WP 2 - Wheat

Progress report for Y2 (1 May 2019 – 30 April 2020)

15 – 16 June 2020
2nd annual online meeting

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WP members

AT – Univ Bodenkultur
CZ – Selgen & Crop Research Inst
DE – Secobra
ES – Univ Vigo
GR - Geokomi
HU – Agric Inst Ctr Agric Res Hung Acad Sci
IT – Univ Tuscia
RO – Natl Agric Res Dev Inst
RS – Inst Field Veg Crops
SI – Agric Inst Slovenia & RGA
SK – Natl Agric Food Ctr & Biomila
UK – Univ Newcastle
US – Washington State Univ

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WP2 Online meetings

T2.1	28 May	protocol pending
T2.2	29 May	"
T2.3	“	"
T2.4	“	"
T2.5	15 & 19 May	updated protocol

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T2.1 Screening of genetic resources and breeding material

DURUM	AT – HU – IT
LATE	CZ – DE – SK
EARLY	HU – RO – RS – SI – SK
SPRING	AT – CZ – DE
ADVPHENO	SI – SK – UK

https://zenodo.org/communities/ecobreed/?page=1&size=20

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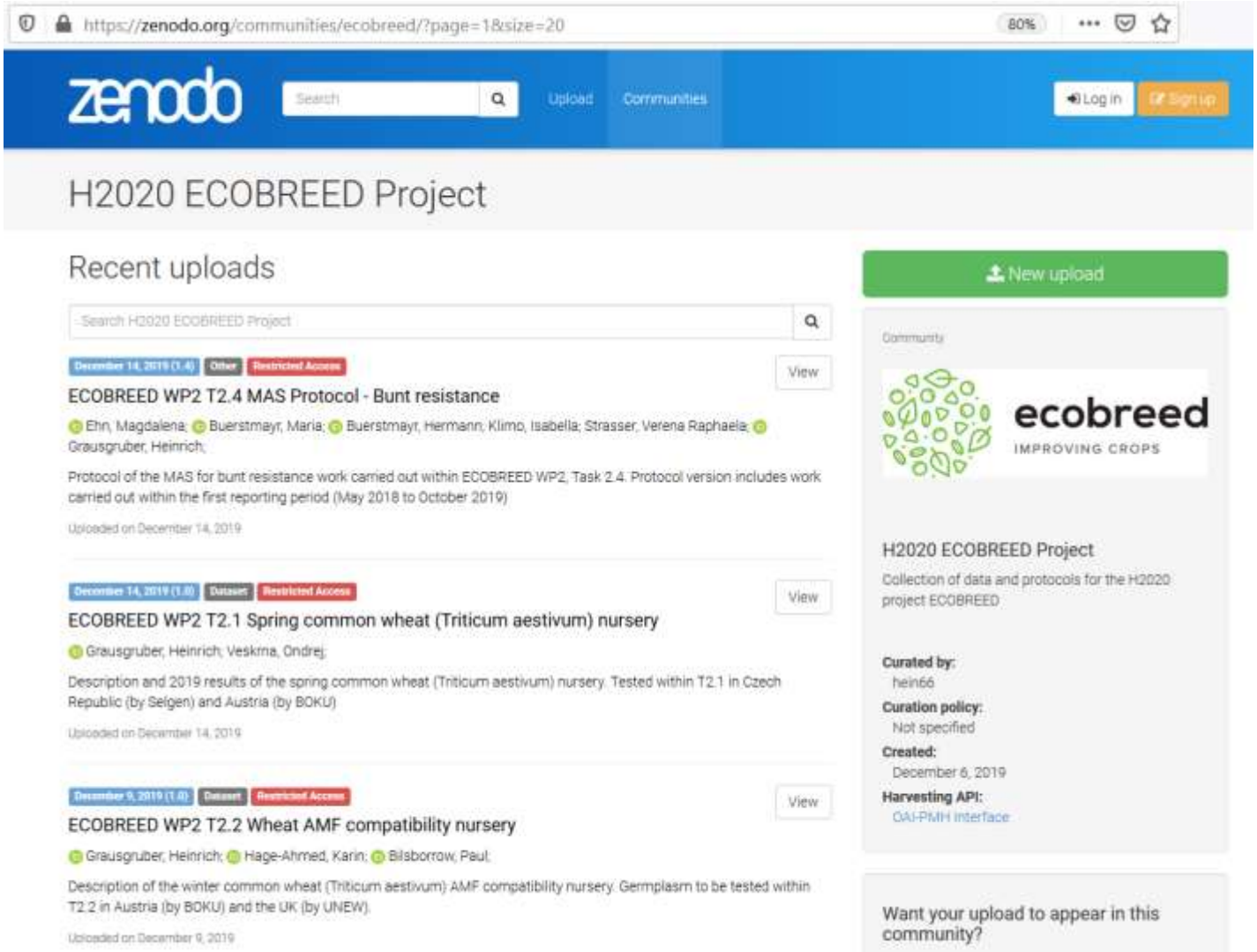

Next update: 1 Sep 2020

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Data delivery → as soon as possible after harvest, not later than 15 August

Excel (template) → Sheet 1: trial metadata (latitude/longitude; sowing/harvest date; management, etc. – see D2.1)
→ Sheet 2: traits abbreviated according to D2.1 + date (e.g. BBCH1206)
→ Sheet 3: field plan

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T2.1 Durum wheat



Severe damage due to WDV (wheat dwarf monogeminivirus) in AT trial → almost only in ICARDA and Italian germplasm; vector: leafhopper *Psammotettix alienus*; fall and/or spring infection → measurements: late sowing (winter crops) and/or early sowing (spring crops)

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T2.1 Durum wheat



No disease development during dry spring → rapid development of powdery mildew and (Septoria) leaf blotch since mid-May (start of the “rainy season”)
→ resistance level of germplasm is (alarmingly) low

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T2.1 Spring wheat

No rainfall & high temperatures after sowing (10 March) → no tillering, poor crop stand, very short inflorescence

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T2.1 Winter wheat



No winter damages → well established crop stands

No rainfall in spring → irrigation applied at individual sites; low/no disease pressure

Photo credits: Maria Megyeri, MTA-ATK

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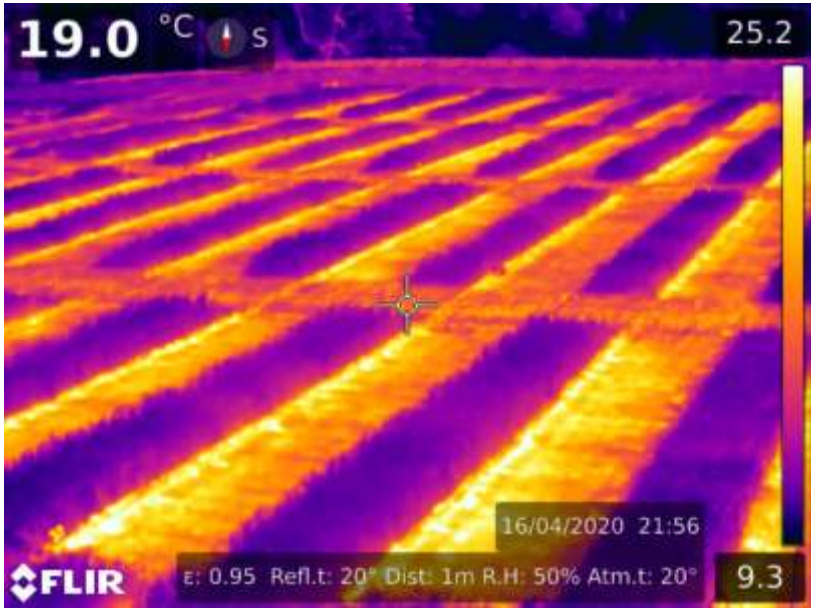
T2.1 Advanced phenotyping



First (preliminary) trials in SI and UK + additional “projects” at individual partners

Subcontracting of indoor trials to Photon Systems Instruments (www.psi.cz) via NPPC → selection of genotypes

Photo credits: Ankush Prashar, UNEW

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T2.1 Digital image analysis for ground cover

Digital images processed via

(i) Canopeo App

(ii) Sigmascan software

(iii) Canopeo Matlab script still to do

References:

Patrignani A, Ochsner TE (2015) Agron J 107: 2312-2320. https://doi.org/10.2134/agronj15.0150

Richardson MD, Karcher DE, Purcell LC (2001) Crop Sci 41:1884-1888. https://doi.org/10.2135/cropsci2001.1884

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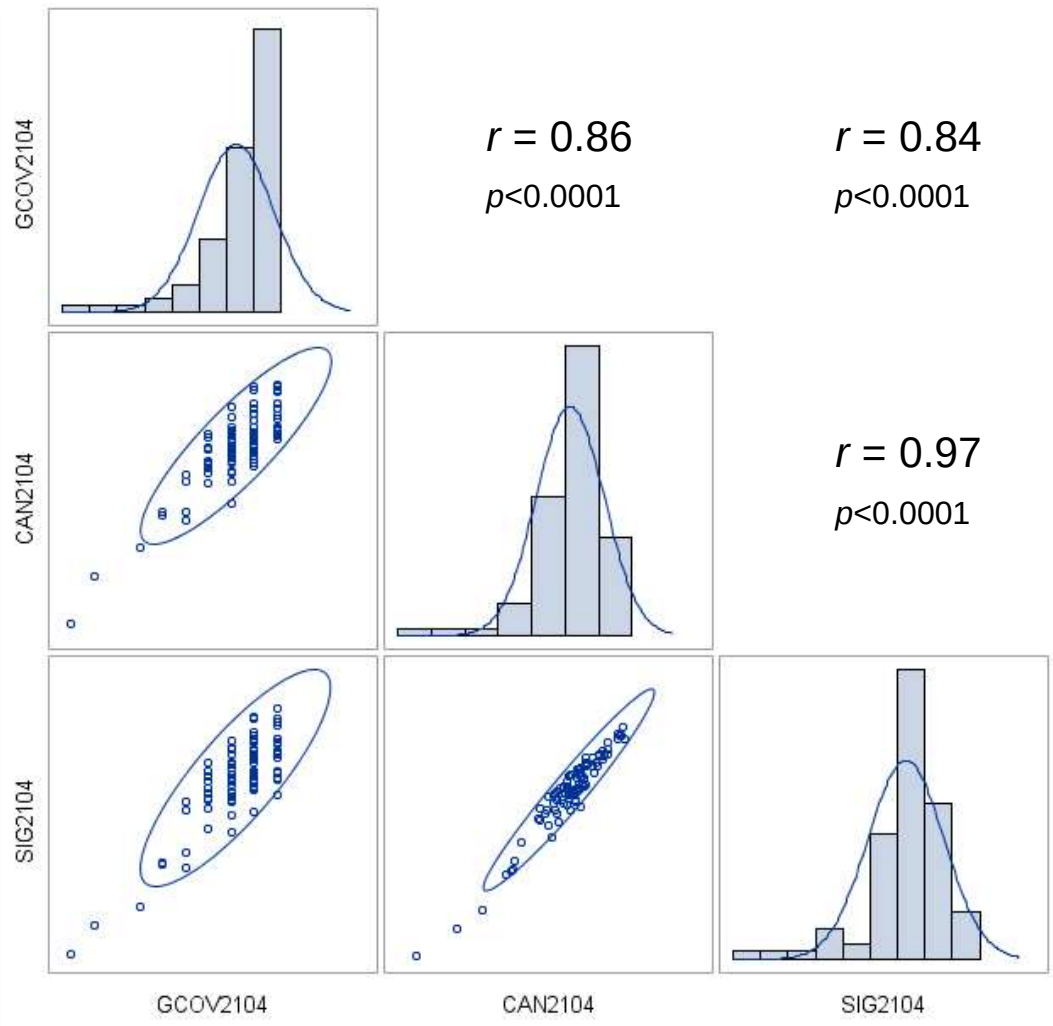
GROUND COVER ECOBREED WINTER WHEAT - 21 APRIL 2020



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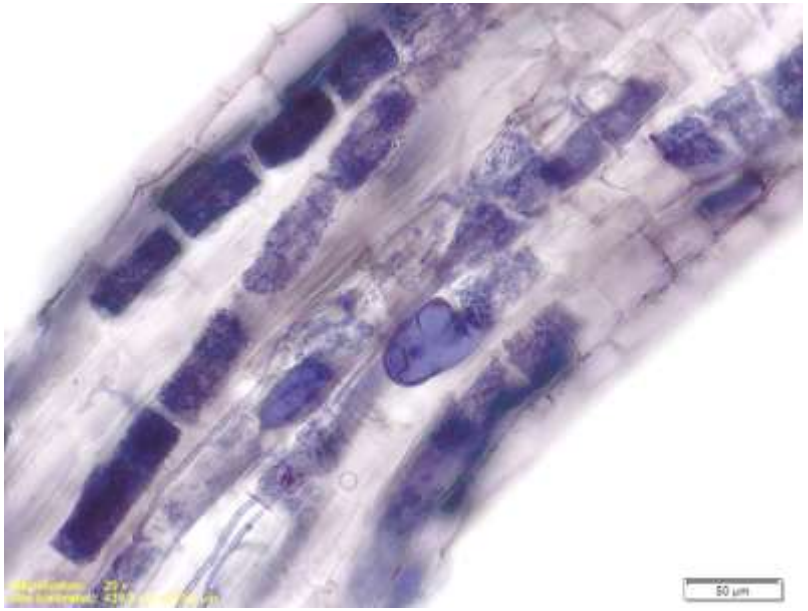
T2.2 AMF-compatibility evaluation



First experiment at UNEW failed, second experiment hampered by COVID-19 restrictions

Experiments at BOKU on schedule

Photo credits: Karin Hage-Ahmed, BOKU

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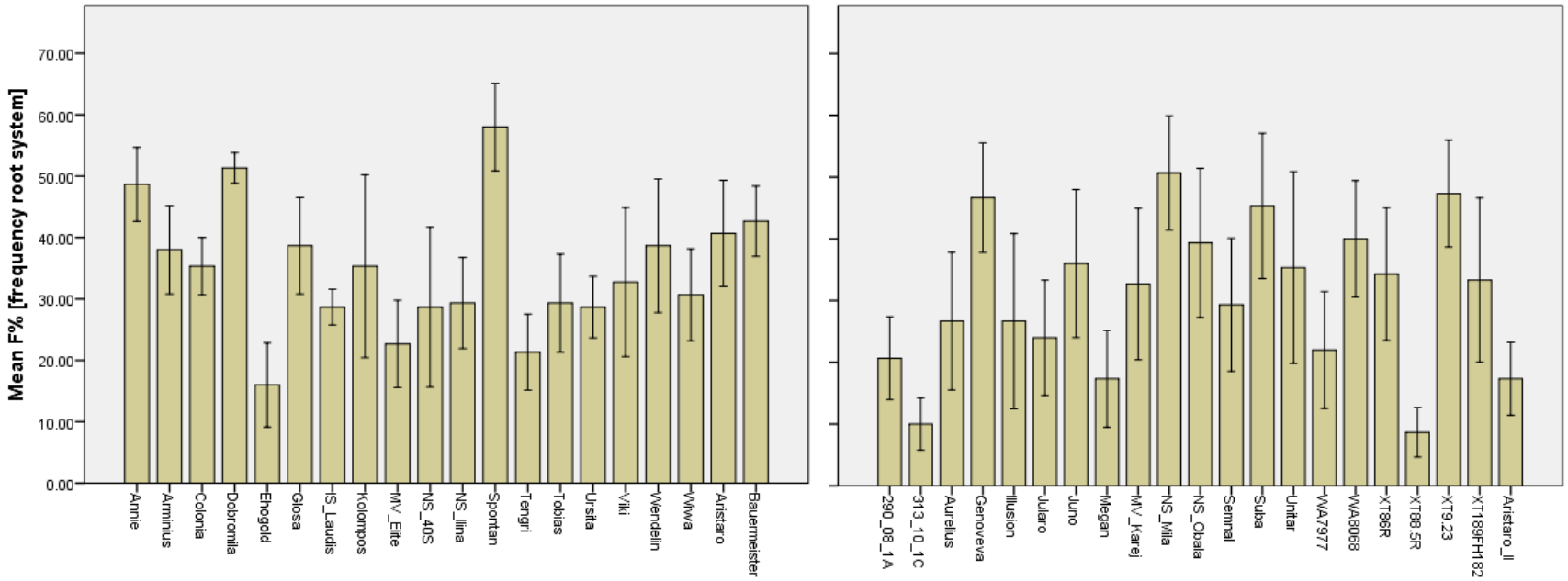

→ most of the genotypes get colonized by AMF

→ only a few genotypes show very little or high colonization rates

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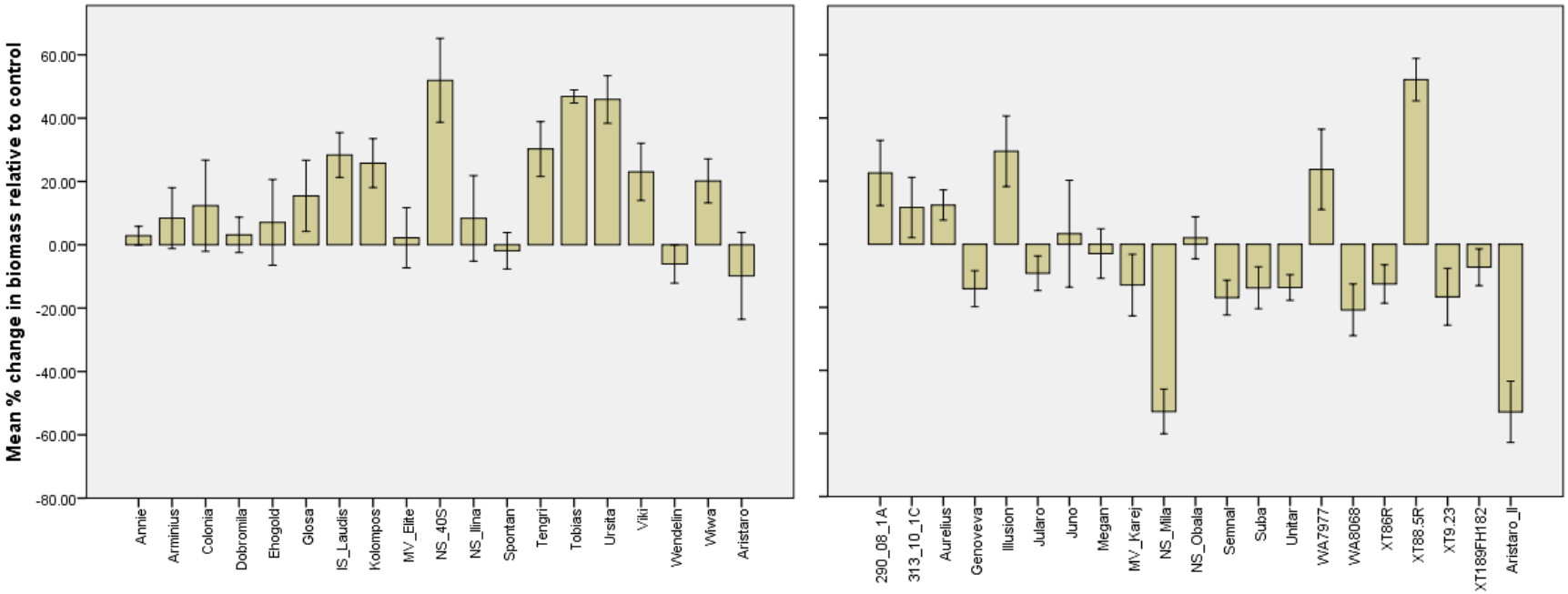

→ plant biomass is affected in a genotype-dependent manner

Outlook: field screening of AMF colonization

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T2.3 Allelopathic activity screening

First results showed genotypic differences in germination and biomass production in the presence of two ‘weedy’ species (*Lolium rigidum*, *Portulaca oleracea*); → chemical analyses also revealed genotypic differences

Photo credits: Adela M. Sánchez-Moreiras, UVIGO

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T2.4 Marker assisted selection

Screening for *Lr & Sr* resistance genes + wheat-rye chromosome translocations at MTA-ATK (Ildiko Karsai, Marianna Mayer) and NARDI

→ MTA-ATK: 32 varieties from EARLY group screened; 5 varieties from LATE group

→ NARDI: 20 varieties from EARLY group

→ compiled list in preparation; discussion on further steps after harvest

Screening for *Gpc-B1* at NARDI (Matilda Ciuca)

→ improvement of protocol

→ transfer of protocol/knowledge to MTA-ATK

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T2.4 *Gpc-B1* – Grain protein content

BOKU 2019 WP1 seed multiplication results

	PROT%	GS2.5%	TKWg
Aurelius	12.6	87.6	37.6
Mv Kolompos	13.4	90.9	35.3
Wiwa	13.5	91.4	33.7
Arminius	14.0	94.8	41.2
Tengri	14.1	95.2	40.1
Mv Toborzo	14.4	97.4	29.0
Tobias	14.6	81.7	35.3
Arnold	14.8	92.5	39.2
Aristaro	15.1	85.4	36.6
Kolompos/Glupro	15.5	92.9	44.1
Spontan/Glupro	16.3	89.7	38.2

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T2.4 Common bunt QTL

Background:

- seedborne disease → control strategy: seed treatment with fungicides (↑ conventional agriculture)
- *Tilletia caries*, *T. laevis*
- yield losses → grain replaced with bunt balls
- quality losses → fishy odour of grains
- 5 resistance QTL on 5 chromosomes identified in 3 resistance sources (Blizzard, Bonneville, PI119333) in previous project

Project aim:

- introgression of resistance QTL into elite varieties/lines
- verification of resistance in artificially inoculated field trials

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- SNP-markers for the detection of resistant alleles in back-cross progenies
- KASP – Kompetitive Allele-Specific PCR → fluorescent dyes for allelic discrimination; fast and easy to handle
- Large panel of KASP-markers tested at BOKU → allelic status for several SNPs on each QTL-region available for all lines in the pedigrees of the experimental populations
- Screening of back-cross progeny with minimum 2 polymorphic and flanking SNP-markers per potentially inherited QTL from the resistance donor
- Selection of lines with ≥2 heterozygous allele calls (F_1-progeny), with ≥2 resistant allele calls ($F_{2...n}$-progeny)

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Population A

BC_2F_3-population: 45 crosses, 609 F_1-progenies screened

MAS

108 heterozygous F_1s → 54 selected
2165 F_2-progenies screened with KASP-markers

MAS

163 lines homozygous at resistance QTL selected

Outlook: Nov 2020 sowing of lines for
- seed multiplication
- artificial inoculation field trials for resistance testing

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Population B

BC_3F_2-population: 30 crosses, 204 F_1-progenies screened

MAS

90 heterozygous F_1s → 50 selected

Outlook:

F_2-progenies screening with KASP-markers (Dec 2020)

MAS

Lines homozygous at resistance QTL will be sown in field trials for resistance testing in 2021/22

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Population C

BC_3F_1-population: 20 crosses, 297 F_1-progenies screened

MAS

73 heterozygous F_1s selected

BC_4F_1-population: 13 crosses between BC_3F_1-plants and ECOBREED-varieties

Outlook:
various other resistance genes (from e.g. Aristaro, Deloris, Genius Graziaro, UI SRG) possibly included but not followed by MAS → pre-screening in artificial inoculation trials in 2020/21

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T2.5 Development of new wheat germplasm for organic farming

Creation of MAGIC populations & CCPs

- some 4-way crosses ($F_1 \times F_1$) failed during winter → repeated on the field
- repetition of crosses by individual partners → inventory of available crosses and seeds after harvest
- re-designing MAGIC scheme → Mv Karej replaced Mv Toborzo; no WSU variety included → new crosses carried out at BOKU in 2020 (e.g. with Skagit 1109)
- 2 CCPs (Brandex, Liocharls) included in LATE, 1 (Mv Elit CCP) in EARLY nursery
- 11 CCPs from RGA tested in SI and HU

Specific ECOBREED crosses

→ inventory of available crosses and seeds after harvest

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Perennial wheat

•screening of *Thinopyrum intermedium* accessions at RGA → crosses with common wheat

•5 bulks at BOKU originally provided by S. Jones (WSU)

•5 selected bulks at NATURLAND originally provided by S. Jones (WSU)

•Outlook/open questions:

→ integration of Kevin Murphy (WSU)

→ synergy with Kernza®-Austria project (funding decision postponed)

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To do

- clarify involvement of WSU/Kevin Murphy
- delivery of available data until 15 Aug → composition of 2021 nurseries
- inventory of successful crosses
- shipment of bulked seed samples from each partner to NPPC for quality analysis
- MAS common bunt: who is screening which crossing progenies?
  (better) co-operation/exchange with LIVESEED

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Nunc est bibendum (Horace)

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