COBRA

Coordinating **O**rganic Plant BReeding **A**ctivities for Diversity

Observations in cycling populations of wheat

Odette Weedon, Maria Finckh

and all the cycling partners

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SEVENTH FRAMEWORK PROGRAMME

Gefördert durch: Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz aufgrund eines Beschlusses des Deutschen Bundestages

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Presentation Contents

- COBRA aims
- Evolutionary Breeding and Composite Cross Populations
- Brief history of the „cycling“ CCPs
- Hypothesis and aims of cycling experiment
- Additional Aim in the experiment
- Results and Discussion
- Conclusion

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Coordinating Organic Plant BReeding Activities for Diversity

- Study plant material with high genetic Diversity
  here: Composite Cross Populations (CCPs)
- Determine CCP resilience, adaptability, and overall performance in organic systems
- Provide options to improve breeding efficiency and novel breeding methods to enhance and maintain crop diversity

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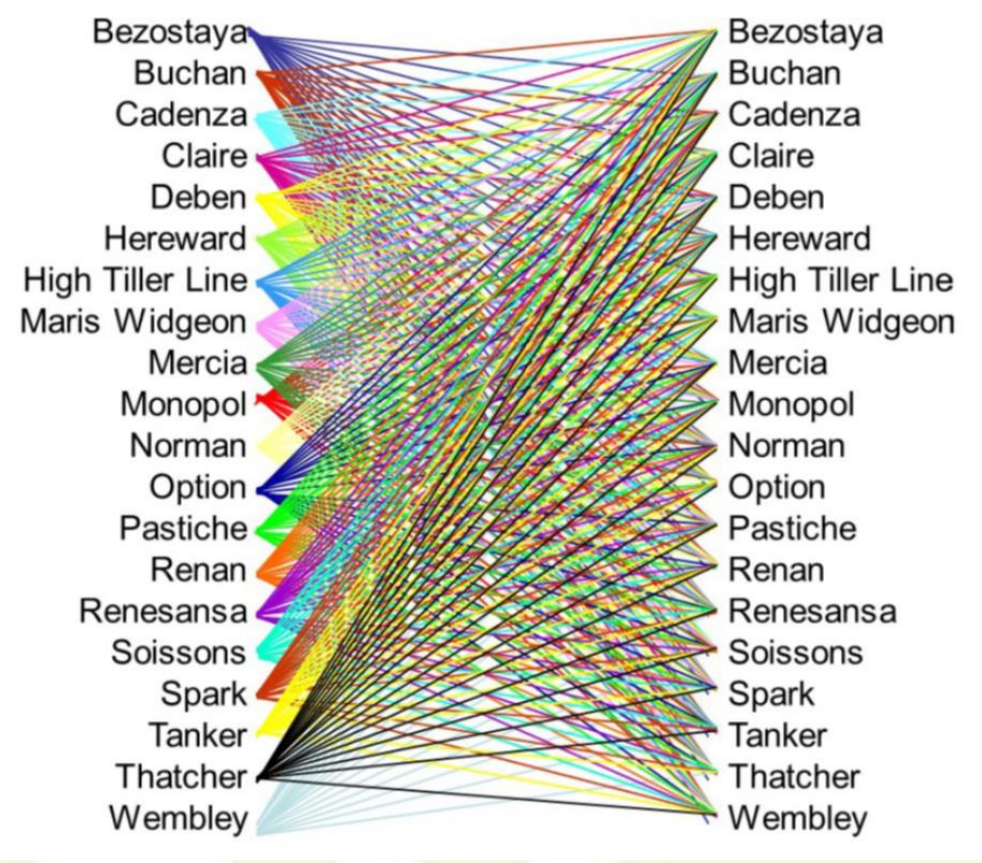
Evolutionary Breeding and Composite Cross Populations

- Creation of genetically diverse populations undergoing both artificial and natural selection under different environmental conditions
- Highly adaptable to many environmental conditions and superior genetic make-up through carefully chosen parental lines



(Figure: ORC)

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Brief history of cycling CCPs

Year	Generation	Location
2001-2004	F_1-F_3	CCP created in the UK: 20 parents
2005	F_4	Distribution among UK, DE, HU, F
2008	F_7	Populations from UK, DE, HU start traveling = “cycling”

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Brief history of cycling CCPs

Year	Generation	Location
2001	F_1-F_3	CCP created in the UK: 20 parents
2005	F_4	Distribution among UK, DE, HU, F
2008	F_7	Populations from UK, DE, HU start traveling = “cycling”
2013	**F_{12}**	**1st COBRA experimental year (Uni Kassel)**
2014	**F_{12} + F_{13}**	**2nd COBRA experimental year (Uni Kassel)**

- Research fields of the University of Kassel (51°22” N and 9°54” E, ppt: 619mm, temp: 7.9°C, 247m above sea level)

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Hypothesis and Aims

H: Exposing genetically diverse material to varying environments under natural selection increases general adaptability.

A: Compare populations that all originate from the same seed batch in 2005, but had been exposed to vastly different climates since 2008 in one site for their performance and diversity.

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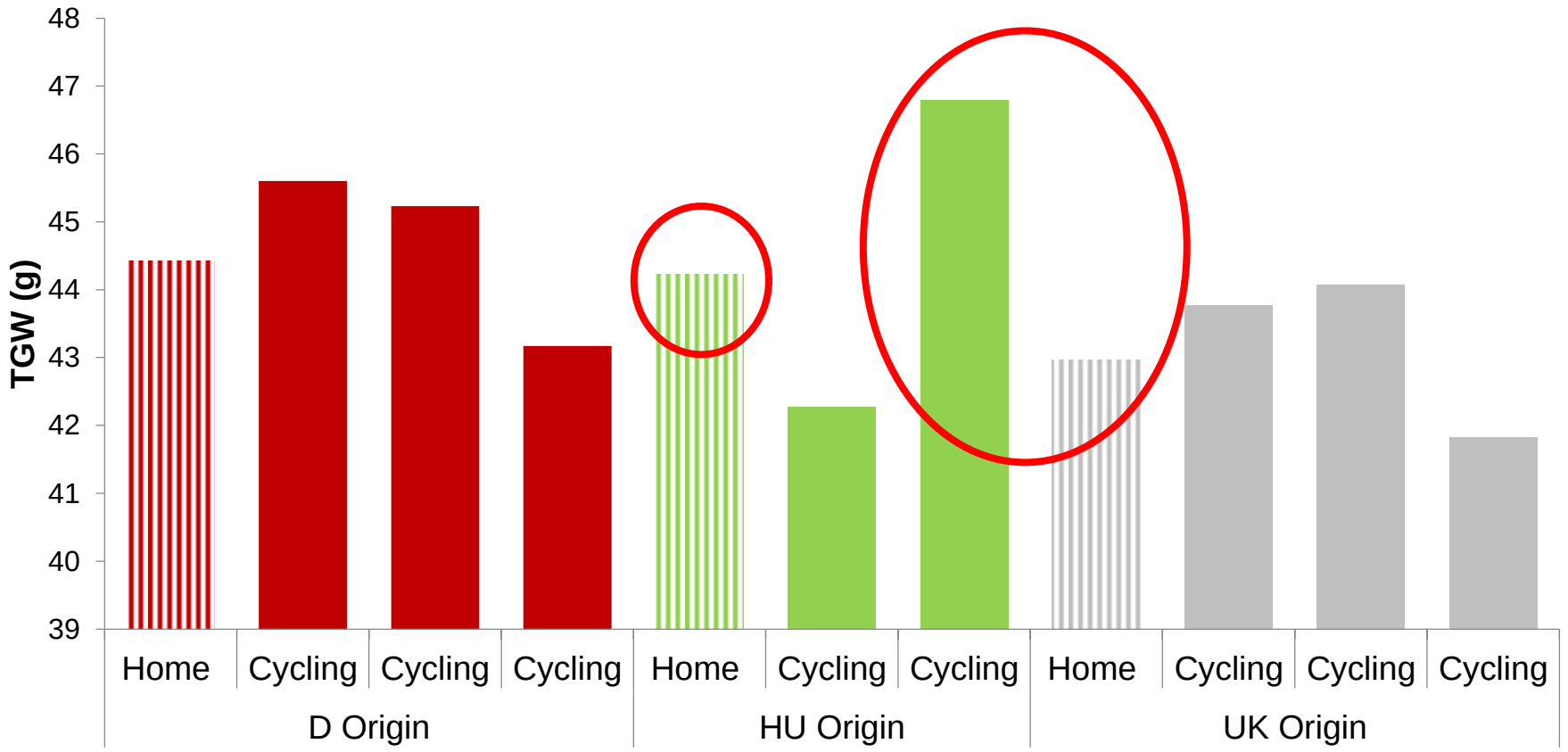
TGW of the populations at experimental start in 2013



Additional aim: Compare effects of origin of seeds on performance
The second year is not financed in COBRA

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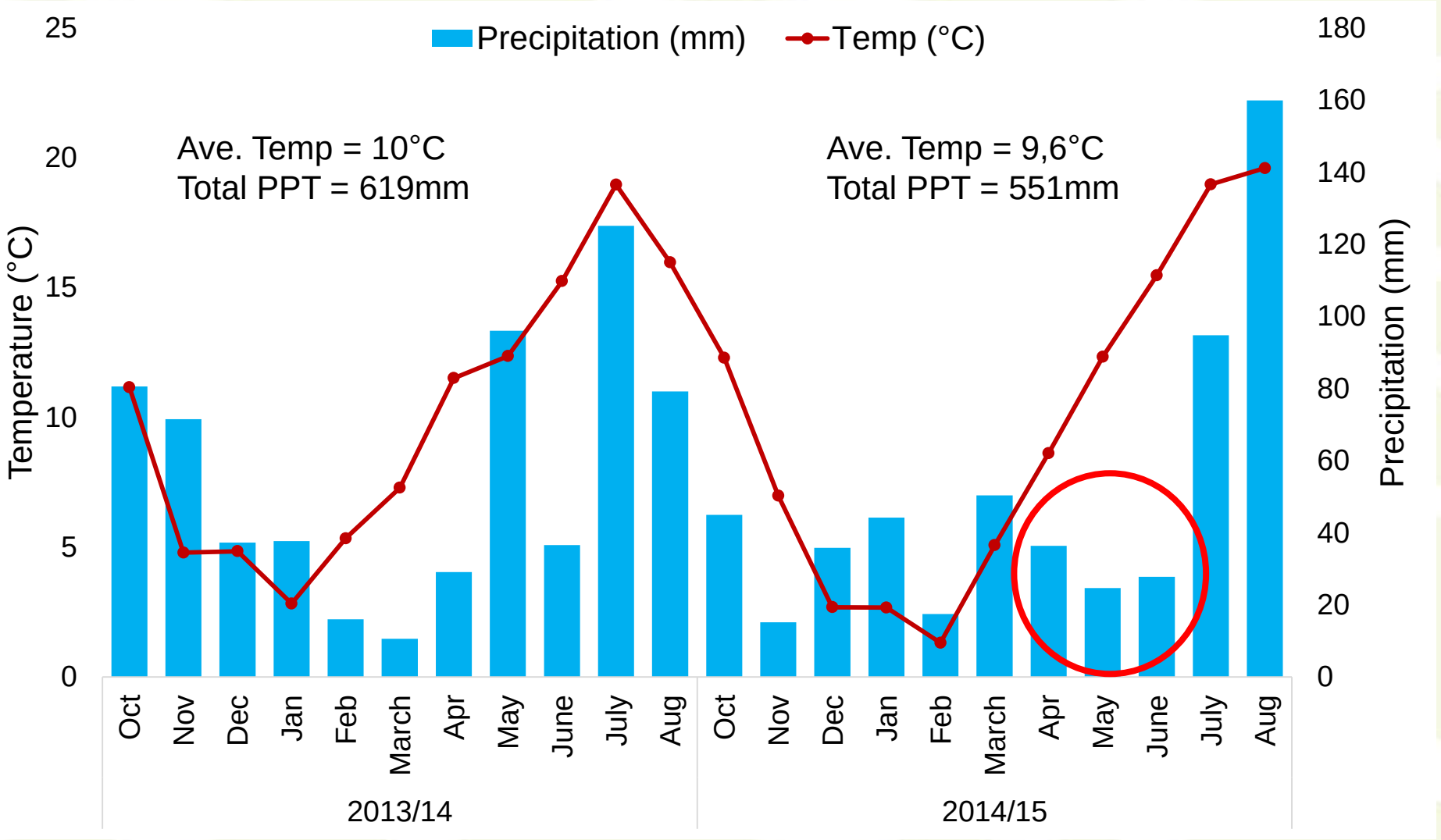
Weather



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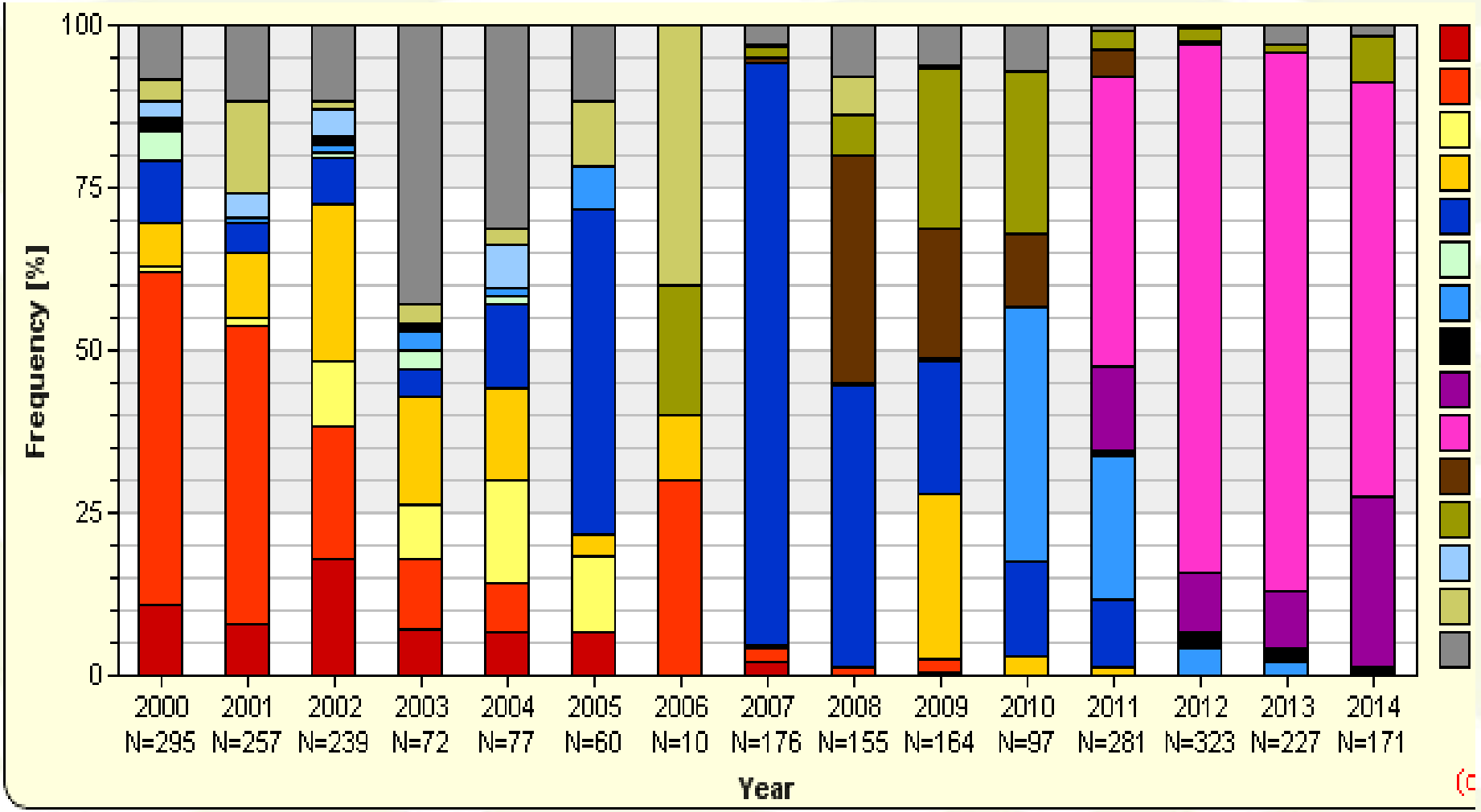
High incidence of a new stripe rust race since 2011



(www.rusttracker.org)

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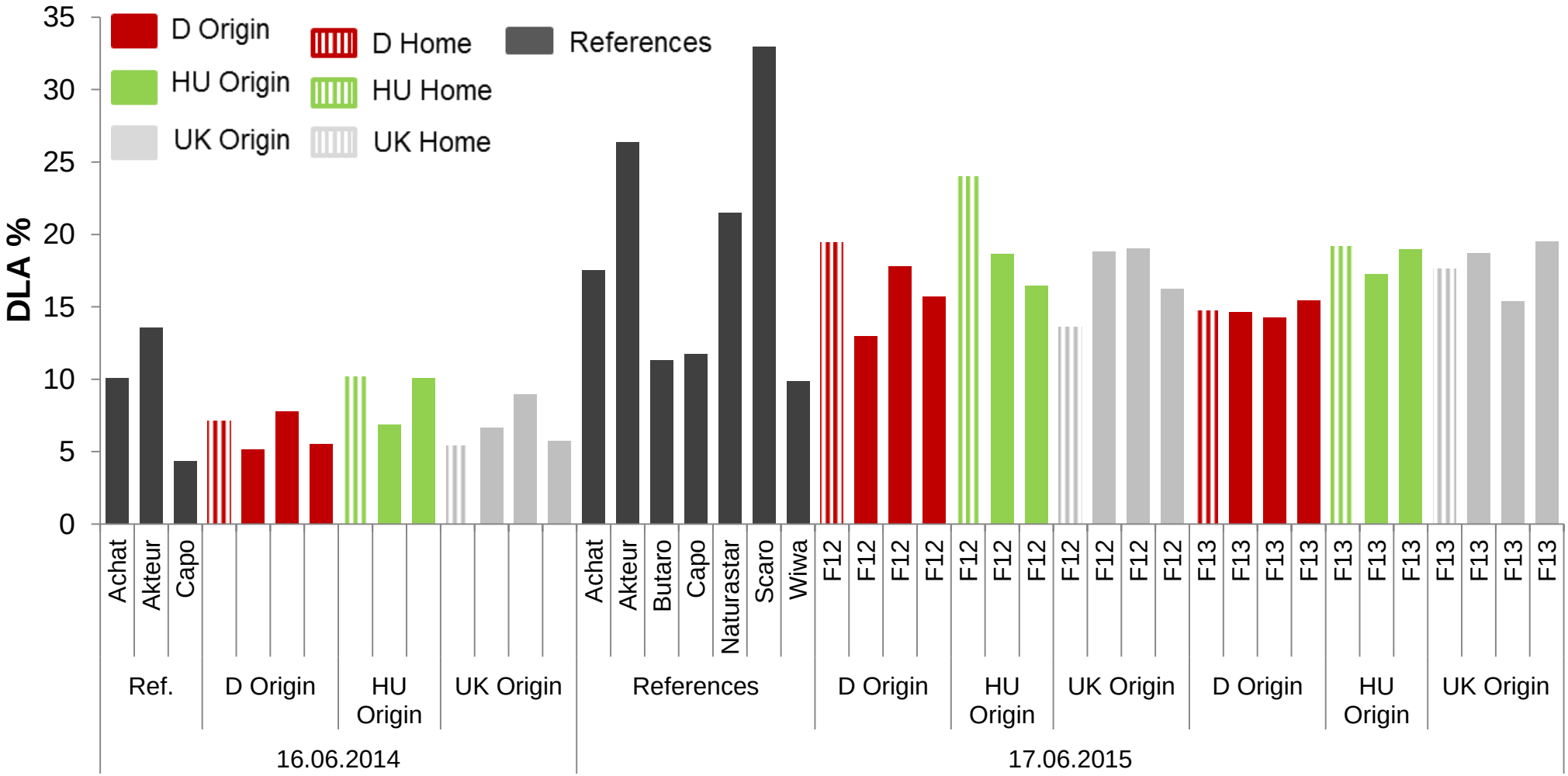

- Stronger epidemic in 2015
- Most populations were healthier than references
- No effect of TGW at sowing on disease

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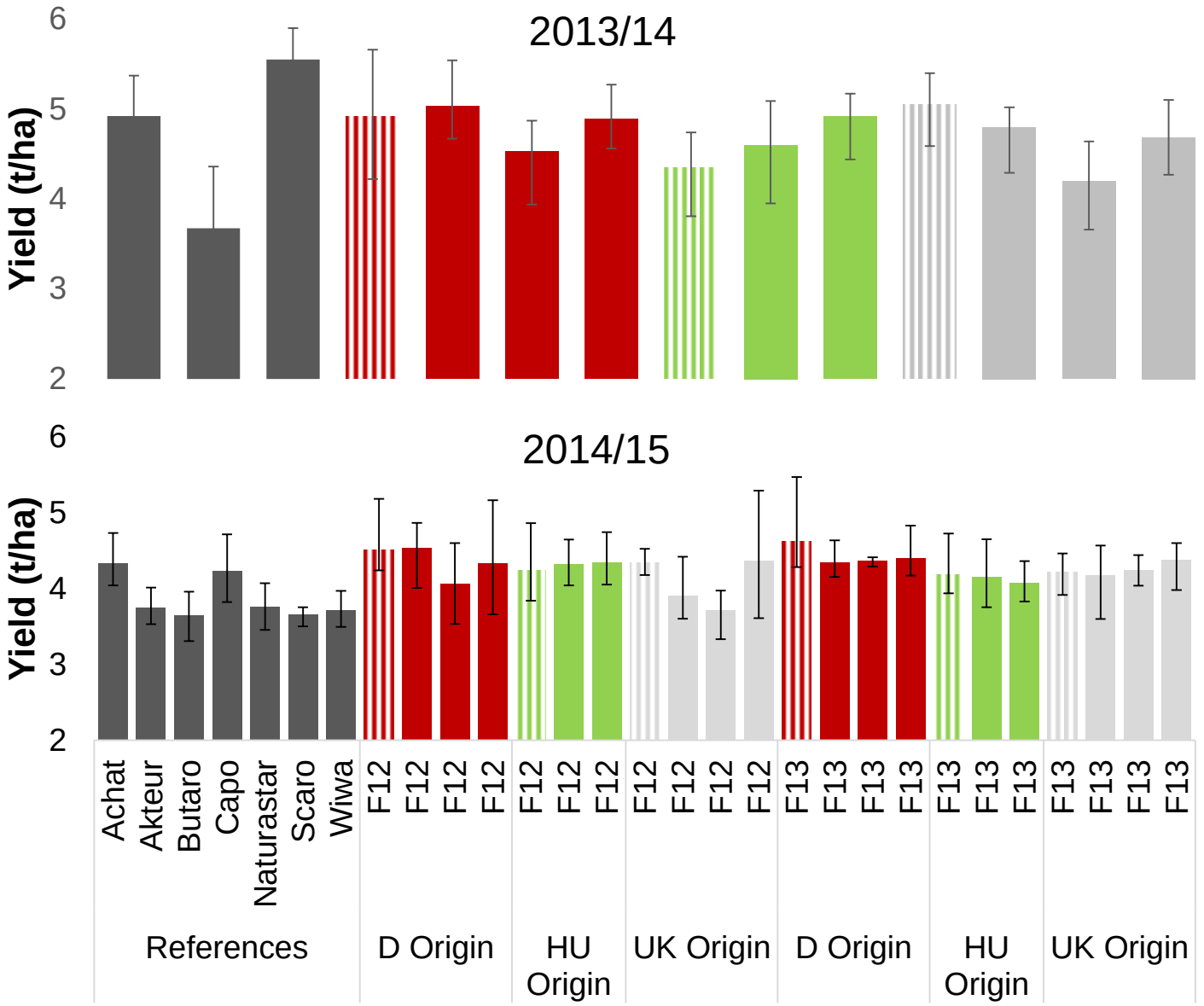

- Overall no effects of TGW on yield but less variation in F13?
- Drought in 2015 reduced yields
- Under drought stress CCPs outperformed varieties

Error bars indicate max. and min. values.

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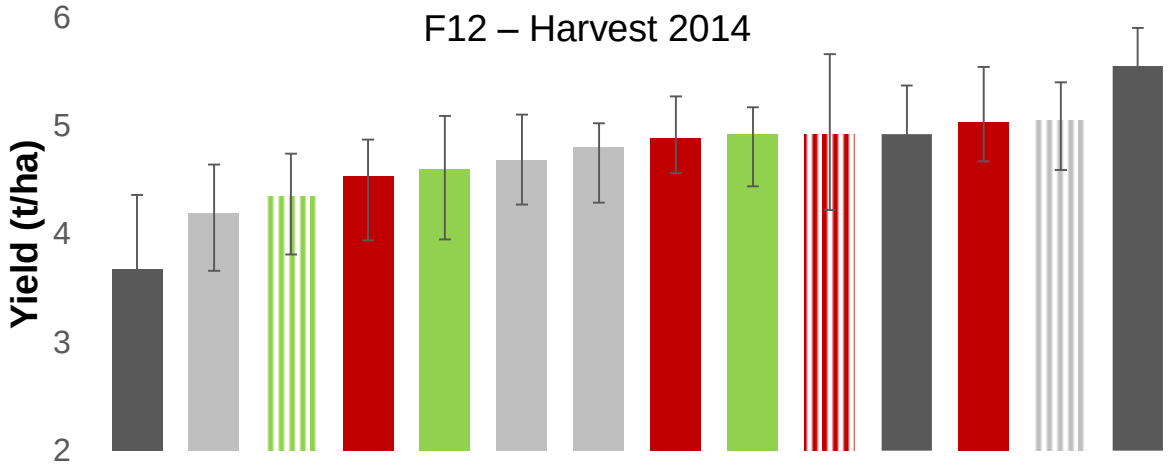
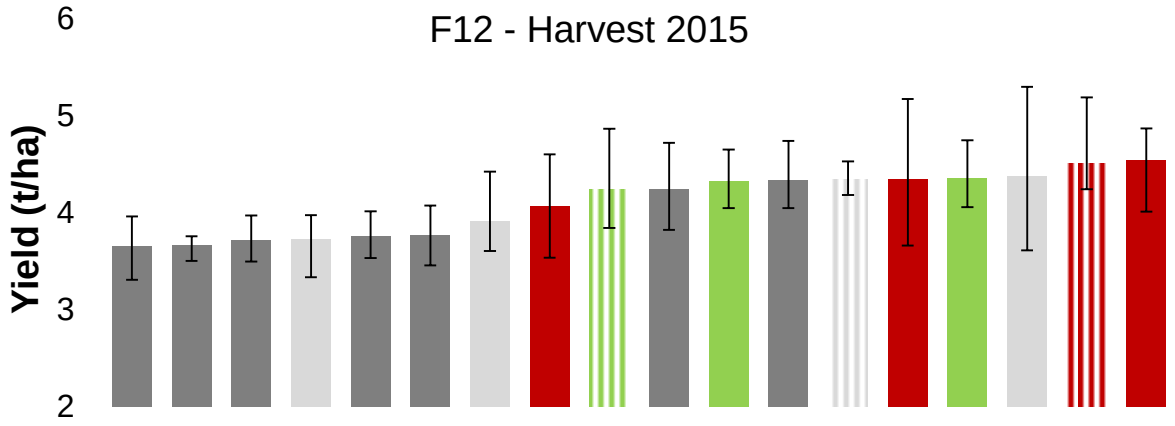
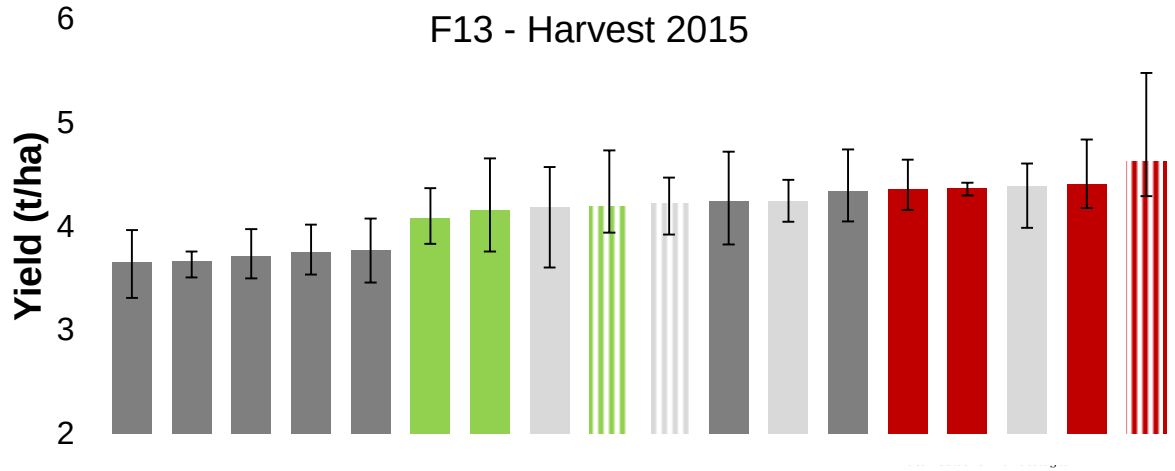




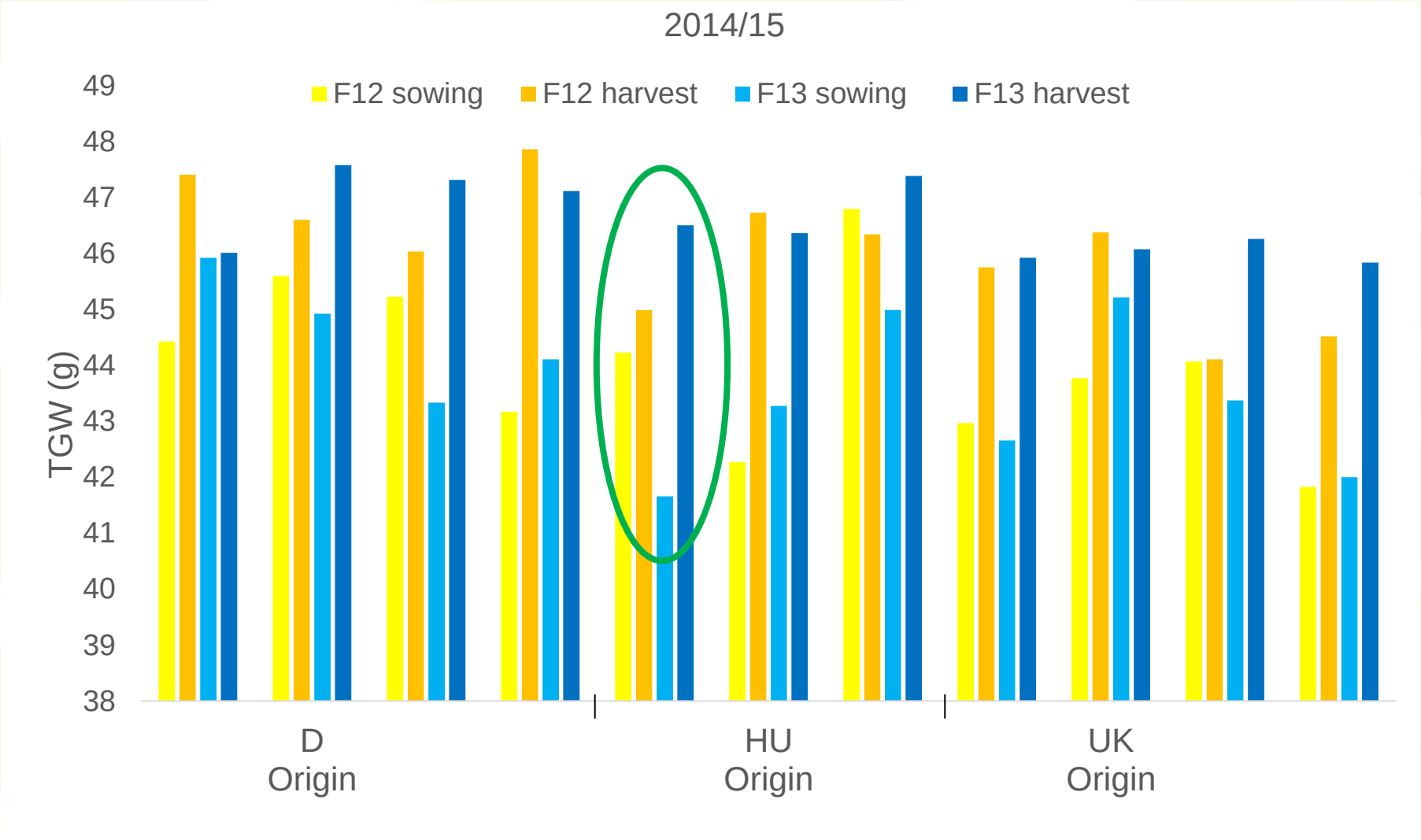


- Cycling populations did not have an advantage over the home populations
- In 2014/15 (F_{13}), dominance of German origin populations

➔ Adaptation advantage over other populations?

D Origin
HU Origin
UK Origin
D Home
HU Home
UK Home
References

Error bars indicate max. and min. values.



- In 2014/15 (F_{12}), still some significant differences of harvested TGW between some of the populations (not shown)
- In F_{13}, no longer significant differences of harvested TGW between populations after one year under the same management system
- F_{12} and F_{13} seeds from HU home pop started with different TGW, but ended similarly

Conclusions

- Populations highly resistant to new yellow rust race
- Populations outperformed references under drought stress
- TGW at sowing did not have any effect on yield and disease incidence
- Significant differences of harvested TGW between populations disappeared in F_{13} after 1 year under same management
- Heritability of seed size is considered to be low, but rather seed size variation tends to be a result of phenotypic plasticity, especially as the result of environmental variation
- Seed size variation is considered an adaptive capacity, but only if seed size equates to seed quality

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- Philip Schierning
- etc...

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And to all the cycling partners!

- FiBL, Switzerland
- Agrologica, Denmark
- INRA, France
- Hungarian Centre for Agricultural Research, Hungary
- Louis Bolk Institute, The Netherlands
- Technical University München, Germany
- Organic Research Centre, United Kingdom

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Thank you for your attention!

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1st experimental year 2013-2014

Origins	F_{12}	History	No. of cycling years
References	Achat		
	Akteur		
	Capo		
D Origin	Home	Since 2005	
	Home	Since 2005	
	Home	Since 2006	
	Cycling	D09-CH10-F11-UK12-DK13	4
	Cycling	D08-CH09-F10-DK11-TUM12-HU13	5
	Cycling	D08-CH09-F10-UK11-DK12-TUM13	5
HU Origin	Home	Since 2005	
	Cycling	HU09-NL10-D11-CH12-F13	4
	Cycling	HU08-NL09-D10-CH11-F12-UK13	5
UK Origin	Home	Since 2001	
	Cycling	UK08-TUM09-HU10-NL11-D12-CH13	5
	Cycling	UK08-DK09-TUM10-HU11-NL12-D13	5
	Cycling	UK09-DK10-TUM11-HU12-NL13	4

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