

Genomics-based exploitation of wheat genetic resources for plant breeding GeneBank2.0

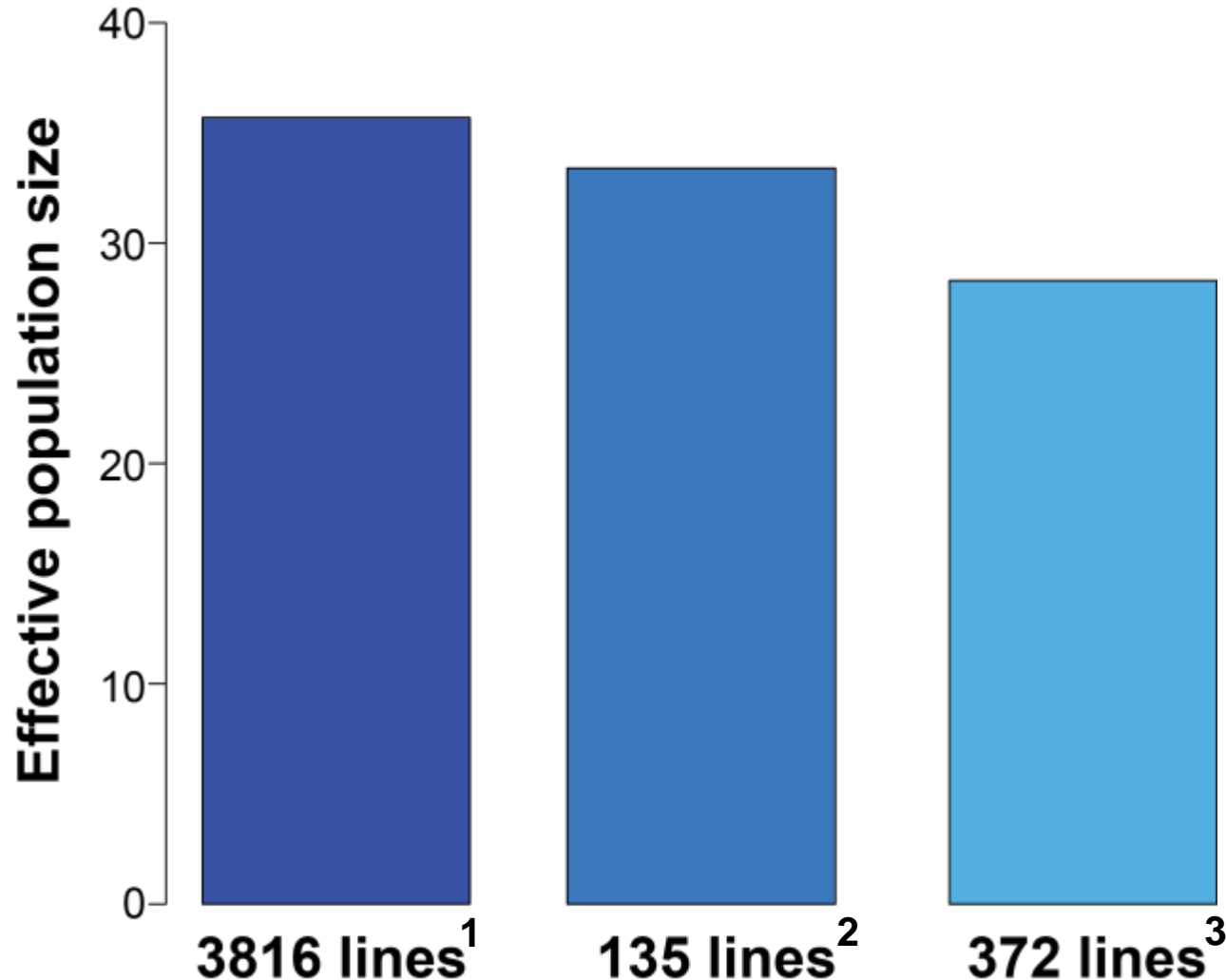
Jochen C. Reif



proWeizen



Effective size of the European elite wheat breeding population

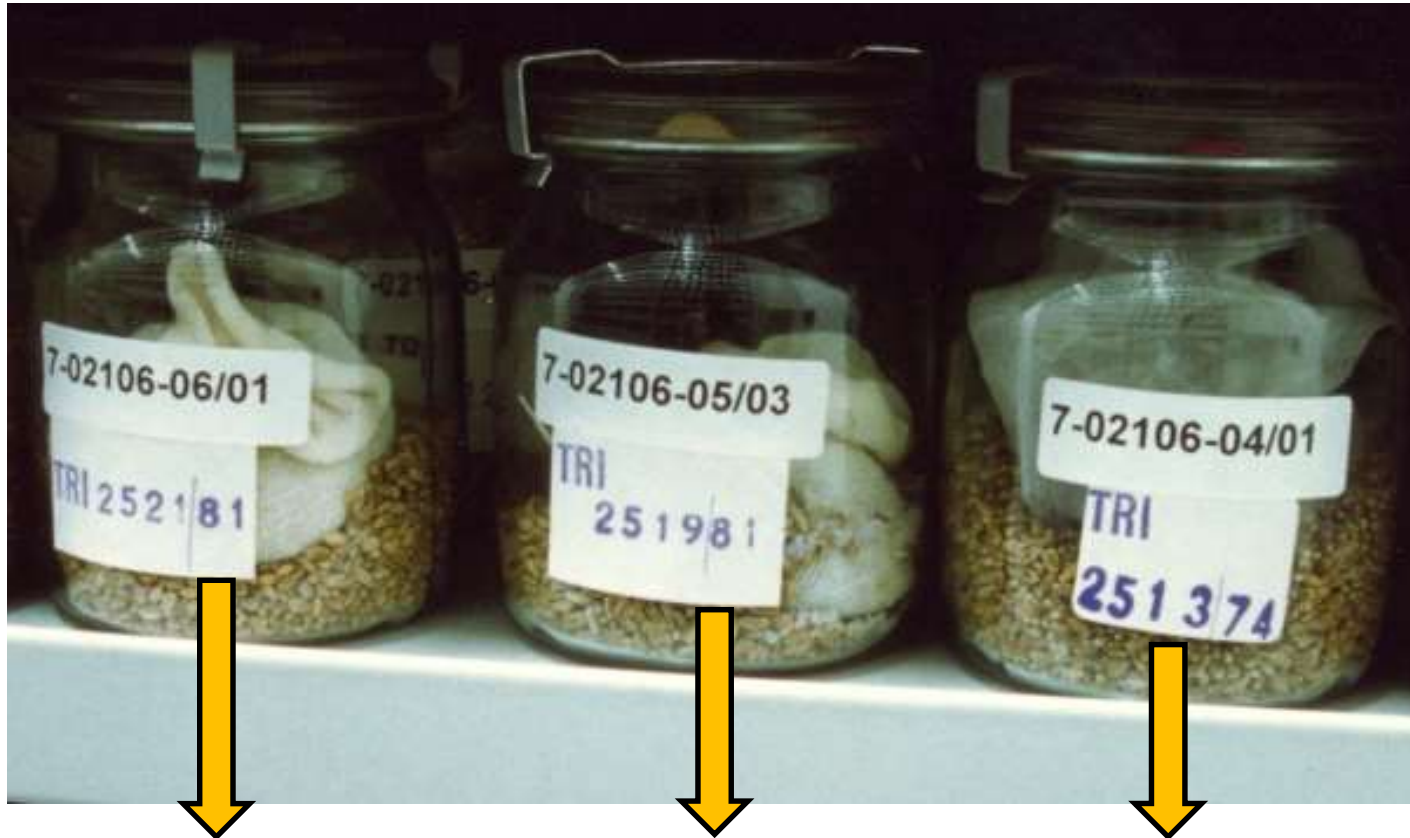


¹He et al. 2016. TAG 129:641-651

²Zhao et al. 2015. PNAS 112:15624-15629

³Jiang et al. 2015. Heredity 114:318-326

Genebank2.0: Leverage the IPK collection to an actively deployed one in breeding and research

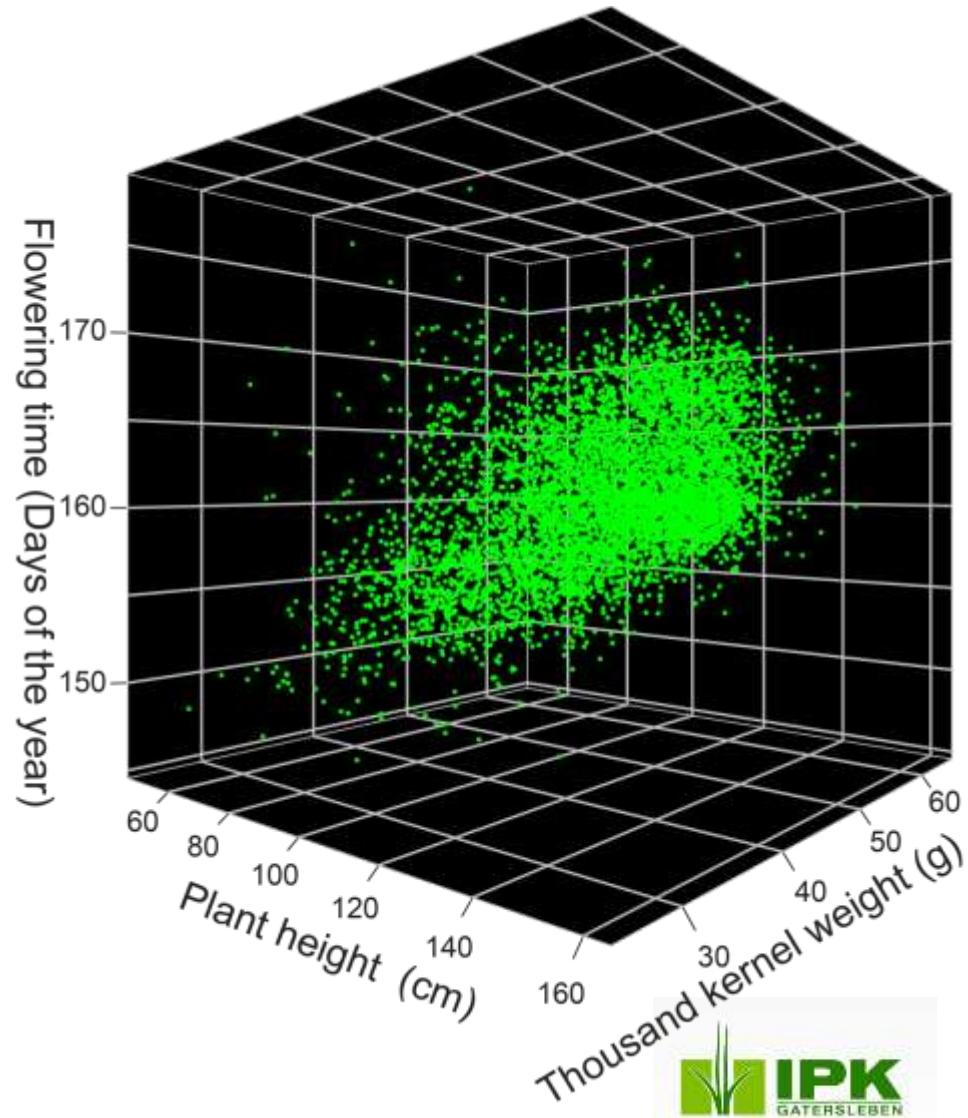
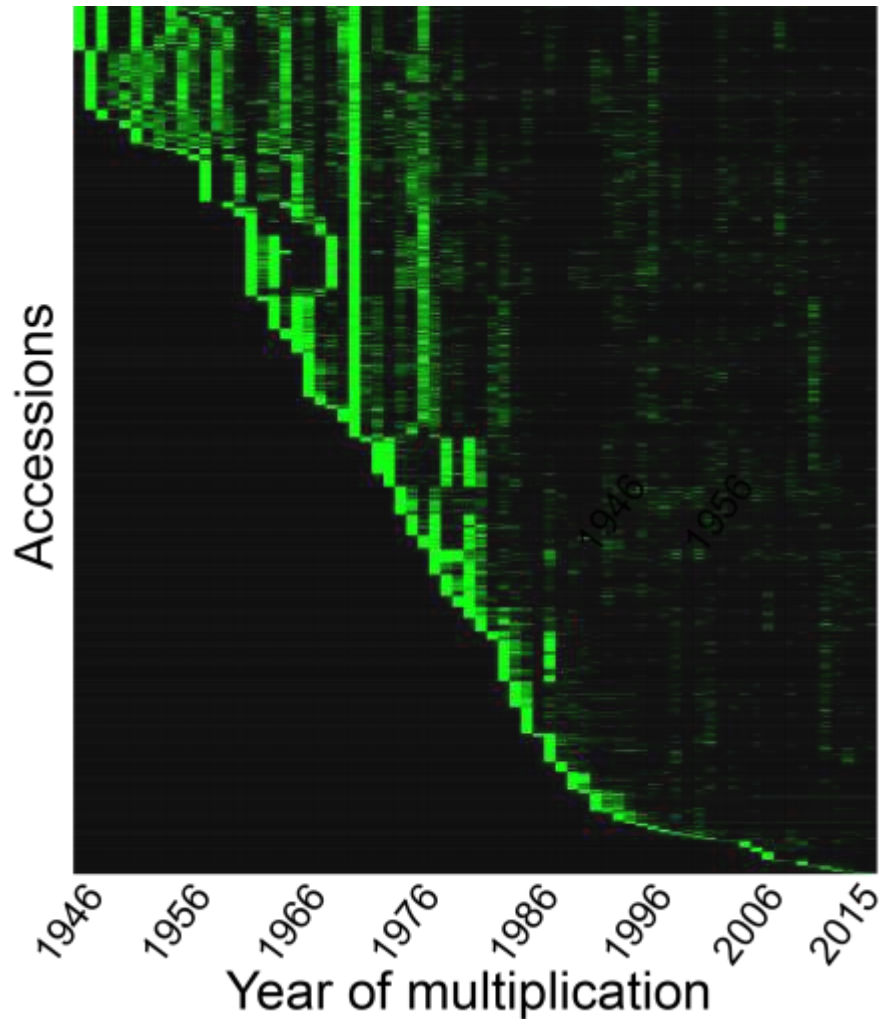


-High breeding value for yield
- Carries the *Lr70* gene

-Haplotype for NRT1.1B gene boosting nitrogen use efficiency

-High anther extrusion => excellent male for F₁ breeding

Status quo of the evaluation of the wheat collection



Breeding targets wheat in Germany

1. Yield and yield stability

- **Grain yield**
- **NUE**
- Winter hardiness
- Lodging resistance
- Plant density
- Number of grains per ear

2. Hybridisation systems

- **Pollination capability**
- Restorer genes

3. Disease resistance

- Septoria tritici blotch
- Fusarium head blight
- **Stripe rust**
- Tan spot
- Eyespot
- Take-all
- **Powdery mildew**
- **Leaf rust**
- Septoria nodorum
- Soil-borne mosaic virus

4. Quality

- Ash content
- Flour yield
- Endosperm texture
- Protein content
- Zeleny sedimentation
- Hagberg falling number
- Water absorption
- Dough quality
- Baking volume

GeneBank2.0



WP 7. Project coordination
IPK-QG

WP 1. Access + genotyping
IPK-GGR, KWS, IPK-QG

WP 2. Biotic stress
JKI, IPK-PSG, KWS, LG

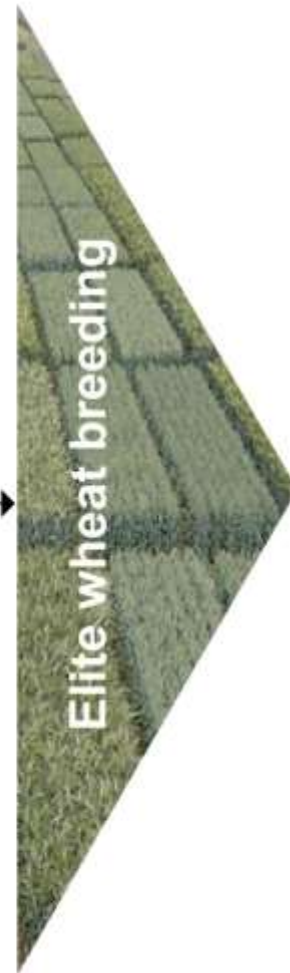
WP 6. Biodiversity informatics
IPK-QG, IPK-BIT, IPK-DG

WP 4. N use efficiency
IPK-MPE, KWS, LG

WP 3. Novel trait discovery
IPK-GGK, KWS, LG

WP 5. Prebreeding
KWS, LG, UHOH, JKI, IPK-QG

Elite wheat breeding



WP-1: Access and genotyping



Goal: Make the entire collection accessible and fingerprint each accession

1th year: Single seed descent

Genotyping by sequencing and resistance gene enrichment sequencing

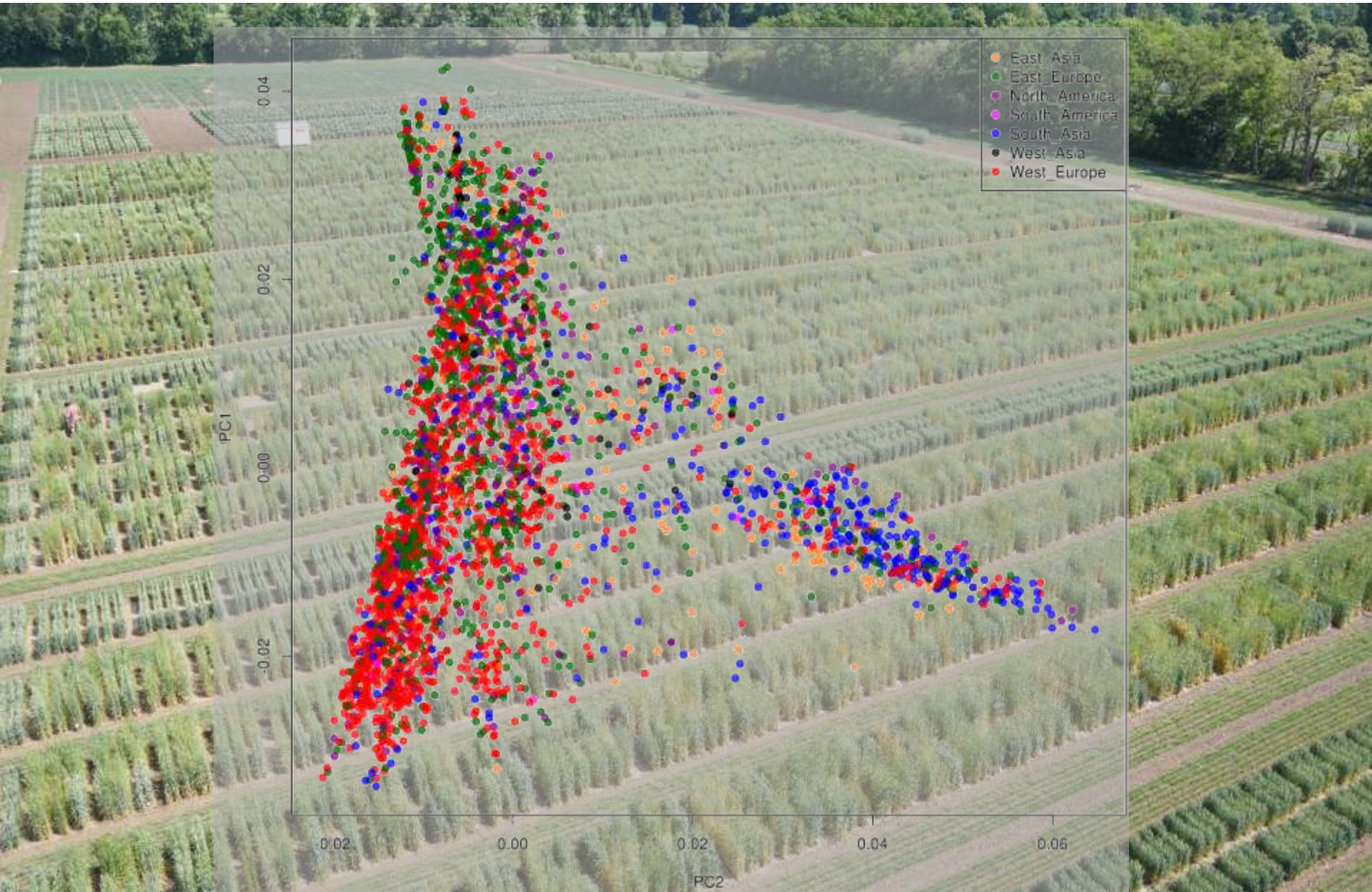
2nd year: Seed multiplication in 0.4 m² plots

WP-2, WP-3, WP-4, WP-5

3rd year: Seed multiplication in 5 m² plots

WP-2, WP-4

Genotyping-by-sequencing

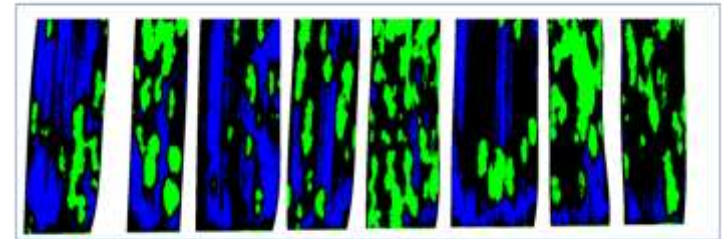


WP-2: Biotic stress

Goal: Characterize the collection for resistance against leaf- and stripe rust and powdery mildew



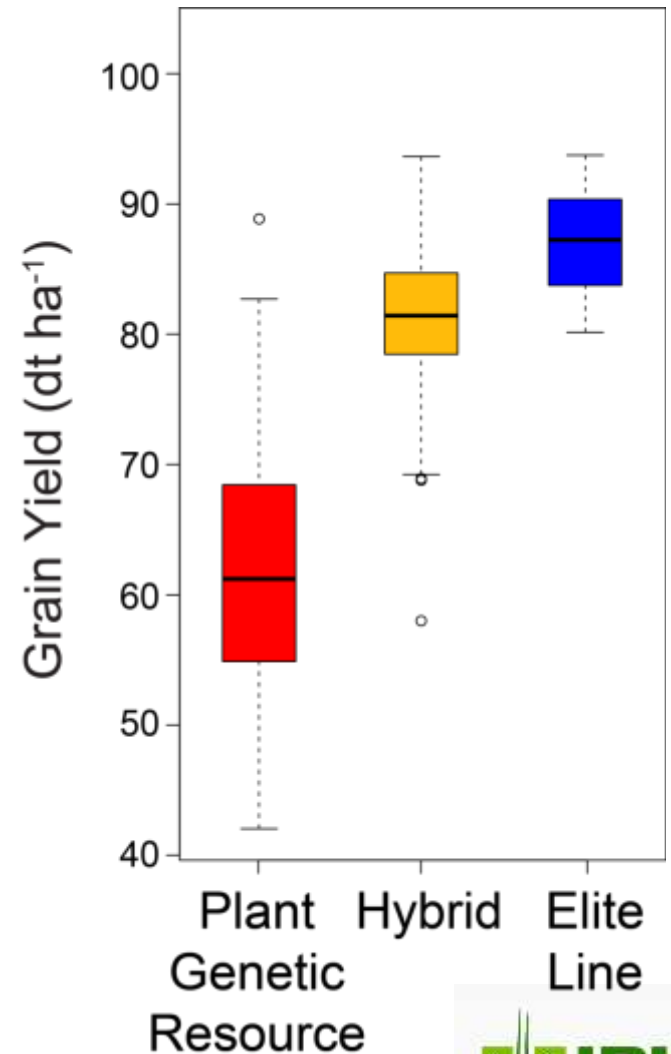
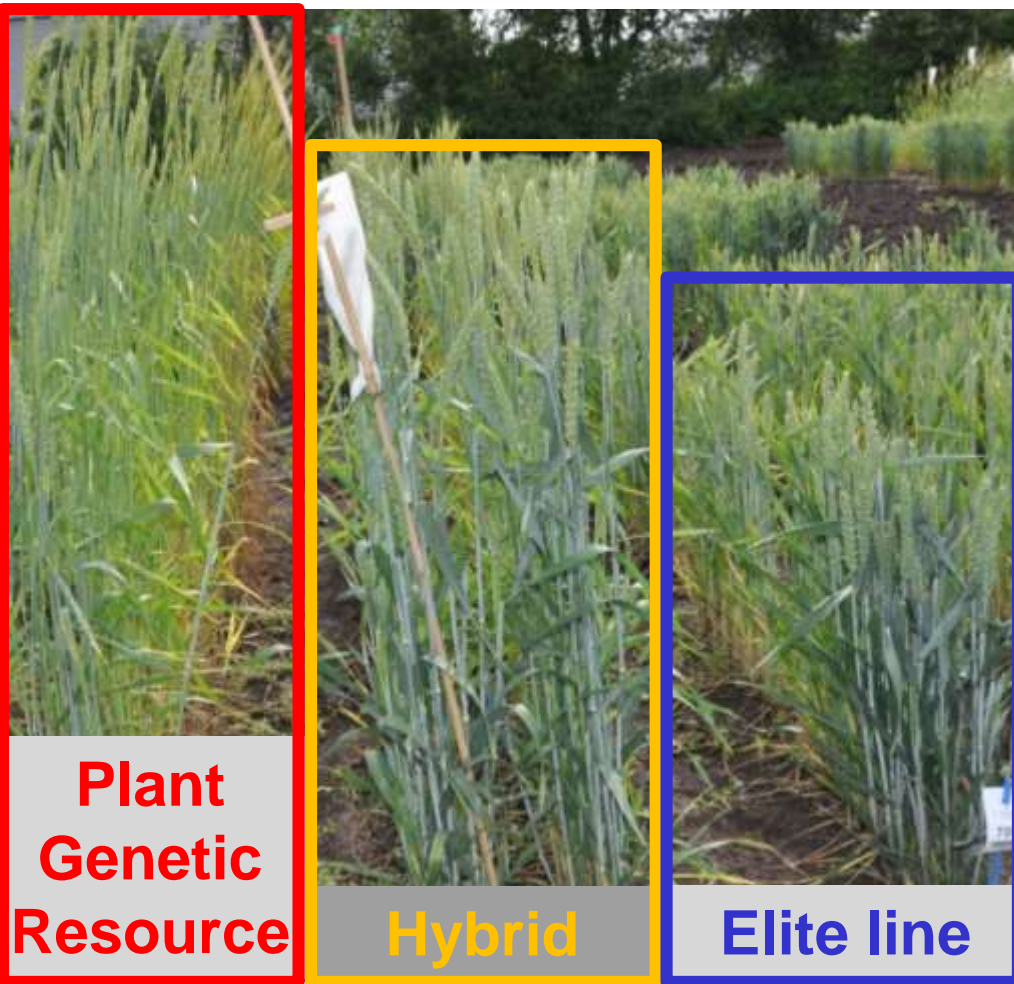
Computer aided disease symptoms rating of infected detached leaves



12.71 30.32 4.64 18.54 38.49 9.78 34.60 20.68

Percent infected area

Hybrid wheat strategy to estimate the grain yield potential

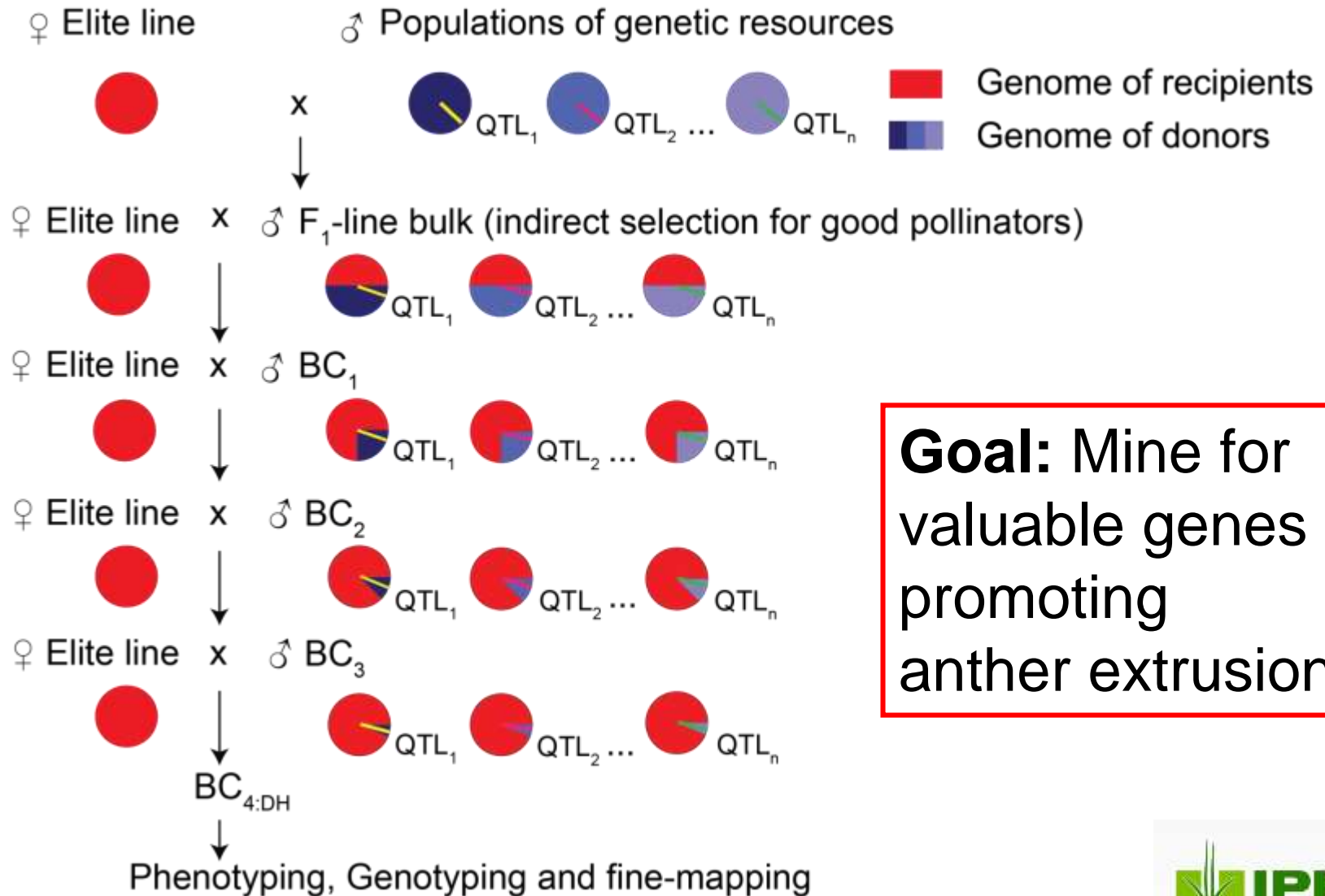


WP-3: Novel trait discovery

Screening for excellent pollinators



WP-3: Novel trait discovery



WP-3: Select and backcross

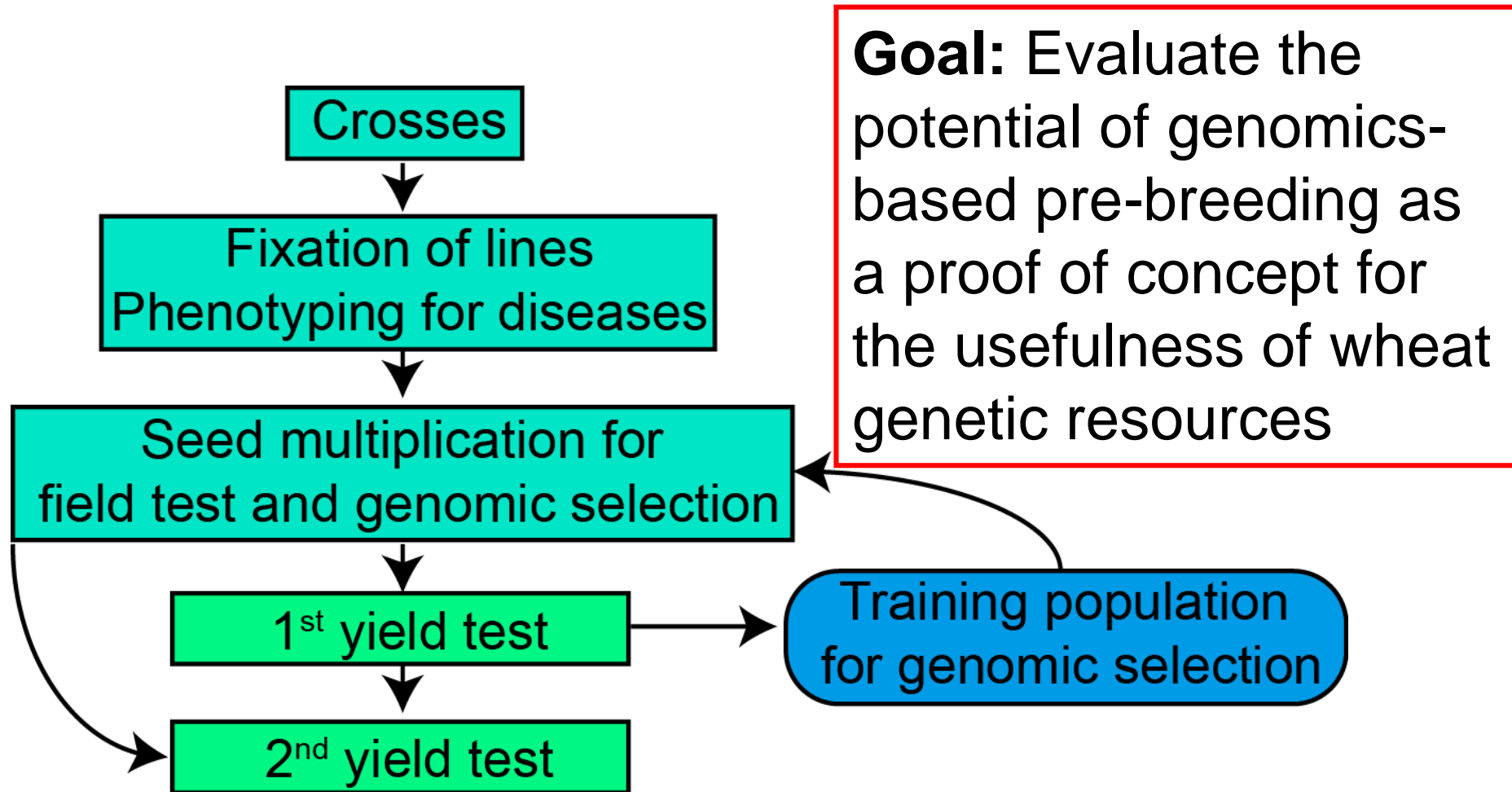


WP-4: Nitrogen use efficiency

Goal: Conduct a targeted allele mining for valuable nitrogen (N) uptake efficiency genes focusing on ammonium and nitrate transporters

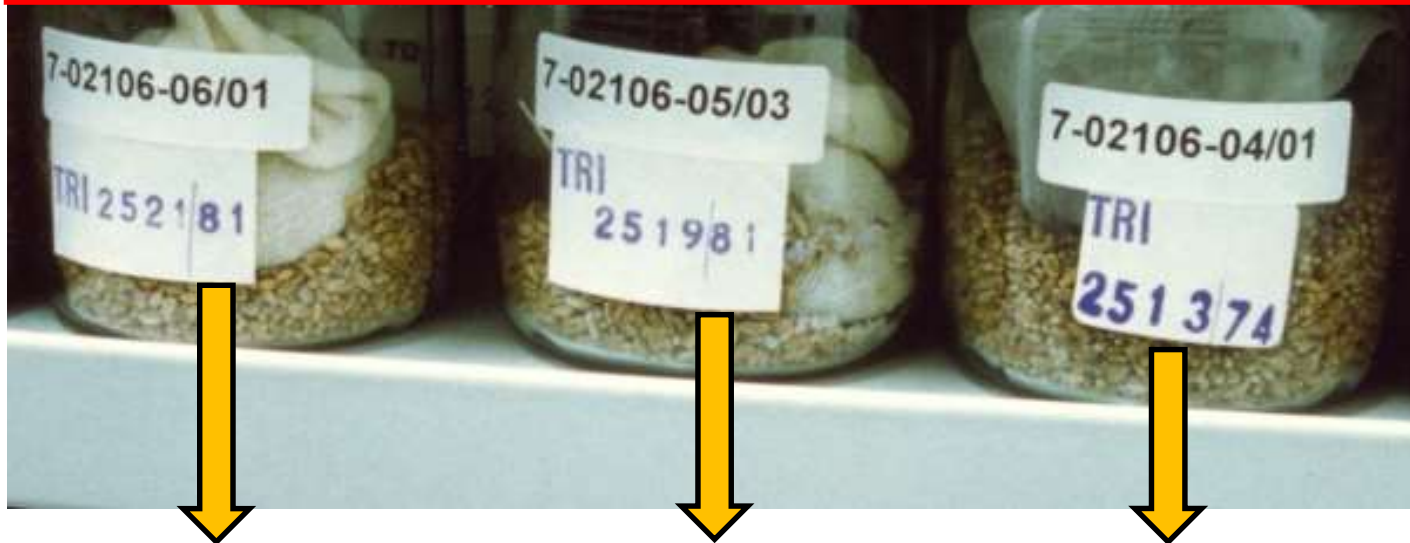


WP-5: Pre-breeding



WP-6: Biodiversity informatics

Goal: Develop wheat data warehouse and suitable biodiversity-informatics toolbox



-High breeding value for yield
-*Lr70* and *YR88* gene

-Haplotype for *NRT1.1B* gene boosting nitrogen use efficiency

-Pronounced anther extrusion
-Fusarium head blight resistance

Acknowledgment



GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

Thank you for your interest!