

## Buckwheat for more diverse crop fields and diets

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### Buckwheat (*Fagopyrum esculentum*)

- Buckwheat is a historically important crop in Switzerland and can still be found as an ingredient in many traditional dishes
- Due to its excellent nutritional quality, buckwheat is becoming increasingly popular
- The production volume in Switzerland is low, mostly because buckwheat yields are not competitive to major cereals
- Buckwheat is a challenging crop to improve through breeding because of its insect-pollinated, self-incompatible reproduction system
- Goal of this project is to study the performance of different buckwheat accessions and develop methods to improve their agronomic qualities



Pizzocheri

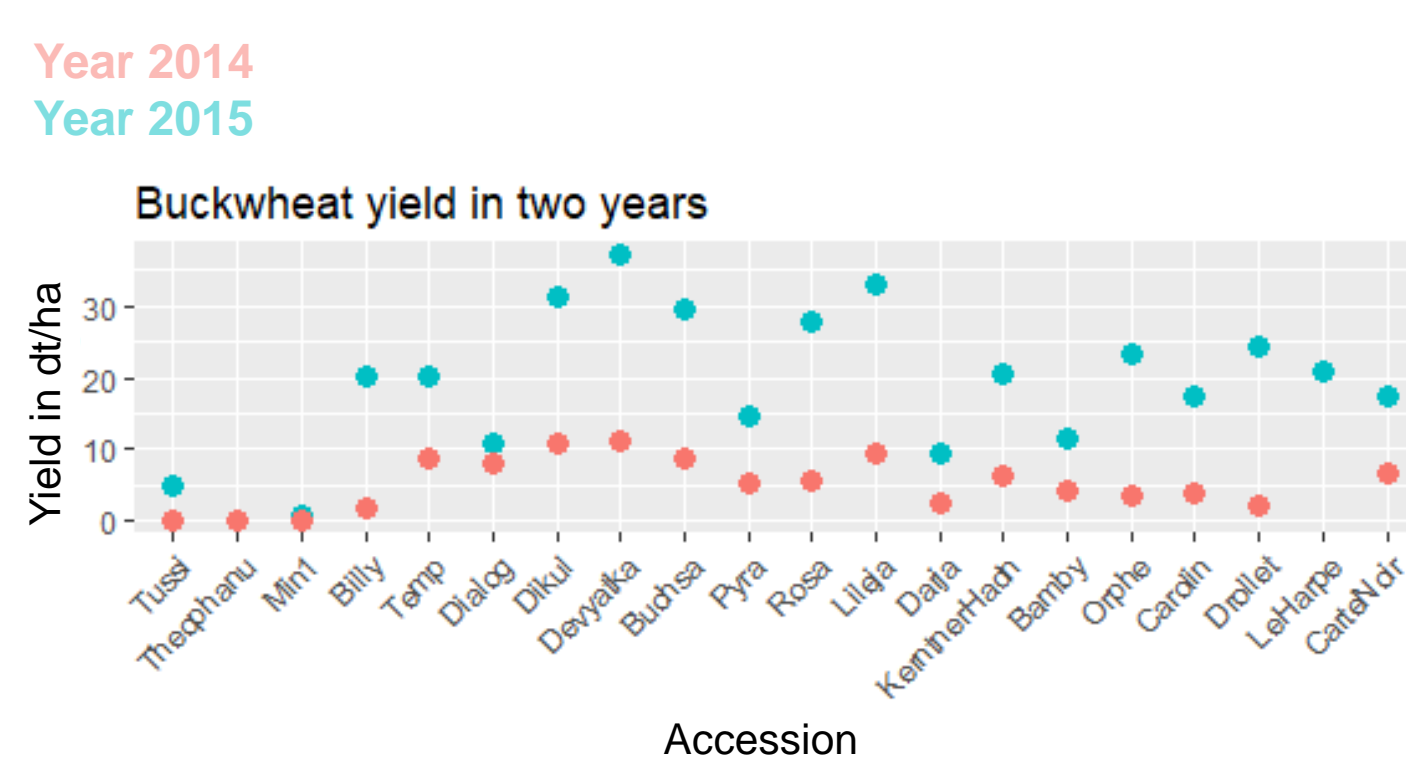
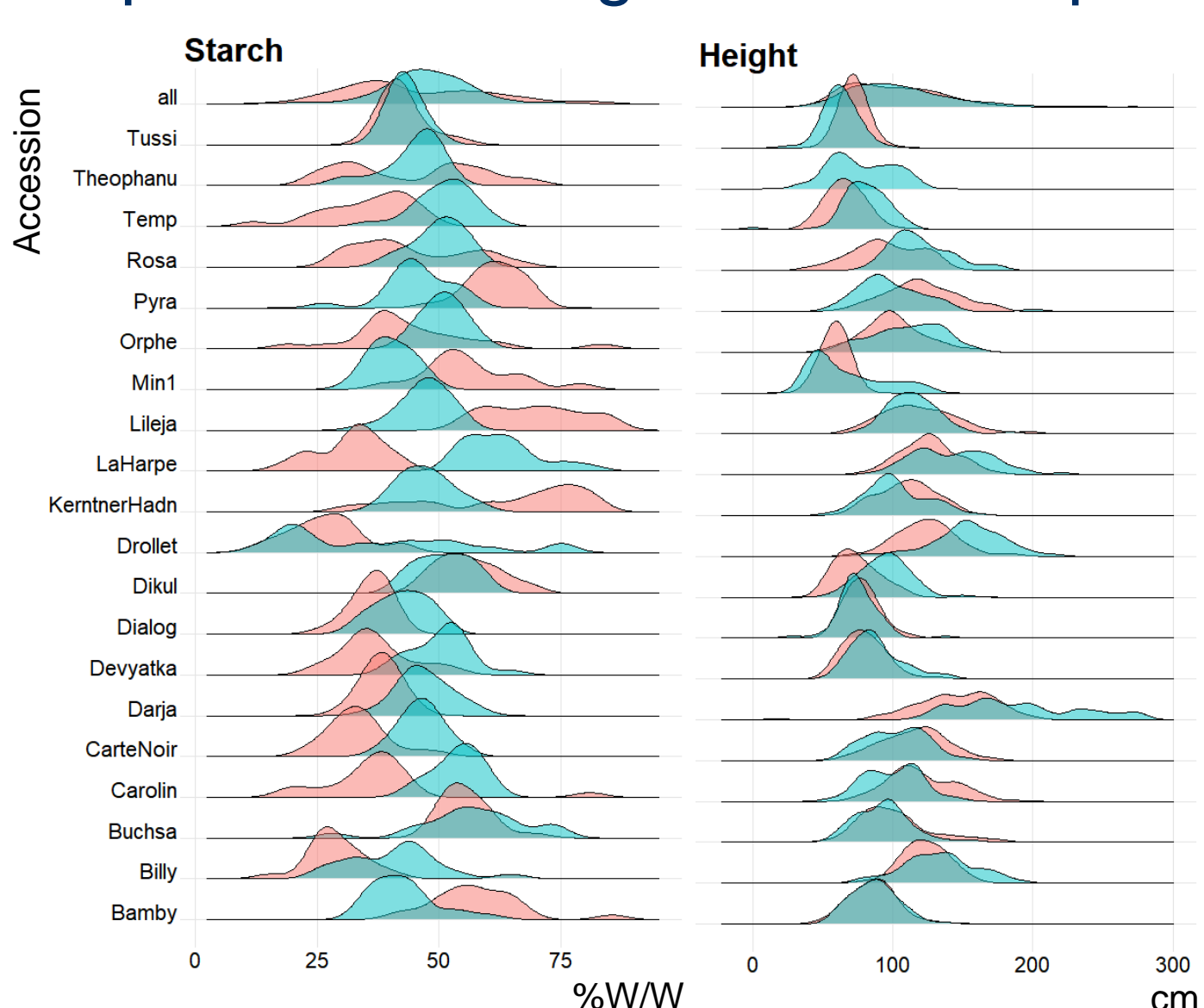
Polenta

Chisciöi

Buckwheat flowers

#### Evaluation of agronomic and phenotypic variability

- 20 accessions from Europe and Russia were characterized
- Extremely high variability within accession as well as between years pose a challenge to select superior accessions

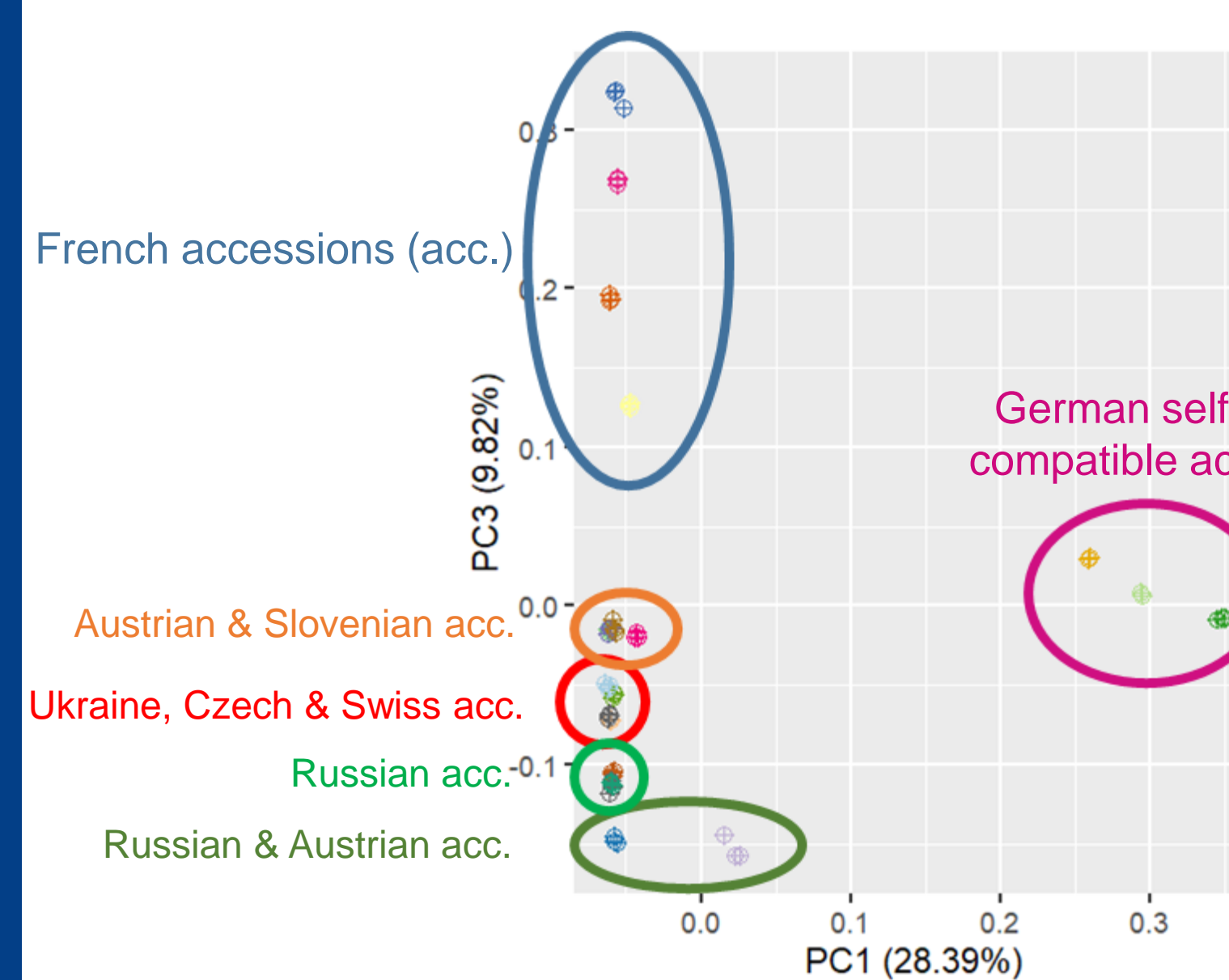


The yield of buckwheat accessions varied greatly between years. The year 2014 was not favorable for buckwheat as it was rather wet, while the year 2015 was dry and more favorable, resulting in a 4.4 times higher yield on average.

Distribution of the traits starch and plant height in the years 2014 and 2015 within the 20 accessions compared to the overall distribution (all)

#### Genotypic characterisation of accessions

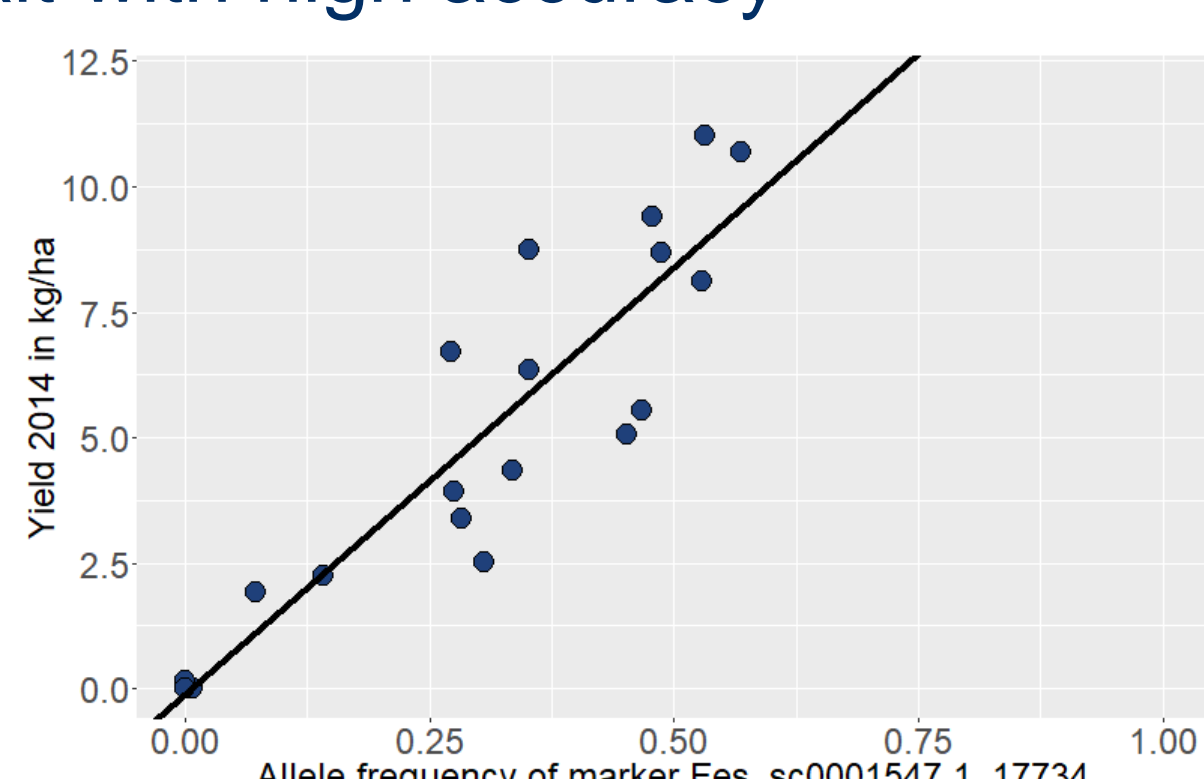
- Genotypic information about the accessions were obtained through genotyping by sequencing (GBS)
- Buckwheat accessions are biologically populations, therefore pools of 100 single plants were sequenced per accession in triplicate



Allele frequencies characteristic for the accessions were calculated based on the GBS data. Principal component analysis of the genotypic data allowed to distinguish the different accessions based on their genetic similarity. The genotyping method proved to be highly accurate, since replicates of the same accessions clustered closely together.

#### Use of the obtained knowledge to select suitable varieties and guide cultivar improvement

- The accession Devyatka achieved the highest yield in both years and seeds of this accession have been made available commercially
- Genome-wide association studies revealed several significant associations between traits and molecular markers. Many markers show a dose-dependent reaction, whereas the allele frequency explains the trait with high accuracy



The allele frequency of the molecular marker Fes\_sc0001547.1\_17734 explained the yield data of the year 2014 well ( $R^2=0.81$ ). Based on this marker-trait association, shifting the allele frequency through marker-assisted selection towards a higher frequency of the desirable allele is expected to result in higher yields, if environmental conditions similar to 2014 are encountered.



#### Outlook: Expand the diversity of the panel by tapping into a collection of 200 buckwheat accessions available at ETH

- Accessions of worldwide origin including self-pollinating accessions, that originated through interspecies crosses to *F. homotropicum*
- Accessions will be multiplied and characterized genotypically as well as phenotypically through large field trials the next years

