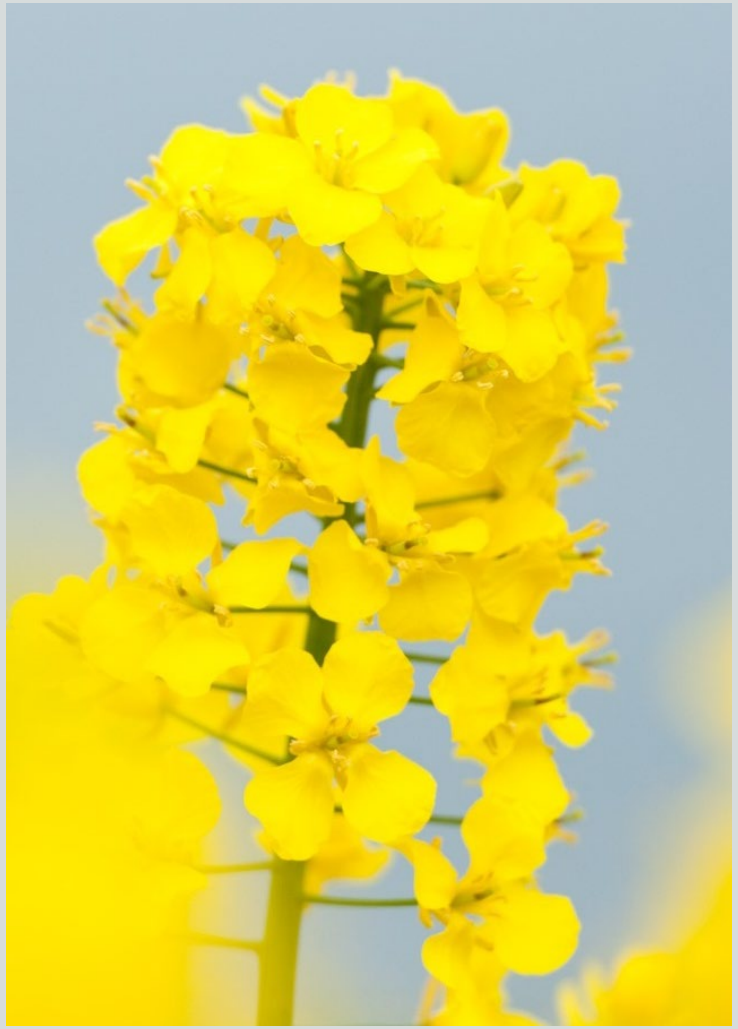


Norddeutsche Pflanzenzucht
Wir lassen Qualität wachsen.

IRC 2023 Sydney

Implementation of heterotic pools and genomic selection in a commercial winter oilseed rape program

C. Flachenecker, T. Kox, G. Leckband, R. Snowdon, M. Frisch, A. Abbadi

Hybrid Breeding – Heterotic Pools I

Corn:

"Today the concept of heterotic groups and patterns is fundamental to hybrid breeding theory and practice."

Reif, J.C., Hallauer, A.R. and Melchinger, A.E. (2005)

Wheat:

"Consequently, for an optimum exploitation of heterosis, parents should be derived from genetically divergent germplasm pools, commonly referred to as heterotic groups."
Dreissigacker, S., Melchinger A.E. et al. (2005)

Triticale:

"Heterotic groups are an essential prerequisite for efficient hybrid breeding"
Fischer, S.; Melchinger A.E. et al. (2010)

Summarized:

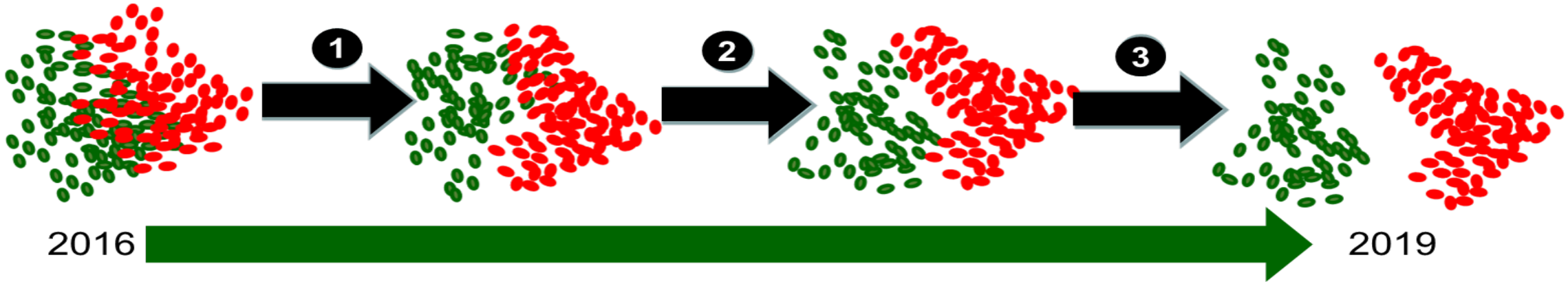
"Heterotic groups and patterns are of fundamental importance in hybrid breeding."

Melchinger, A.E. and Gumber, R.K. (1998)

Heterotic Pools in Rapeseed

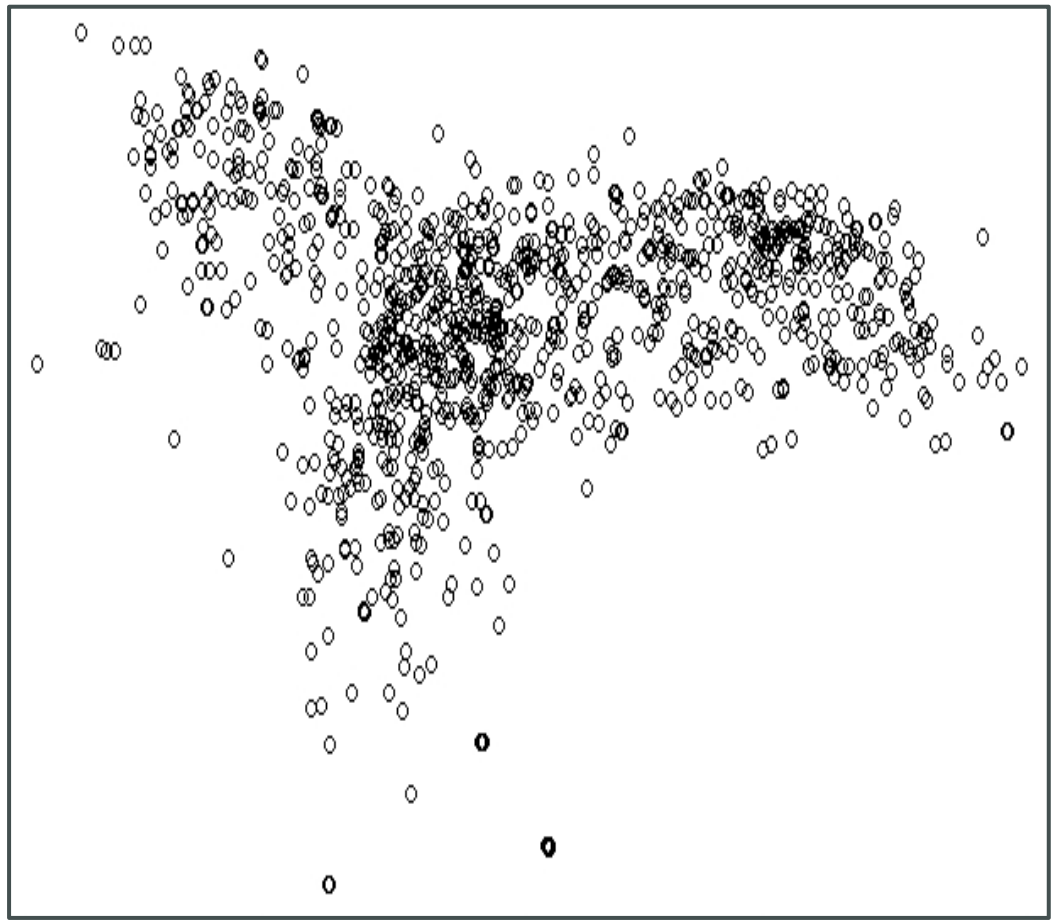
BreedPatH

Develop a **Fast-Track genomic based crossing scheme** for separation of genetic pools and conservation of combining ability in each pool: **3 cycles of simulation and crossing,** starting with two sets of 50 elite winter oilseed rape breeding lines

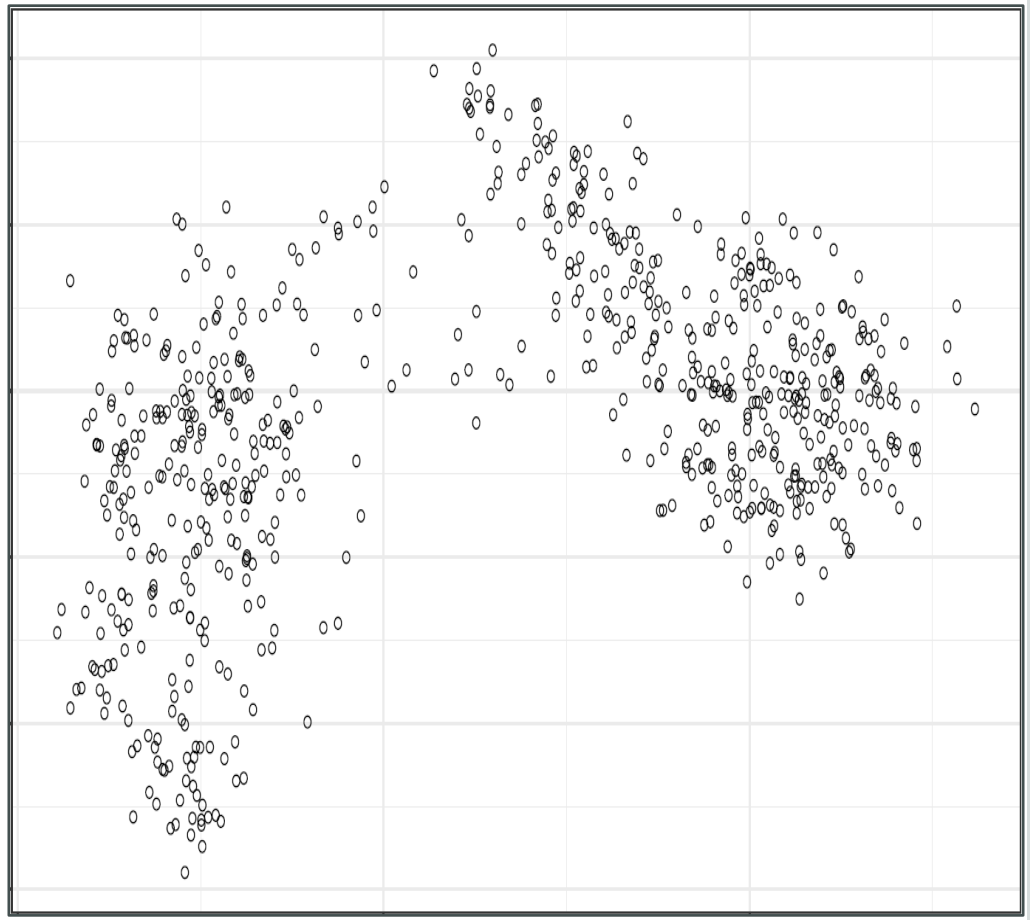


Hybrid Breeding – Dinstinction in NPZ breeding material

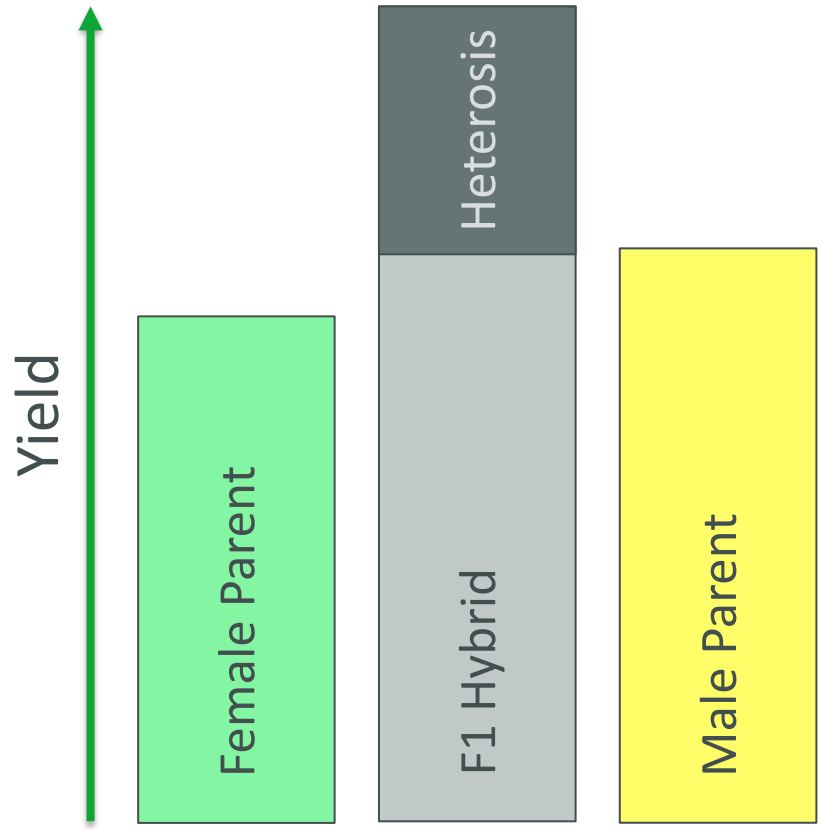
Yesterday



Today



Hybrid Breeding - Heterosis



Hybrid varieties outperform their inbred progenitors in most field crops => Heterosis in yield:

- Corn: 222%
- Sunflower: 135%

} Cross pollination

- Wheat: 9%
- Barley: 8%

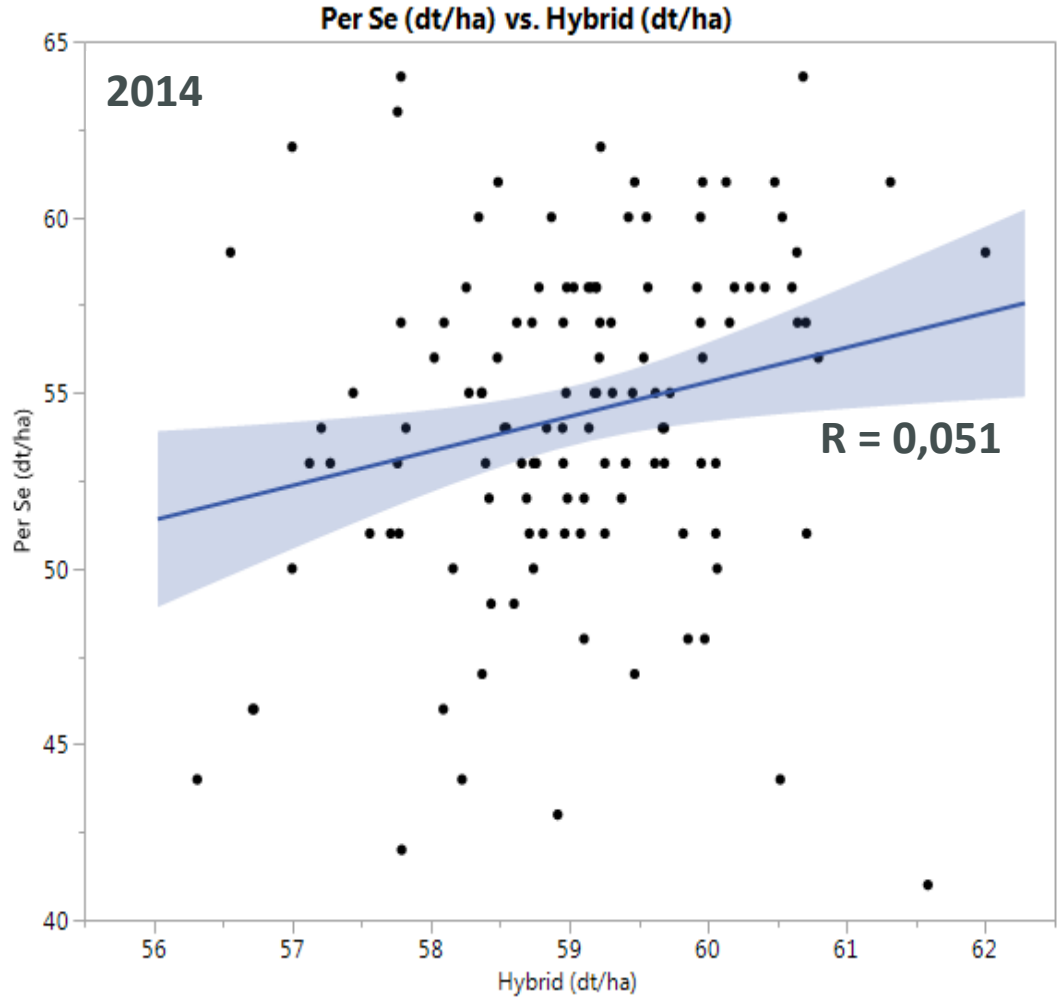
} Self pollination

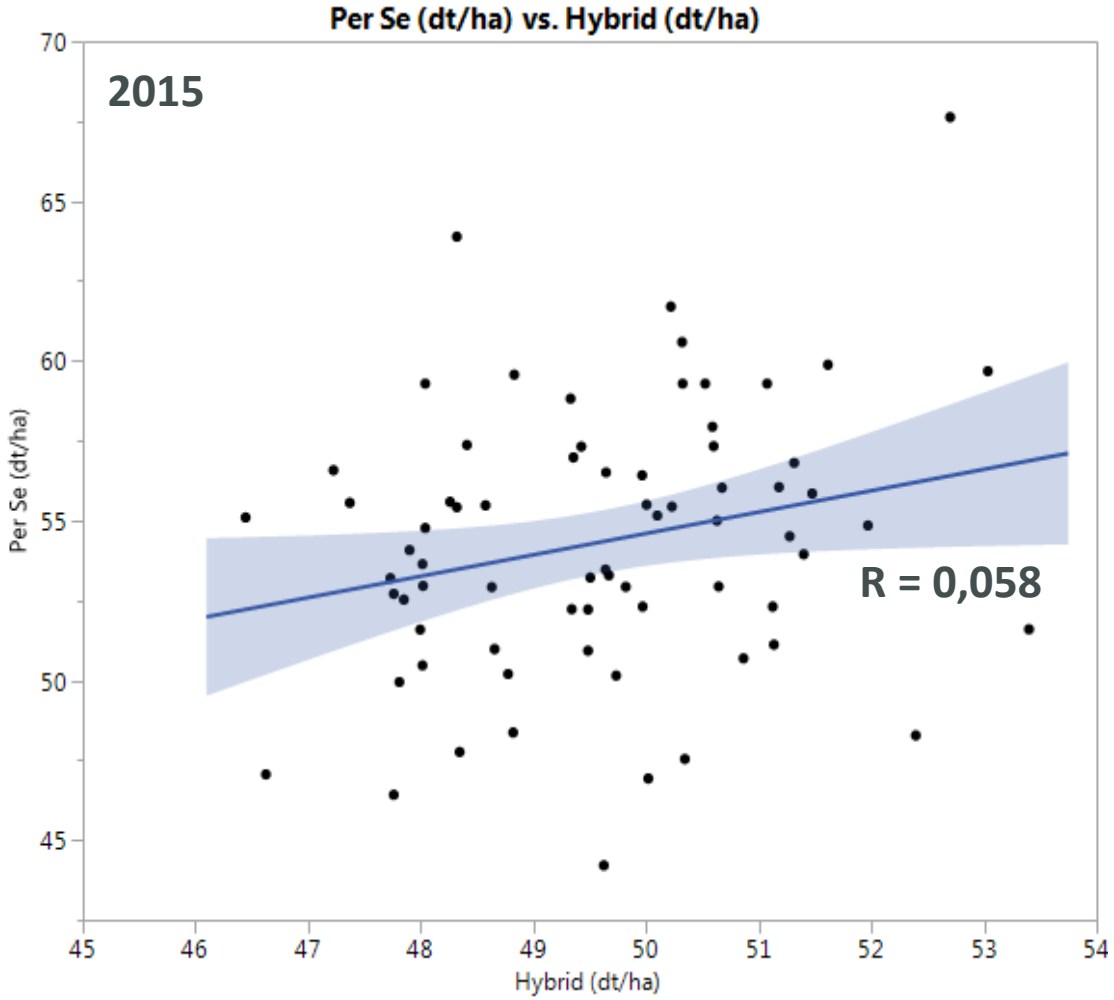
- **Oilseed rape: 45%**

20-30% cross pollination
= „partial allogamous“

Exact source in Becker – Pflanzenzüchtung (2011)

Inbred vs. Hybrid Yield



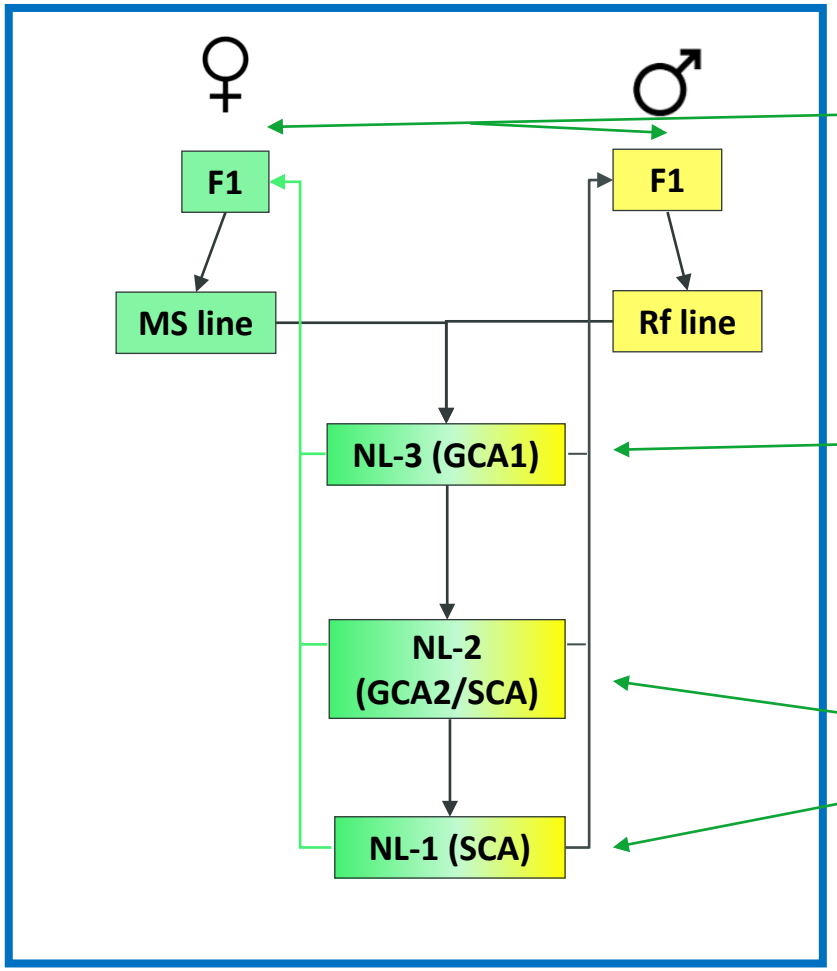


Inbred vs. Hybrid Yield

=> Replace per se performance test by testcross performance test

Hybrid Breeding - Challenges

Implementation of Genomic Selection

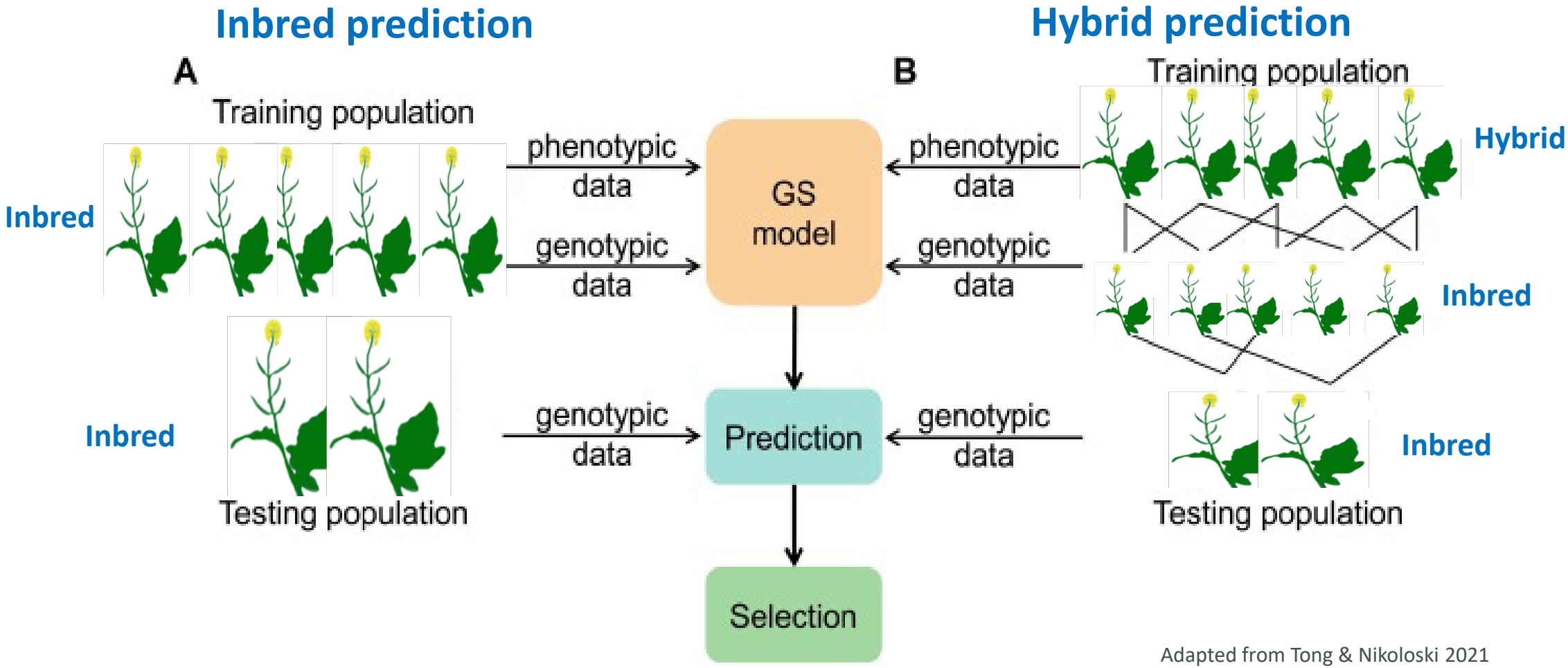


(1) Select breeding start parents with GS

(2) Replace (partially) GCA1 by GS

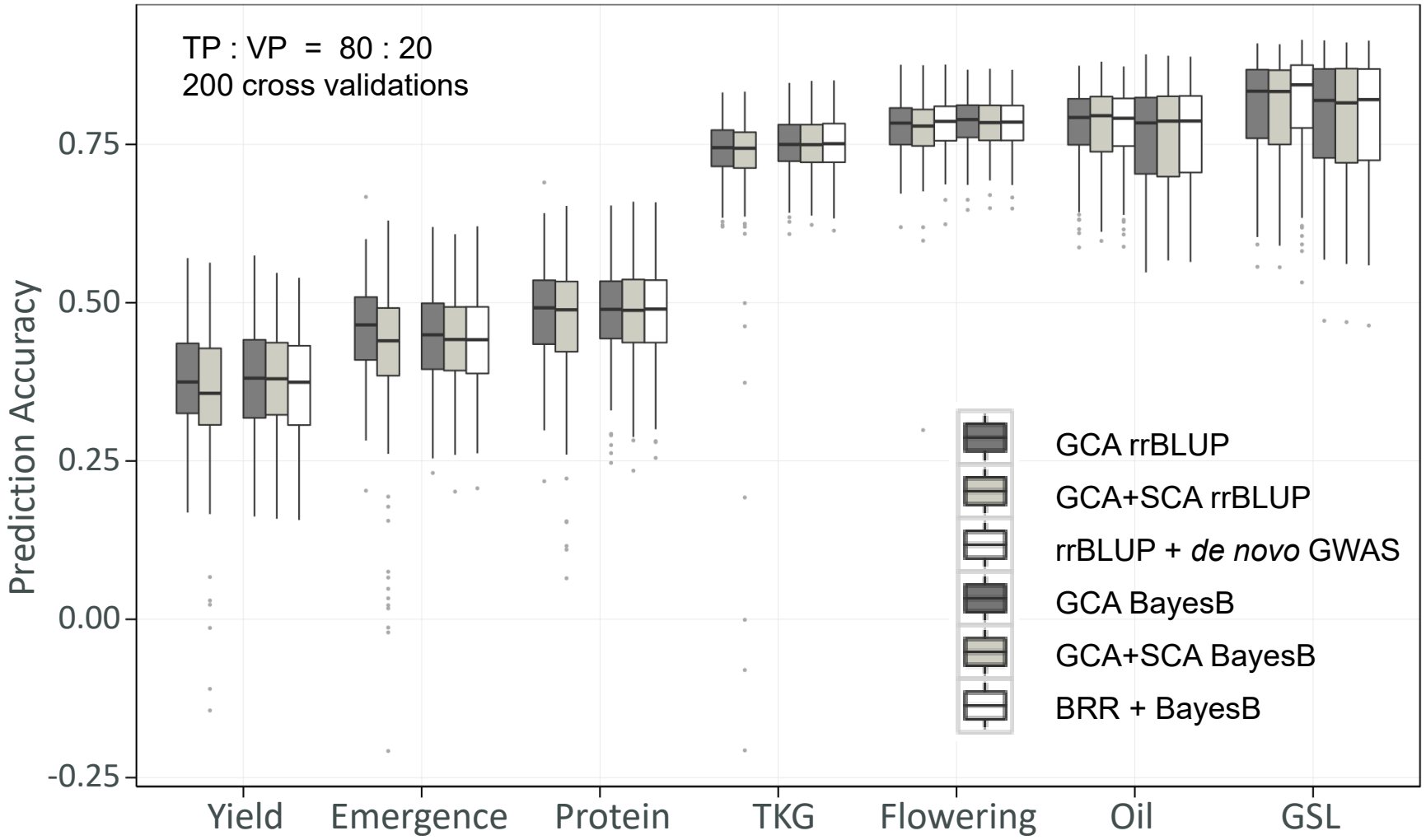
(3) Select with GS best hybrid combinations for testing (SCA)

Genomic prediction



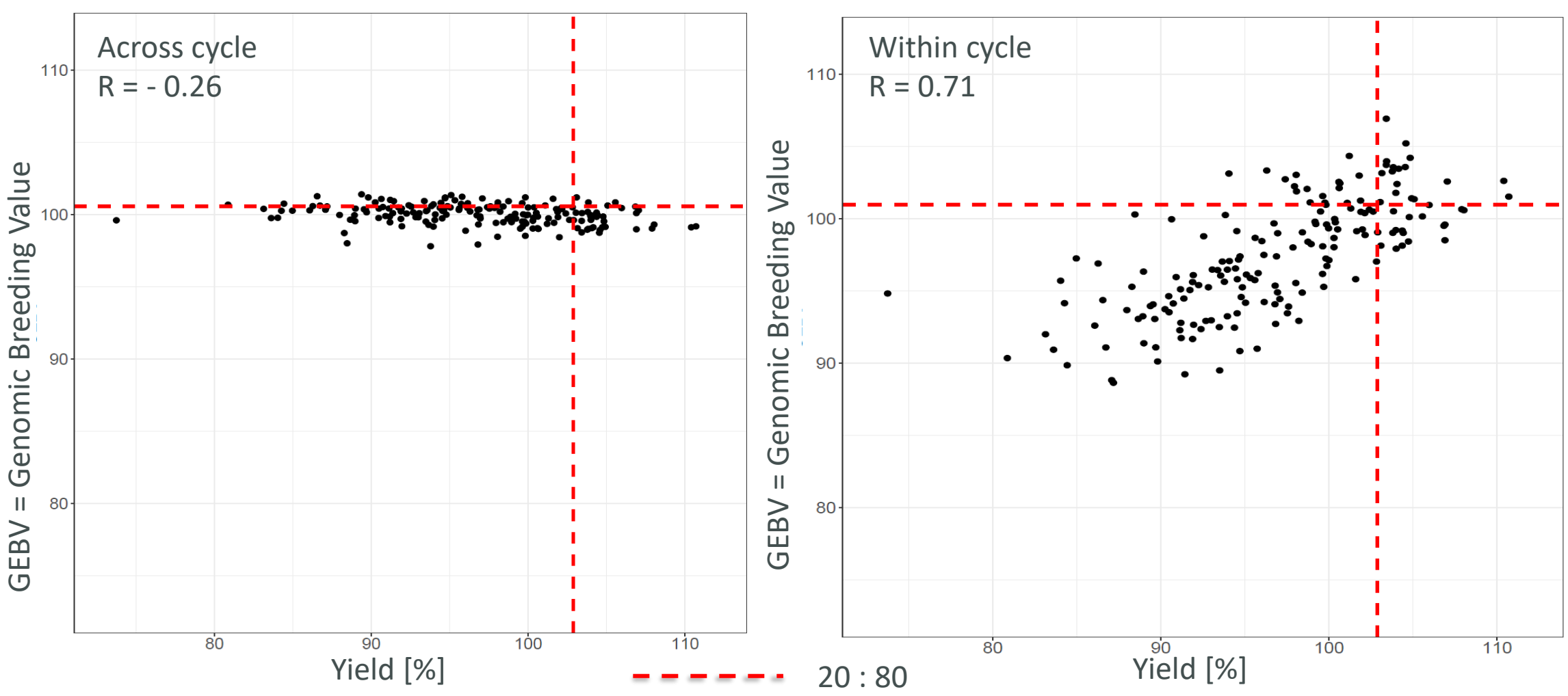
Adapted from Tong & Nikoloski 2021

Genomic prediction accuracy in WOSR

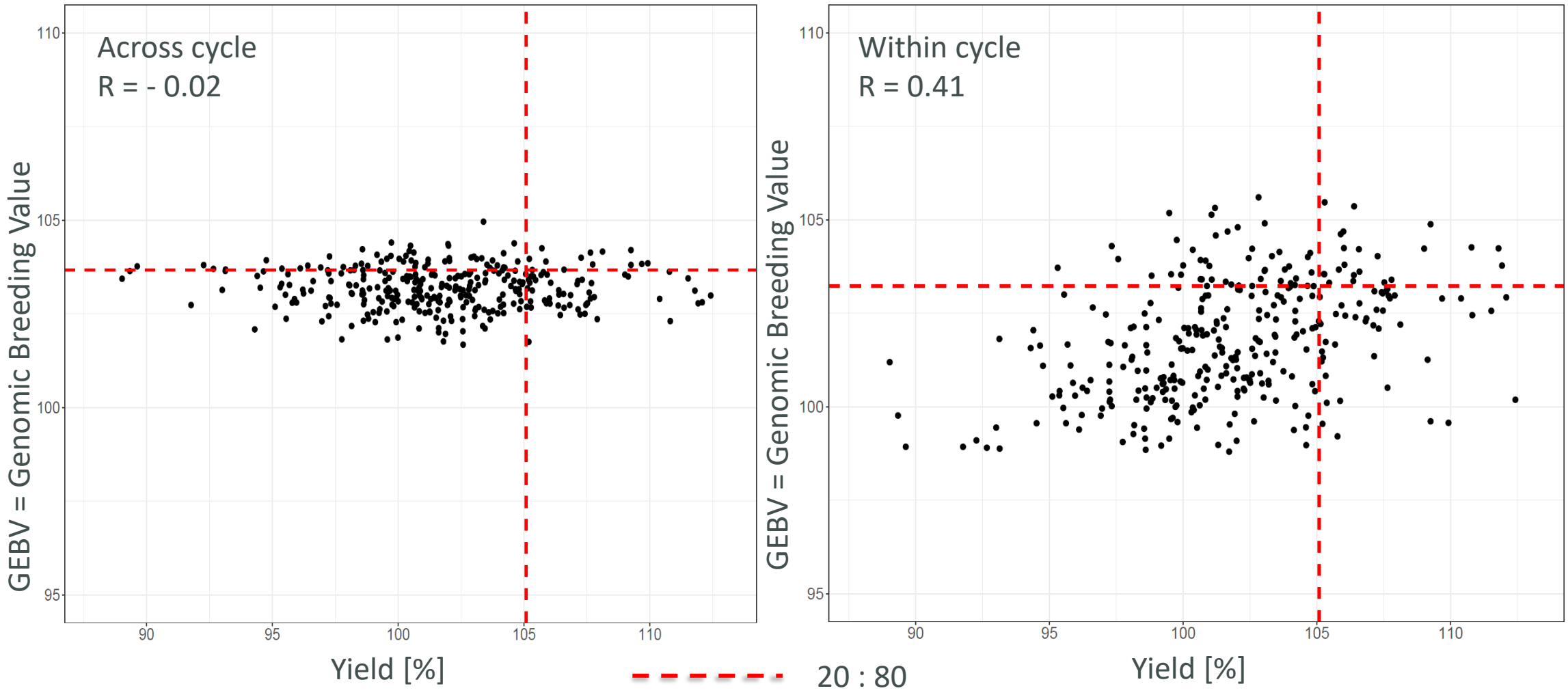


Werner, C.R., Qian, L., Voss-Fels, K.P. *et al.* Genome-wide regression models considering general and specific combining ability predict hybrid performance in oilseed rape with similar accuracy regardless of trait architecture. *Theor Appl Genet* **131**, 299–317 (2018)

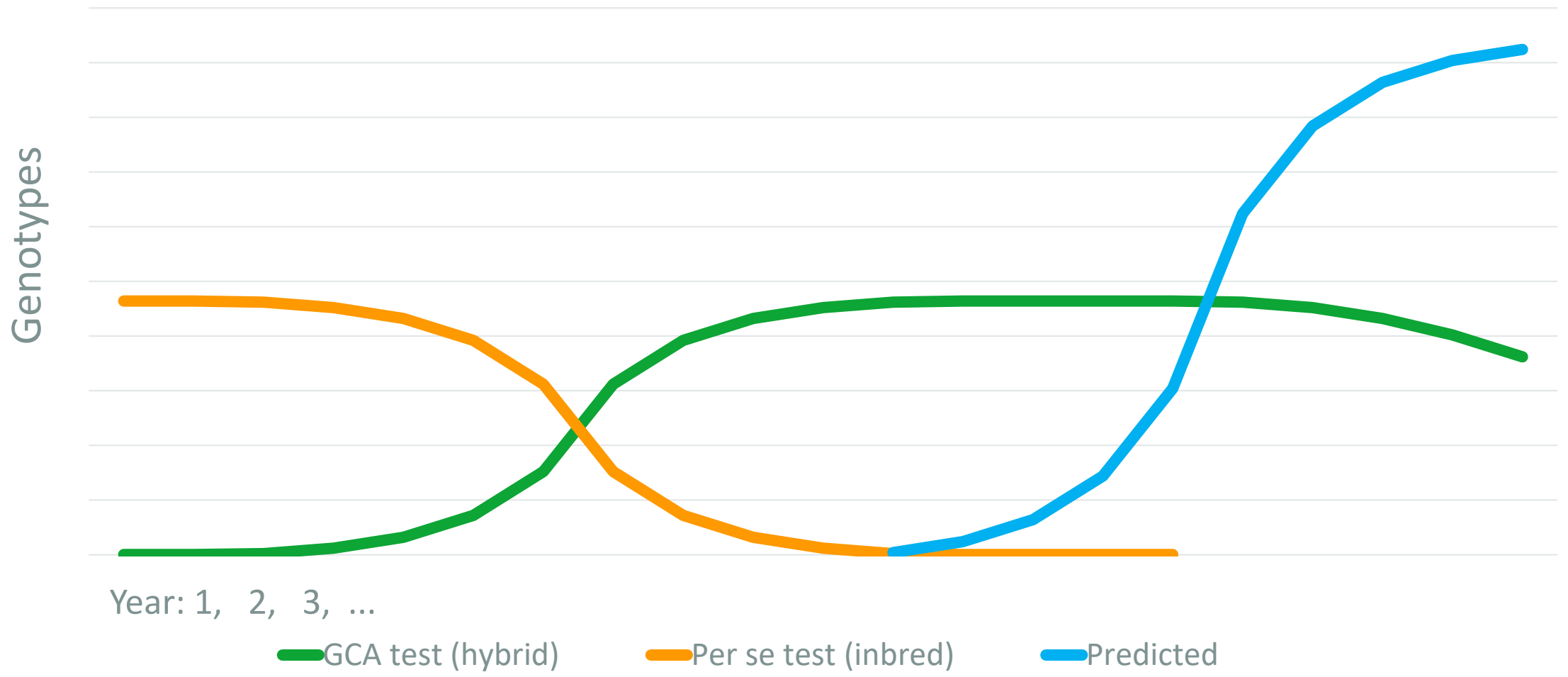
Prediction accuracy in a commercial WOSR program 2020



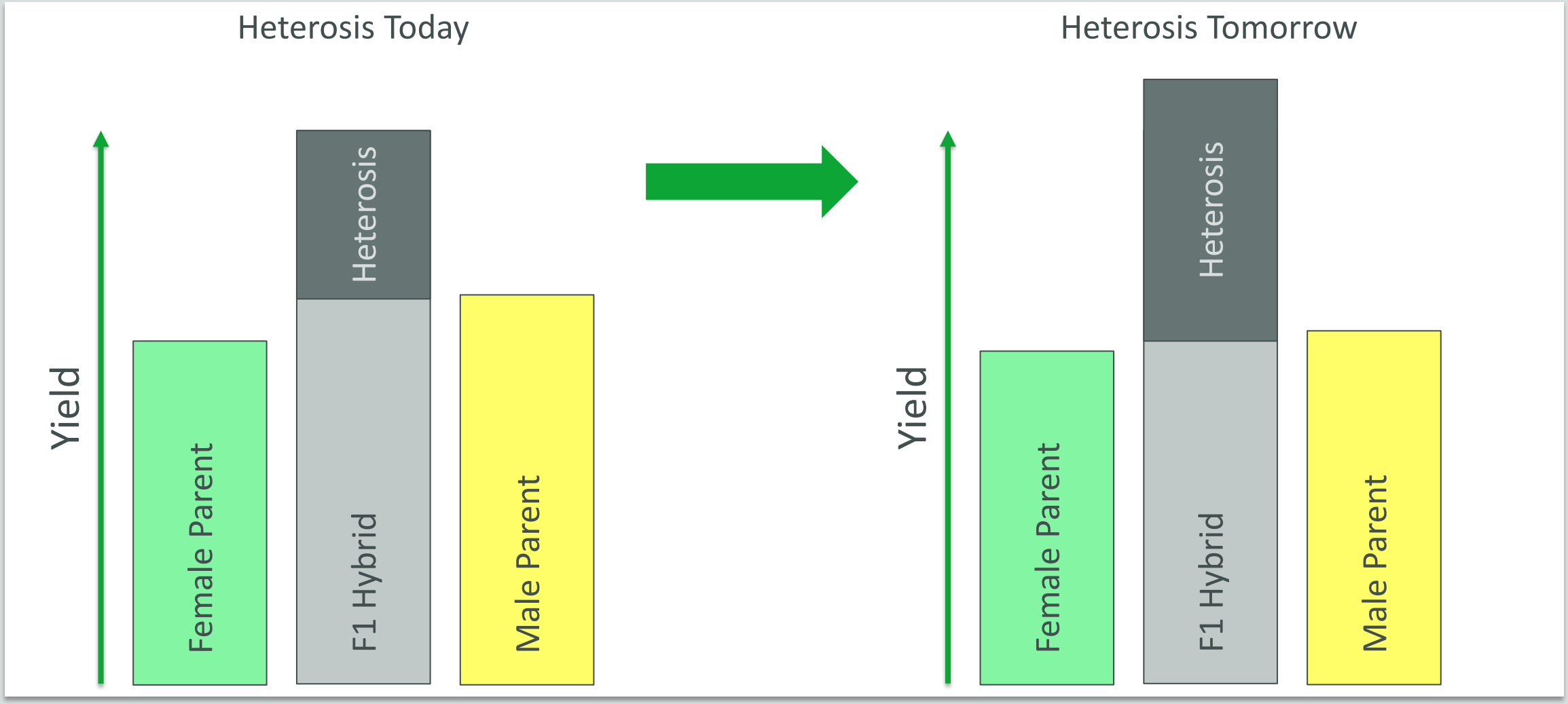
Prediction accuracy in a commercial WOSR program 2021



Summary I


Genotypes
Year: 1, 2, 3, ...
GCA test (hybrid)
Per se test (inbred)
Predicted

Summary II


Heterosis Today
Yield
Female Parent
F1 Hybrid
Heterosis
Male Parent
Heterosis Tomorrow
Yield
Female Parent
F1 Hybrid
Heterosis
Male Parent

Questions?