More than 90 EVA partners

- **Public partners**
  - Genebanks
  - Universities and research institutes

- **Private partners**
  - Multinational breeding companies
  - SME breeding companies
  - Organic breeding companies
  - Breeding and farming cooperatives
<table>
<thead>
<tr>
<th>Network</th>
<th>Carrot</th>
<th>Wheat/Barley</th>
<th>Lettuce</th>
<th>Maize</th>
<th>Pepper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countries</td>
<td>7</td>
<td>20</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Public partners</td>
<td>6</td>
<td>21</td>
<td>6</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Private partners</td>
<td>8</td>
<td>26</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Accessions eval.</td>
<td>67</td>
<td>3643</td>
<td>224</td>
<td>617</td>
<td>182+~50</td>
</tr>
</tbody>
</table>
Cooperation agreement ensures privileged access to data, while material is exchanged through SMTA and can be used for further development and eventual commercial use.
EVA Accessions field crops

Wheat (N=1318)
- Austria
- Bulgaria
- Germany
- Latvia
- Nordgen

Barley (N=918)
- Austria
- Bulgaria
- Czechia
- Estonia
- Germany
- Italy
- Latvia
- Lithuania
- Nordgen
- Portugal

Maize (N=442)
- Croatia
- France
- Italy
- Portugal
- Romania
- Serbia
- Spain
- Switzerland
EVA uses SMTA

The ITPGRFA Standard Material Transfer Agreement (SMTA)

- Provisions that govern the exchange of material under the Multilateral System
- Used for every transfer of material
- Significantly lower transaction costs compared with bilateral approach
- Ensures benefit sharing multilaterally among Contracting Parties

ECPGR promotes use of SMTA:

- ECPGR recommends use of SMTA for all exchange of PGRFA, even if not Annex 1
- Use of SMTA with the terms and conditions of the MLS of ITPGRFA has proven to be the best available option to involve private breeders into partnerships with genebanks and the public sector in EVA
109 Evaluation trial sites across Europe

- EVA wheat trial 2021, BASF (V. Spamer)
- EVA carrot trial 2021, Institut Agro Angers (E. Geoffriau)
- EVA pepper trial 2021, Semillas Fito (M. Fernandez)
- EVA maize trial 2021, CREA-CI (C. Balconi)
- EVA lettuce trial 2022, Sativa Rheinau (C. Aichholz)

Map showing trial locations across Europe.
EVA – Maize network workplan 3 sets (~600 accessions total)

Year 1
- Selection, multiplication
  - Accessions from ten genebanks multiplied
  - Group by maturity level and genetic relatedness

Year 2
- Evaluations A, genotyping
  - All accessions
  - Limited traits, sites and replicates
  - 5-6 locations/acc.
  - Genotyping of all accessions – SNP array

Year 3
- Evaluations C
  - Hybrid testcrosses
  - Larger plots
  - Limited traits
  - ~5 locations/pop

- Evaluations B
  - Subset of accessions
  - More traits
  - ~5 locations
  - More datapoints

Full set (Eval A):
- ~200 accessions

Subset Eval C:
- ~100 testcrosse populations

Subset Eval B:
- ~100 accessions
EVA Wheat and Barley

3 Geographic zones – 7 crop types – ~4500 accessions in 3 sets:

**Nordic zone:**
- Spring barley: 452 acc.
- Spring wheat: 573 acc.
- Winter wheat: 420 acc.

**Central Zone:**
- Spring barley: 435 acc.
- Winter barley: 374 acc.
- Winter wheat: 568 acc.

**Southern zone:**
- Common wheat: 550 acc.
- Durum wheat: 440 acc.
- Barley: 511 acc.
Workplan of EVA Wheat and Barley network

2020

- Set 1 SSD Multiplications
- Set 1 Evaluations (2 years)

2021

- Set 2: SSD Multiplications
- Set 2 Evaluations (2 years)
- Set 1 +2 Genotyping SNP array

2022

- Set 3: SSD Multiplications
- Set 3 Evaluations (2 years)

2023

- Set 3+2 German project
- Set 3: H2020

2024

- Set 3 genotyping in AGENT barley – GBS; wheat - DartSeq

The AGENT project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 862613.
EVA as part of an activated genebank network

- 10 Genebanks created precision collections of wheat and barley
  - 6600 Wheat accessions
  - 3900 Barley accessions
- Genotyping with GBS and DartSeq
- EVA network evaluates ~1250 each in 2023 and 2024
- Evaluation by EVA partners including organic farmers’ network
Phenotyping in AGENT

Precision collections:
- 500 barley/500 wheat with high potential of uniqueness
- Agronomy: FT, FT, TKW: all GB
- Biotic Stress: individual GB

Selected set of precision genotypes
- Abiotic Stress: multiple locations

Precision collection of 500 genotypes per gene bank will be genotyped and phenotyped for:
- Leaf rust
- Yellow rust
- Septoria
- Powdery mildew

Locations across Europe are shown on the map.
EVA – Lettuce network workplan - field

2020

Phase 1
- All accessions
- Limited traits and replicates
- 3 sites

SSD Subset

Full set: ~180 accessions,

2021

Phase 2
- Larger plots
- Include also quality traits
- 5 locations, 10 trials

Genotyping
- SPET
- 155 accessions

SSD Subset

Subset Phase 2: 60 accessions

2022

2023

Phase 3
- Additional trials complementing existing data

Data Analysis

2024
Workplan of EVA Carrot network

2020

Regenerations (~40 accessions)

Evaluations (field, lab)
- 60 accessions
- 26 trials, 13 locations
- >100 traits

2021

Genotyping and analysis
- GBS, WGS, SNP array

2022

EVA Carrot 2.0

2023

Joint data analysis

2024
Workplan of EVA Pepper network

2020
- Regenerations ~180 accessions

2021
- Evaluations (field, lab, greenhouse)
  - 180 accessions
  - 20 trials, 10 locations
  - >30 traits

2022
- Regenerations ~50 accessions

2023
- Genotyping and analysis ~230 accessions

2024
- Joint data analysis
Output of EVA networks (2020-2023)

- >5000 accessions
- >230 Traits evaluated
- 309 EVA trials
- >420,000 evaluation data points
Open access and FAIR data management

Ensure open access to EVA project data according to FAIR principles:

**Findability** – indexed metadata allows easy search
**Accessibility** – open access databases and common identifiers
**Interoperability** – standardized data is usable across platforms
**Reuse** – clear and accessible licensing

Accessions in EURISCO with direct link to C&E data and genotyping data
EVA Data management
EURISCO-EVA intranet

- Database for phenotypic data
- Developed by IPK using same backend as EURISCO
- Compatible with EURISCO (publish with the click of a button)
- Project-specific access and embargo
- Template for AGENT and INCREASE data portals
- Accession metadata synced with EURISCO
- Trial data upload with universal data check
- New networks can be easily added to the database
- Extensions could be added
Metadata

- **Accessions** – passport data, material type, images
- **Traits** – definitions, valid scoring scales or metric intervals
- **Trials** – locations, dates, agronomic practices, treatments
- **Genotyping** – metadata of experiments
- **Partner organizations** – locations, contacts, roles

- Trait groups – e.g. agronomic, morphologic, stress traits
- Trial groups – e.g. crop, year, repeat
Observation data

• Individual datapoints
• Grouping and filter functions as well as pivot reports possible
• Download as Excel or csv
• Chart drawing function
## Data analysis in EVA networks

### EVA Maize
- SNP array genotyping - INRAE
- Phenotypic analysis – all partners their trials, led by CSIC
- Combined analysis – tbd, led by INRAE

### EVA Wheat and Barley
- SNP array genotyping - SGS
- Phenotypic analysis – Task force for data analysis
- Combined analysis – crop responsible per zone (Luke, JKI, CREA-GB)

### EVA Carrot
- Genotyping by GBS, WGS, SNP array – JKI
- Phenotypic analysis – all partners their trials
- Combined analysis – all partners for different traits, GWAS JKI

### EVA Lettuce
- Genotyping by SPET – CREA-OF
- Phenotypic analysis – all partners their trials, overall statistics Limagrain
- Combined analysis – led by Limagrain/CREA-OF

### EVA Pepper
- SNP array genotyping – CREA-OF
- Phenotypic analysis – all partners their trials
- Combined analysis – tbd, led by CNR

### Data Statistics
- **48 trials, >64k data**
- **210 trials >240k data**
- **26 trials, >80k data**
- **15 trials, >10k data**
- **20 trials >20k data**

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![Image](image.png)
Data analysis – phenotypic data

- Diversity in phenotypes and bolting sensitivity of 60 accessions evaluated in EVA Carrot

Data from seven trials in 2020, 115 days after sowing, rates cumulated from Northern to Southern trials, accessions sorted by latitude of country of origin) E. Geoffriau (Institut Agro)
Data analysis – genetic structure

Genetic diversity of EVA maize (left) and EVA Lettuce (right) landraces

D. Madur, INRAE, France

P. Tripodi, CREA, Italy
Genome-wide association in Lettuce

6 Models:

- **a)** Seed colour
- **b)** Leaf anthocyanin
- **c)** Outer leaf colour
- **d)** Bolting time

Cooperation agreement in EVA networks
Letter of Commitment for joining EVA

• Part of the EVA framework document
• Outlines in general terms the expected duties from partners and the benefits to them.
• Signed once to join the EVA networks

Establishment of the European PGRFA Evaluation Network (EVA)
Cooperation agreement

• Each crop-specific network has this signed by all partners
• Outlines more specifically the obligations and benefits within each network
• Outlines how to join and leave an EVA crop-specific network
• Networks are in principle open-ended
• Workplan is annexed to cooperation agreement

• Agreement is the same (with minor modifications) in all networks
Funding options for activities in EVA Legumes
Funding sources for EVA

Project funding by Germany (2019-2024): ~1M € for

Additional project funding through EU project AGENT ~250k € for:

- Multiplications
- Evaluations
- Analysis
- Dissemination + exploitation
- Travel to project meetings (private partners)

Multiplication of 3rd Set of accessions for EVA Wheat and Barley (2023-2024)
Expansion of stakeholders to on-farm evaluations by organic network
Contribution to EVA coordination (ECPGR staff costs)
Financial sustainability of EVA

**ECPGR support for EVA in Phase XI**
- Coordination of networks
- Budget management
- Permanent database infrastructure (EURISCO)
- Meetings organization

**In-kind contributions by private and public partners**
- Phenotypic evaluations (field trials)
- Regenerations/multiplications
- Data analysis

**Funding needed for specific network activities:**
- Genotyping
- Public partners’ activities
- Specific experiments (requiring lab space, special equipment)
- Data analysis
- Project meetings
Future funding sources for activities in EVA

- ECPGR grant scheme – EVA networks (in collaboration with relevant WG) can apply (max 30k per project)
- Collaborate in EU Horizon project proposals or other European project calls (e.g. Biodiversa+, ERANet etc.)
- National funding opportunities/projects for partners
- Activities funded through network partner financial contributions
Funding options for EVA Legumes

• What activities would need funding and how much?
• Can we exploit some pre-existing data (e.g. from finished Horizon projects)?
• Can we collaborate with projects for specific activities
• What activities at what capacity can be provided by partners as in-kind contributions?

Thanks to financial support from BMEL for the ForEVA meeting, the ForEVA grant scheme activity can be extended to kickstart the EVA Legumes network, using funds available (15k Euro)
Next Steps

• Develop workplans for different Legumes of interest:
Grain legumes network workplans

• Traits of interest
• Experimental setup (# of accessions, agricultural practice)
• # of trials and trial locations
• Identify partners with interest
• Synergies with ongoing or past projects
• Existing data from past projects that can be further exploited
• Activities that can be contributed in-kind
• Activities that need funding
THANK YOU