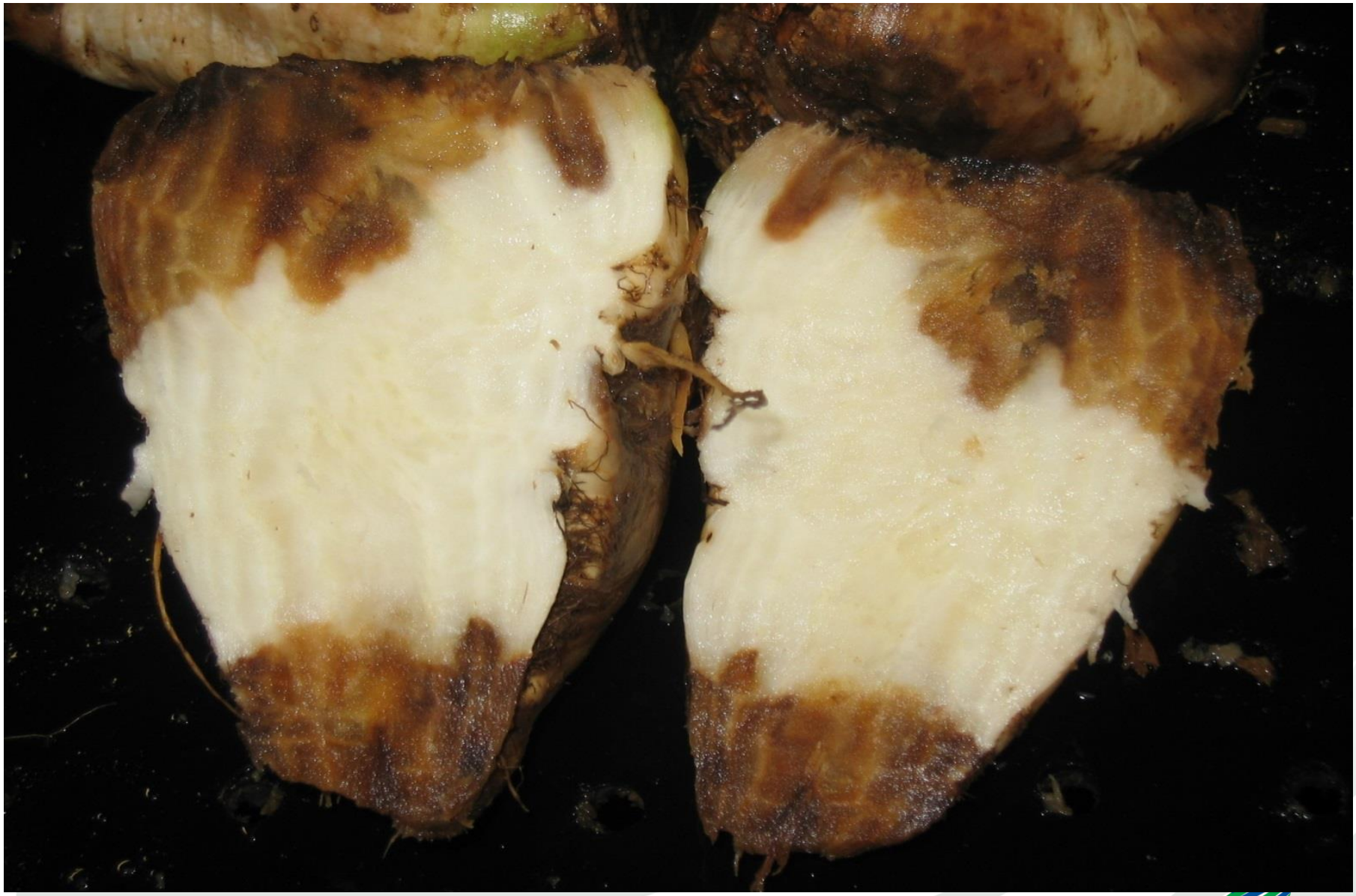

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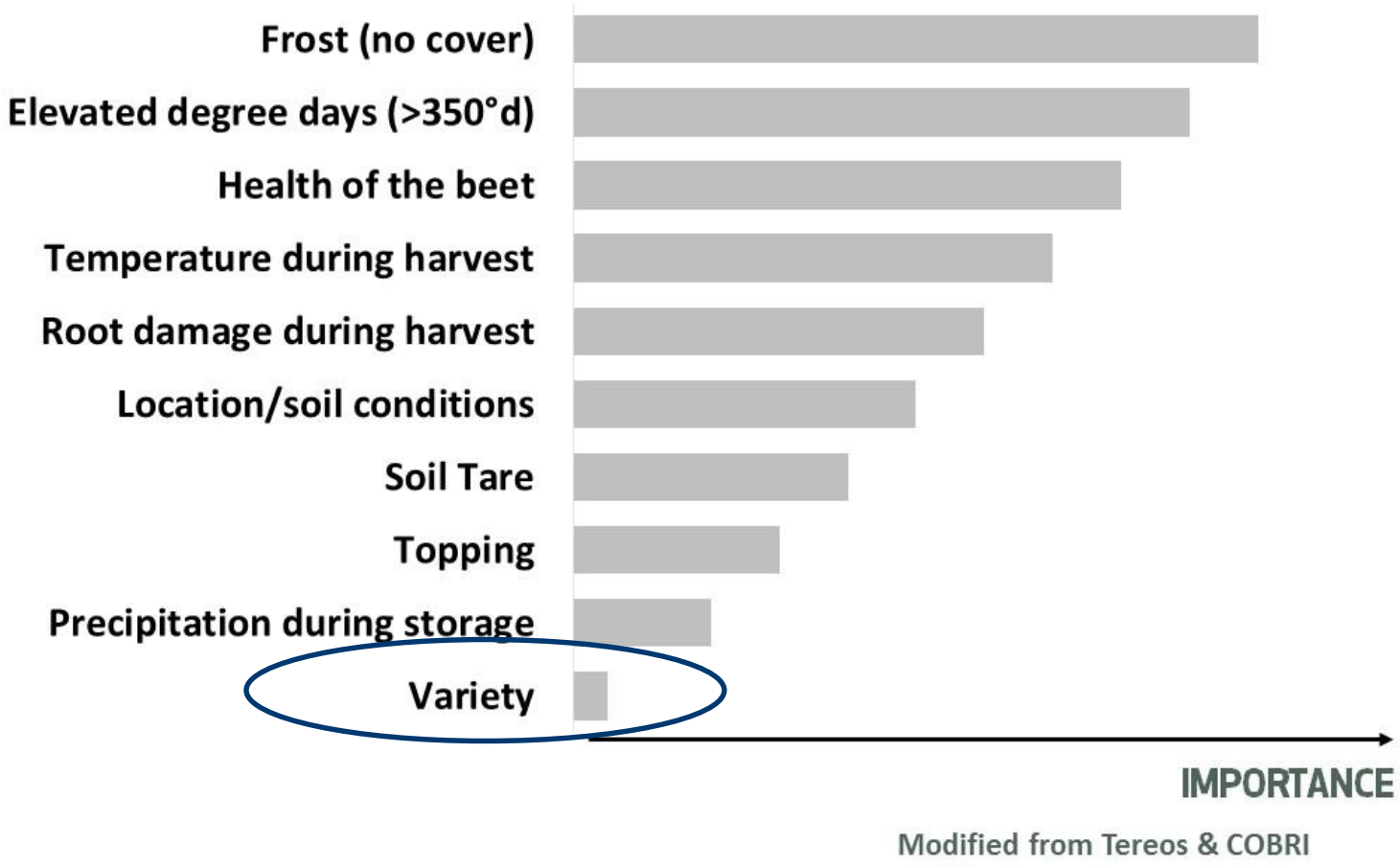
Factors influencing sugar losses



Modified from Tereos & COBRI

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Conclusions

- SESVanderHave has a lot of trialdata due its worldwide network
- Big genetic screening for good storable genetics
- Good agricultural practices are most important
- Genetic influence only at last place

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THANK YOU