European Cooperative Programme for Plant Genetic Resources
ECP/GR

for EVA

EVA
European Evaluation Network

OVERVIEW OF THE EVA FRAMEWORK AND DATA MANAGEMENT

S. Goritschnig

Scientific Officer ECPGR,
EVA coordinator

ForEVA meeting, Bucharest, Romania

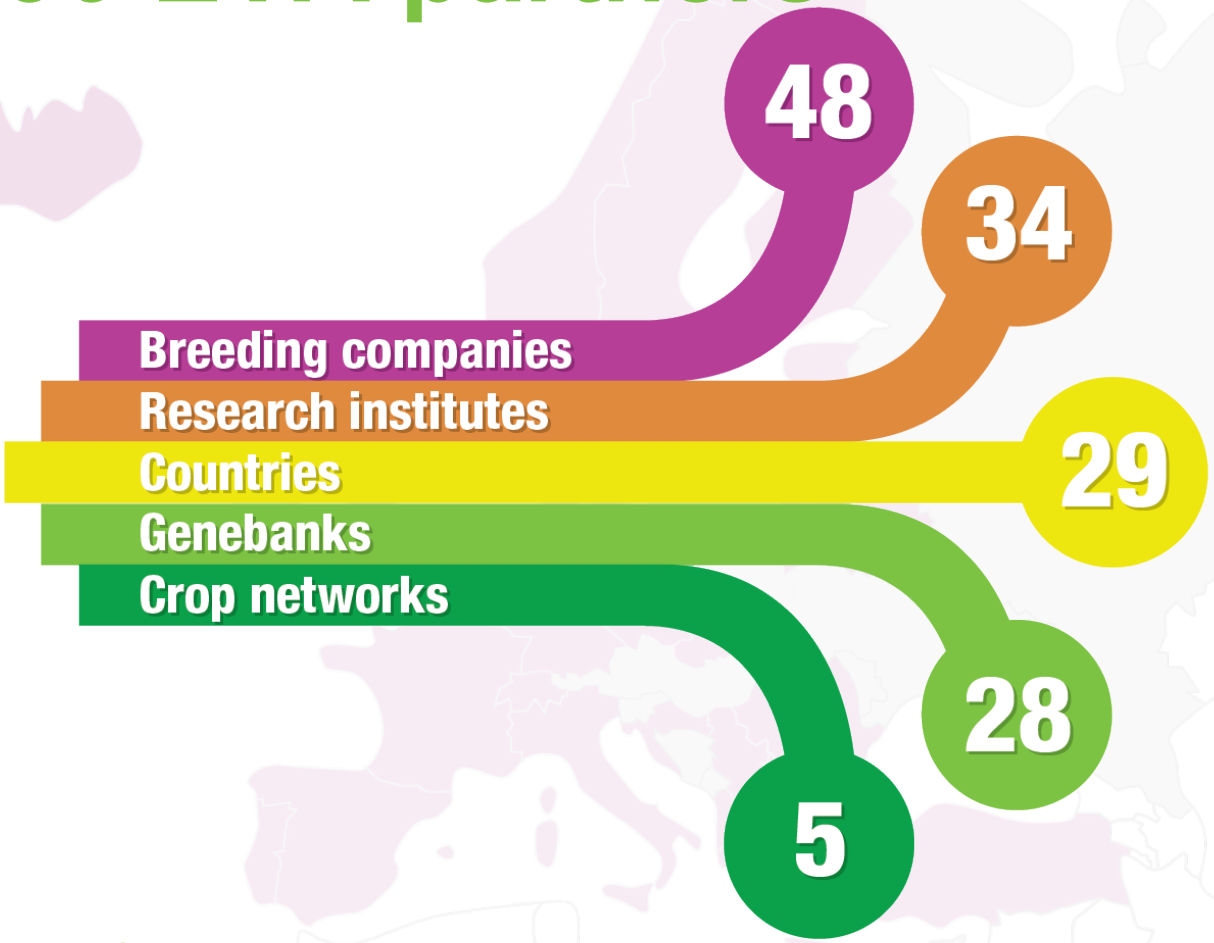
11 October 2023

EVA

European Evaluation Network

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



Euroseeds

Embracing Nature

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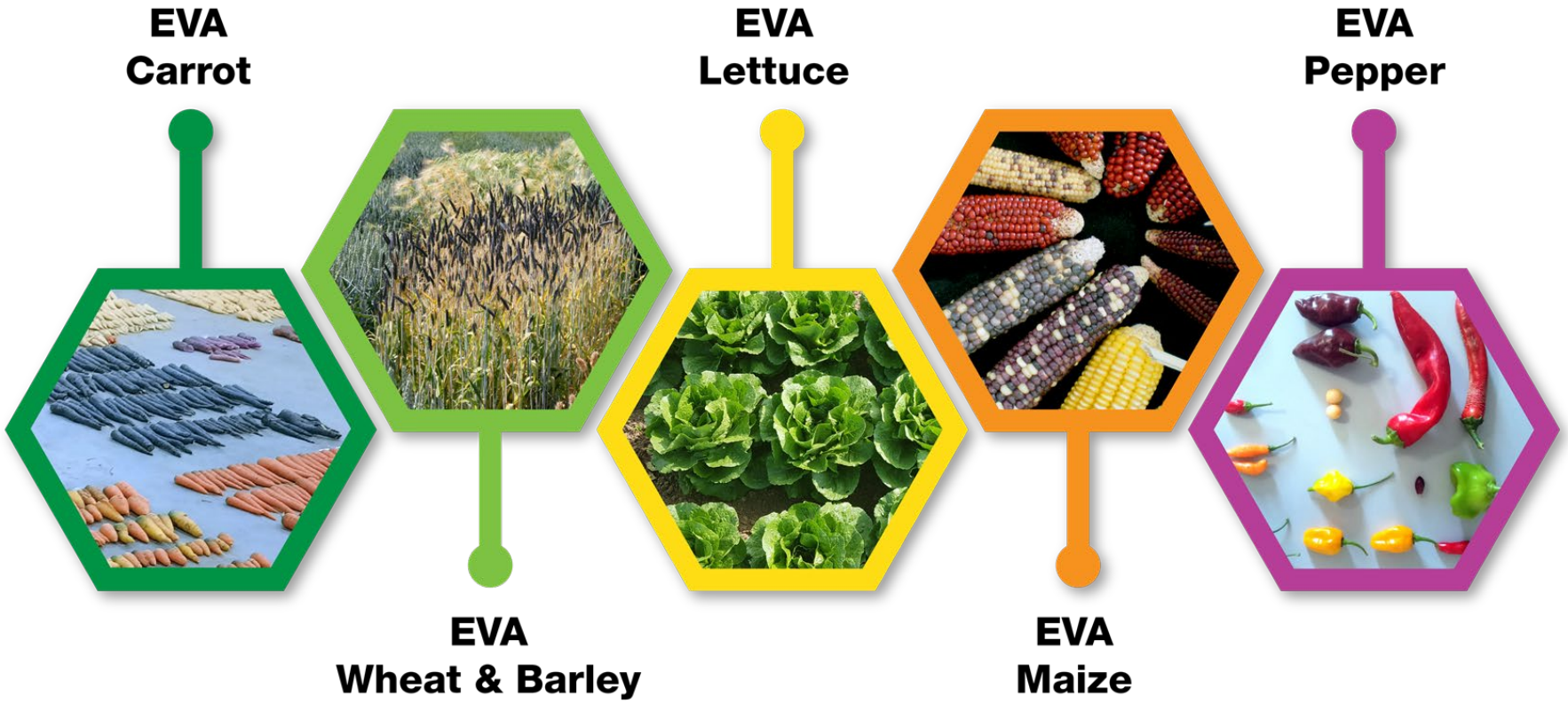

Network	Carrot	Wheat/Barley	Lettuce	Maize	Pepper
Countries	7	20	8	9	10
Public partners	6	21	6	10	9
Private partners	8	26	6	8	6
Accessions eval.	67	3643	224	617	182+~50

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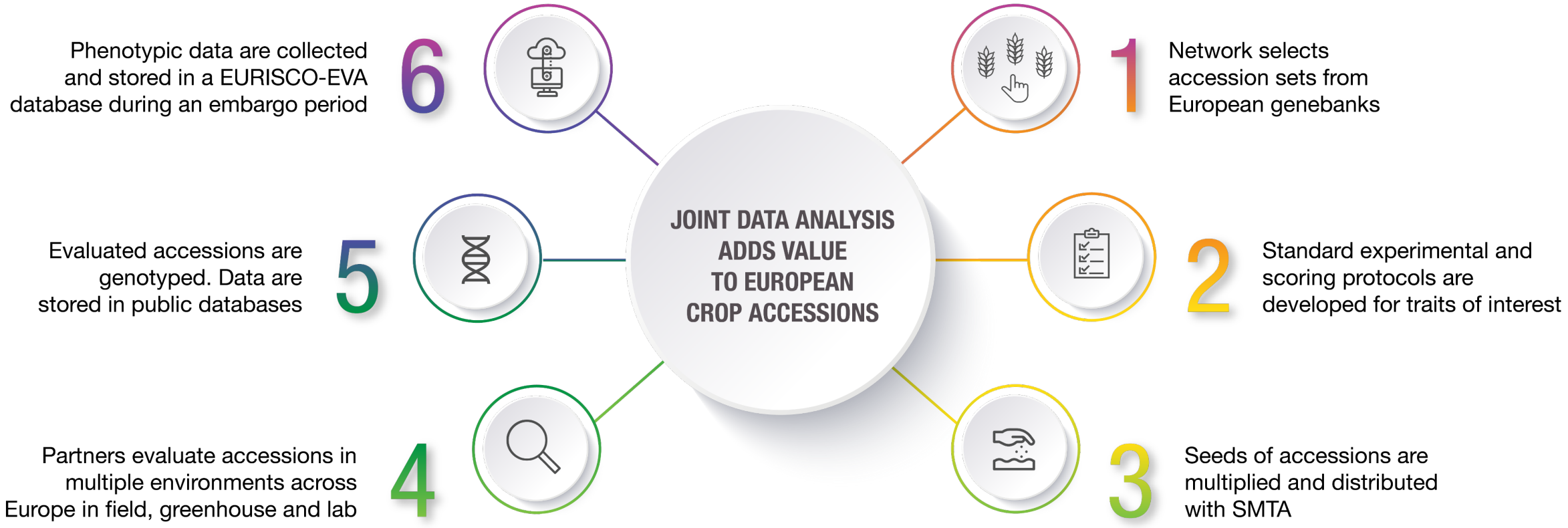
HOW THE EVA CROP NETWORKS OPERATE



Cooperation agreement ensures privileged access to data, while material is exchanged through SMTA and can be used for further development and eventual commercial use

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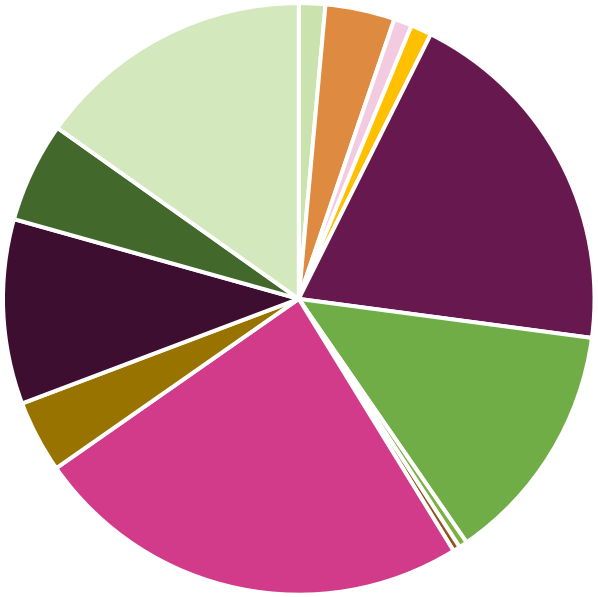
1 Network selects accession sets from European genebanks

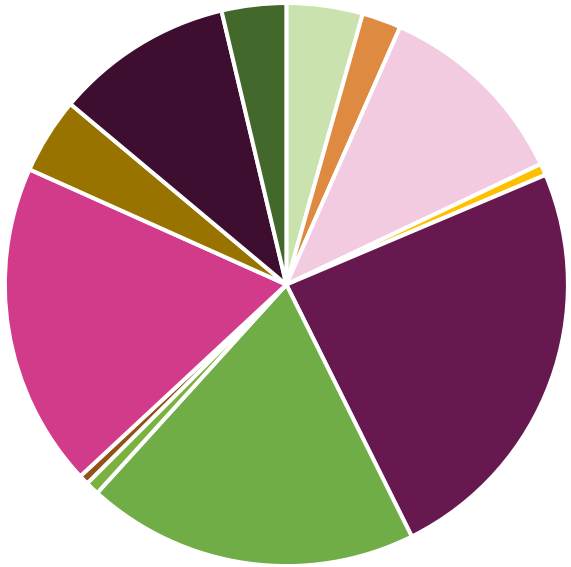
EVA Accessions field crops

Wheat (N=1318)



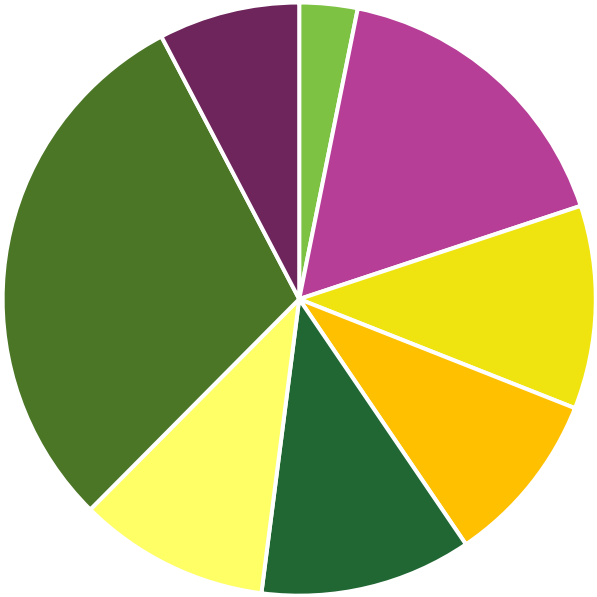
Austria, Bulgaria, Czechia, Estonia, Germany, Italy, Latvia, Lithuania, Nordgen, Portugal

Barley (N=918)



Austria, Bulgaria, Czechia, Estonia, Germany, Italy, Latvia, Lithuania, Nordgen, Portugal

Maize (N=442)



Croatia, France, Italy, Portugal, Romania, Serbia, Spain, Switzerland

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3 Seeds of accessions are multiplied and distributed with SMTA

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

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109 Evaluation trial sites across Europe

EVA wheat trial 2021, BASF (V. Spamer)

EVA lettuce trial 2022 *Sativa* Rheinau (C. Aichholz)

EVA pepper trial 2021, Semillas Fito (M. Fernandez)

EVA carrot trial 2021 Institut Agro Angers (E. Geoffriau)

EVA maize trial 2021, CREA-CI (C. Balconi)

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EVA – Maize network workplan 3 sets (~600 accessions total)

Selection, multiplication

- **Accessions from ten genebanks multiplied**
- **Group by maturity level and genetic relatedness**

Evaluations A, genotyping

- **All accessions**
- **Limited traits, sites and replicates**
- **5-6 locations/acc.**
- **Genotyping of all accessions – SNP array**

Select

Subset

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

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EVA Wheat and Barley

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

Nordic zone:

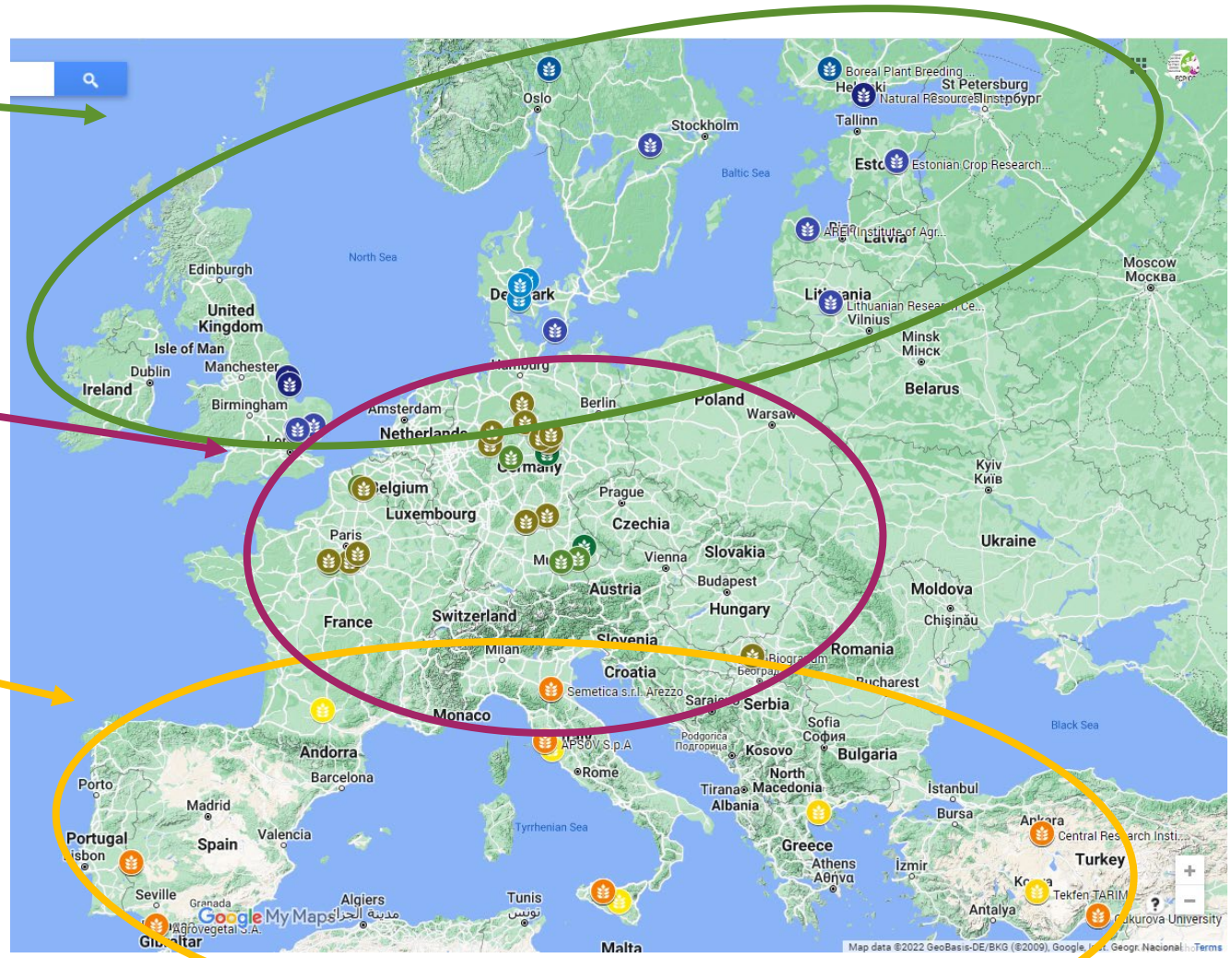
Spring barley	452 acc.
Spring wheat	573 acc.
Winter wheat	420 acc.

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.



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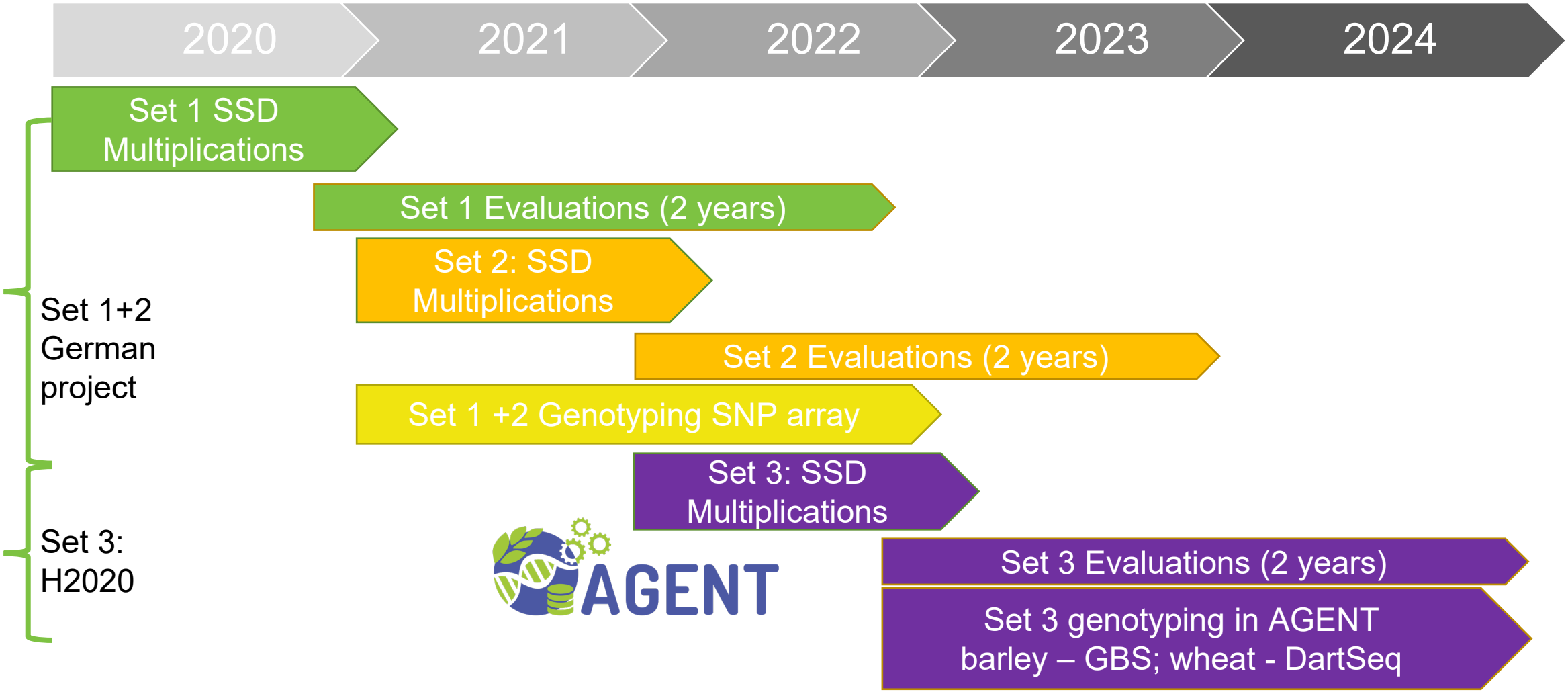
Workplan of EVA Wheat and Barley network



The AGENT project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862613.

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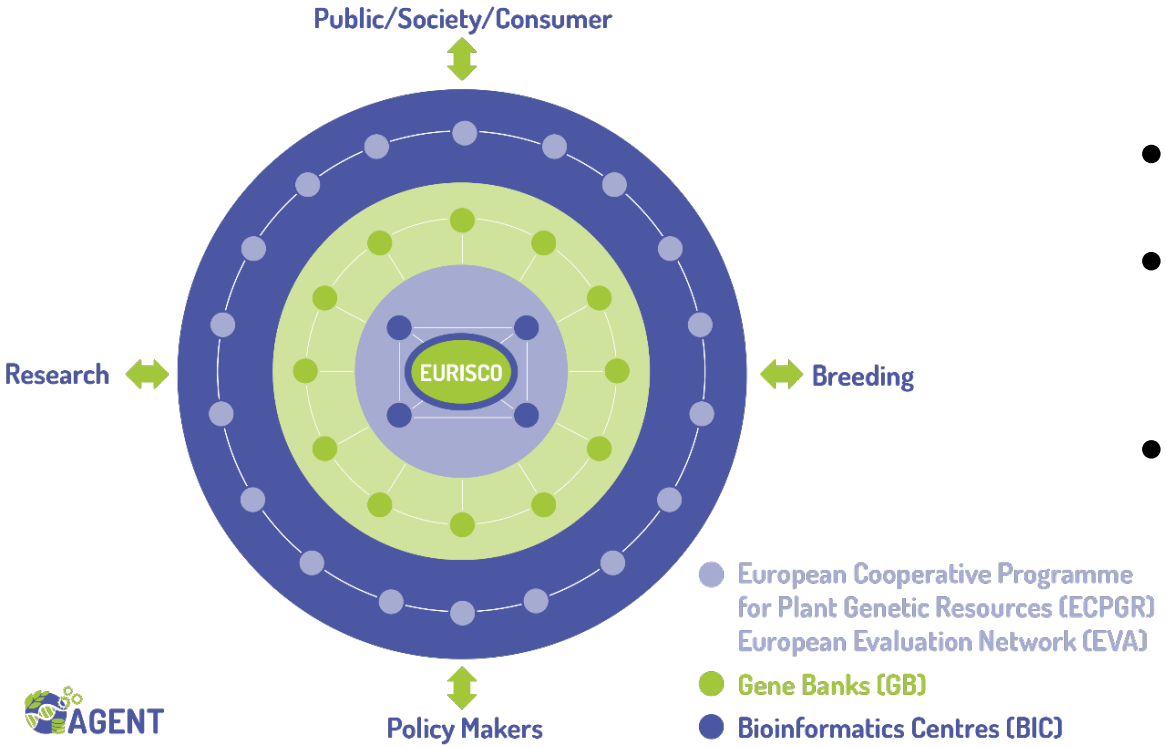
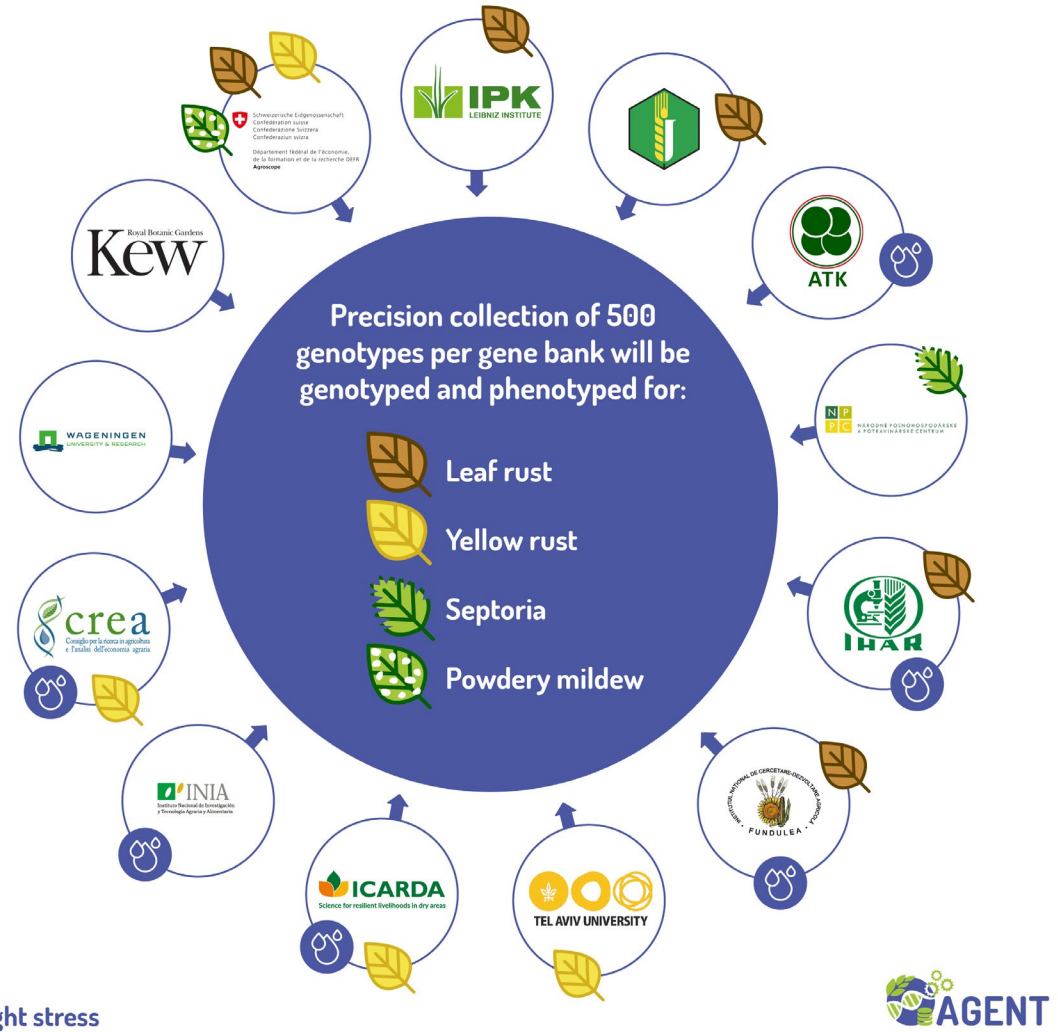
EVA as part of an activated genebank network



- 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

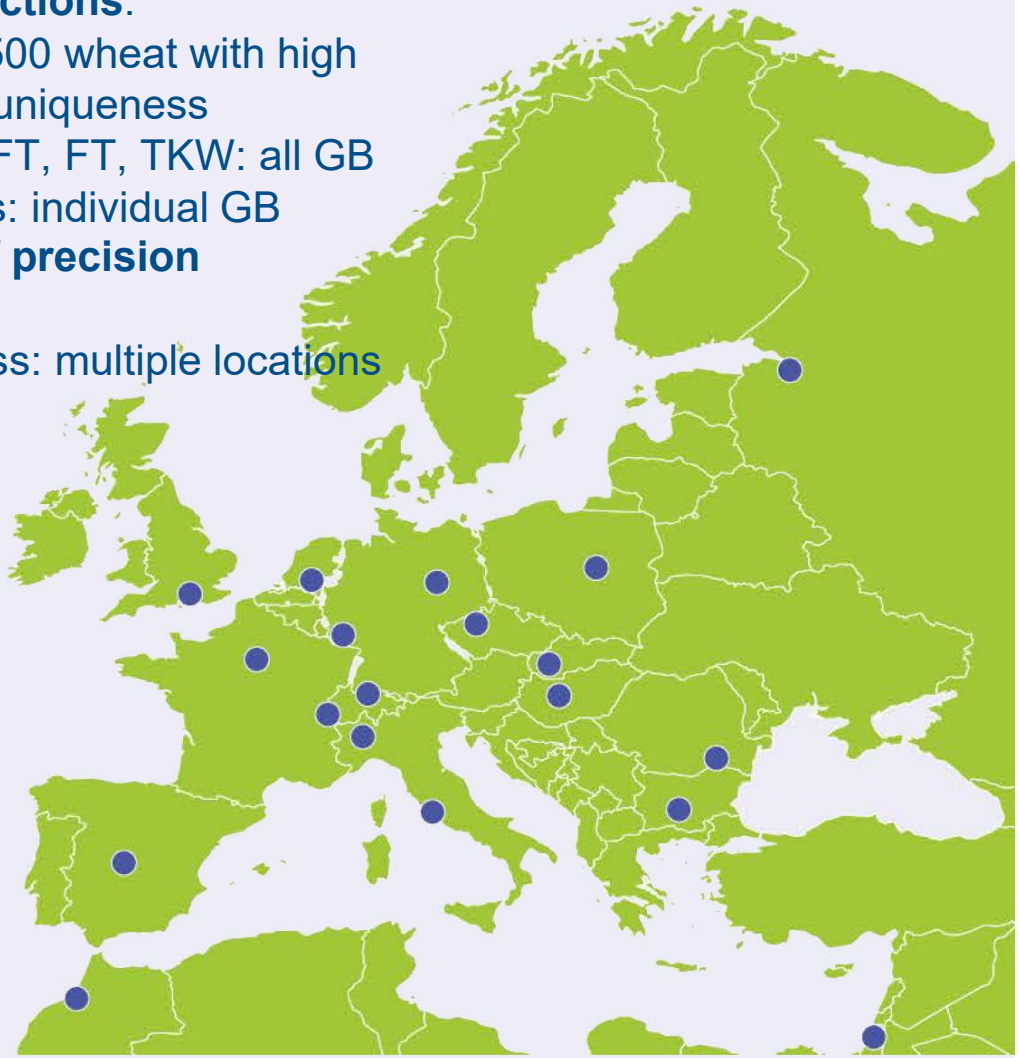


Precision collections:

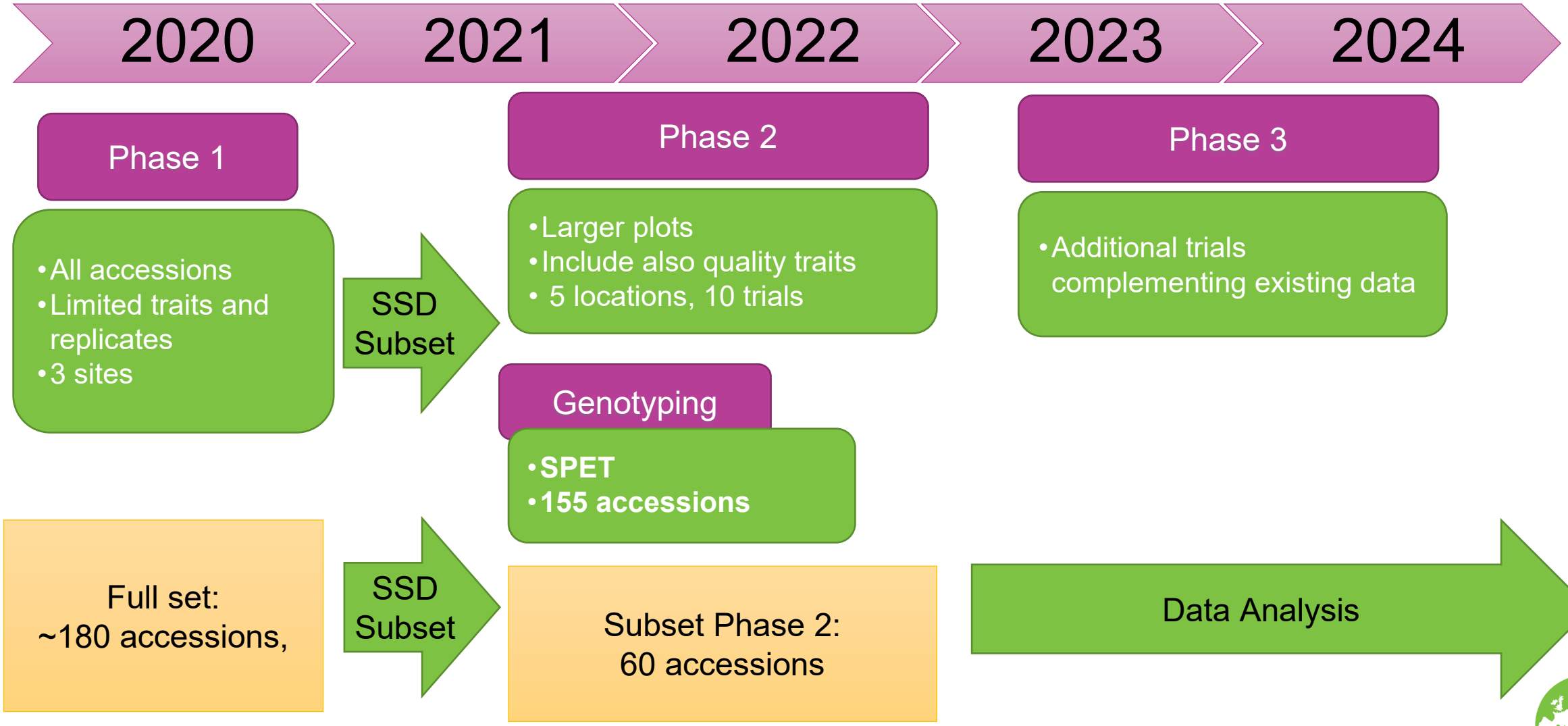
- 500 barley/500 wheat with high potential of uniqueness
- Agronomy: FT, FT, TKW: all GB
- Biotic Stress: individual GB

Selected set of precision genotypes

- Abiotic Stress: multiple locations



EVA – Lettuce network workplan - field



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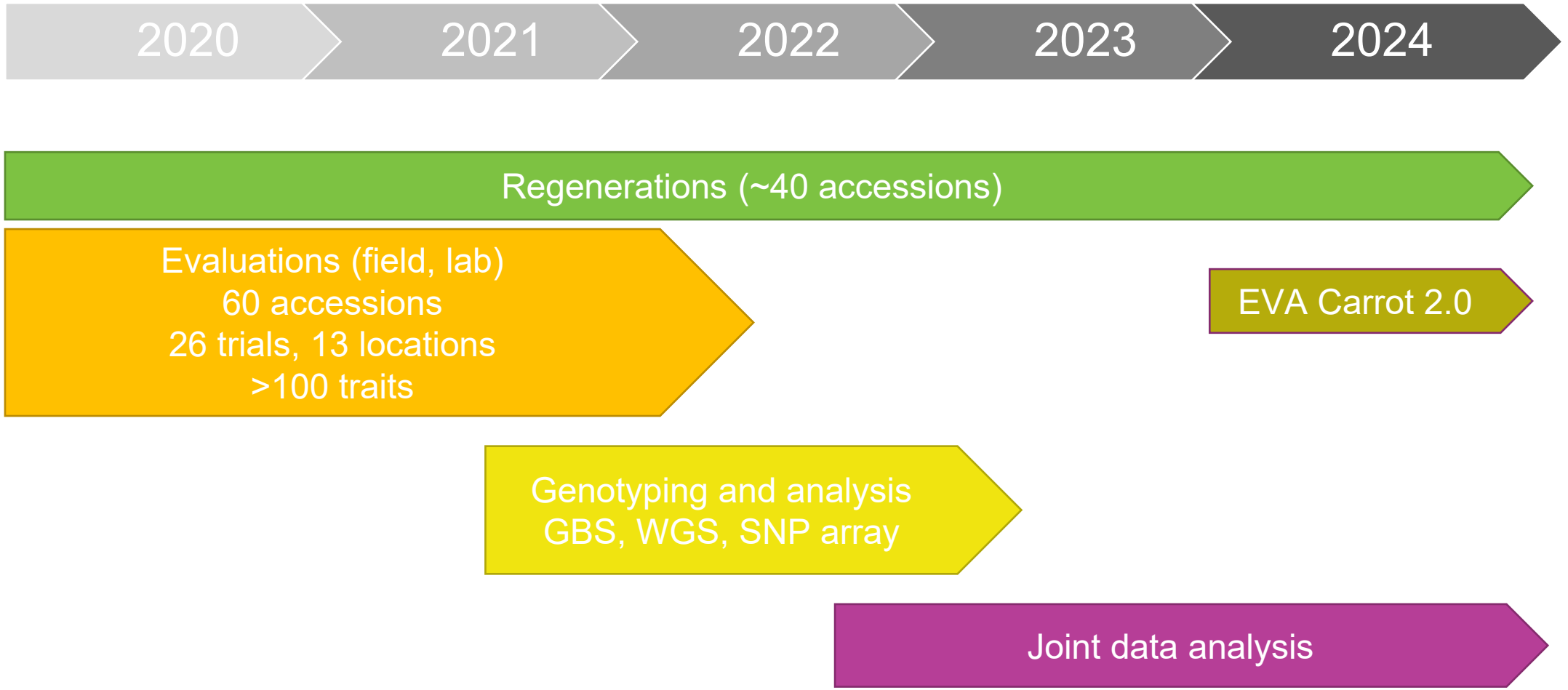
Workplan of EVA Carrot network



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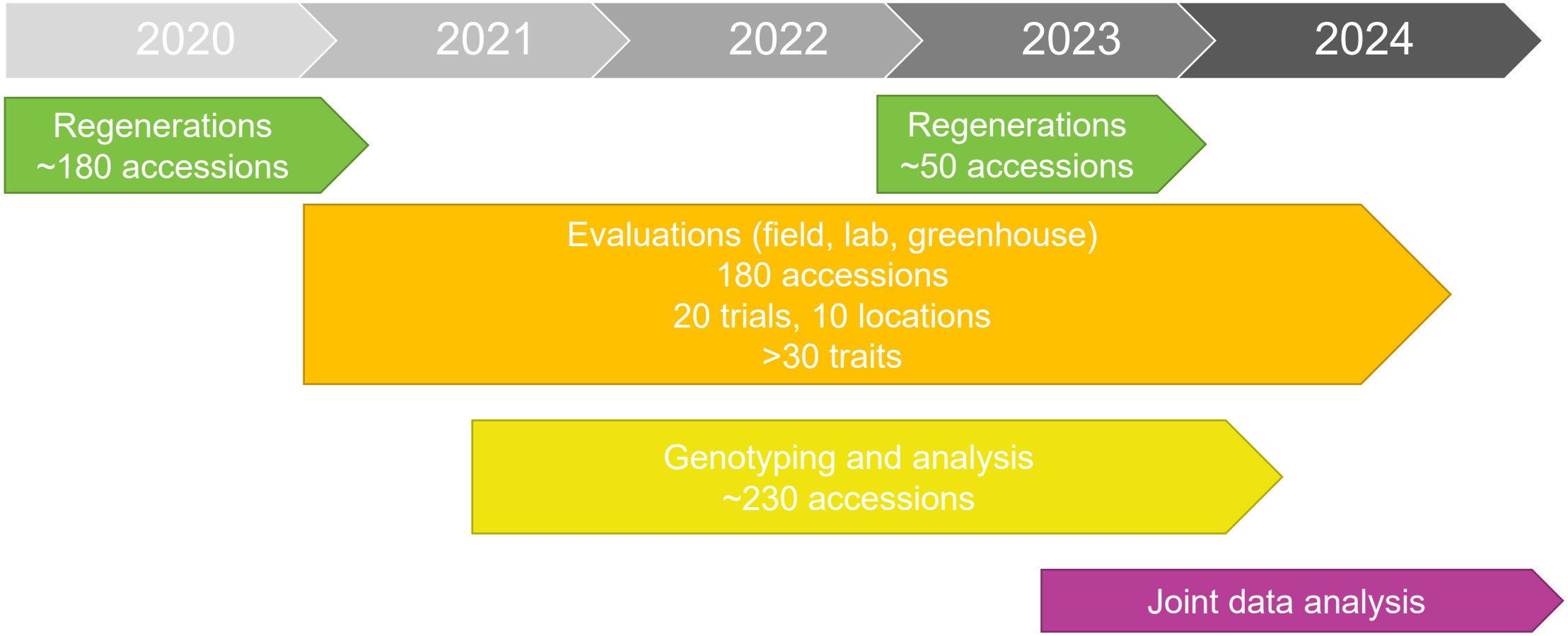
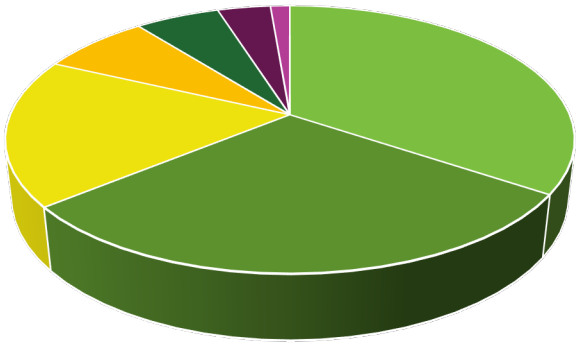
Workplan of EVA Pepper network

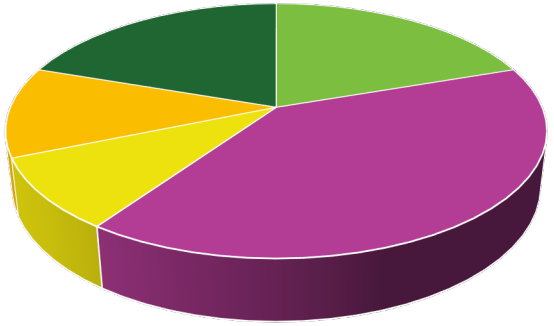


Output of EVA networks (2020-2023)

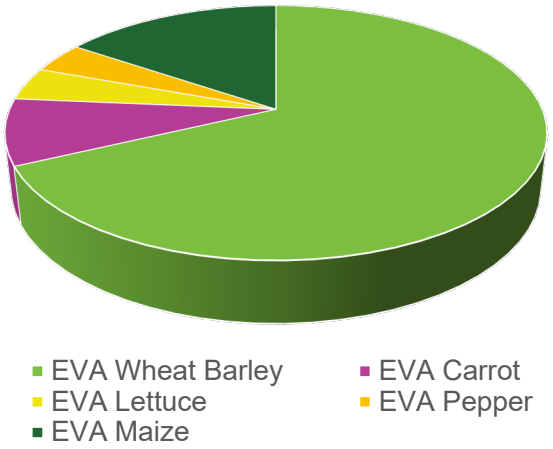
>5000 accessions



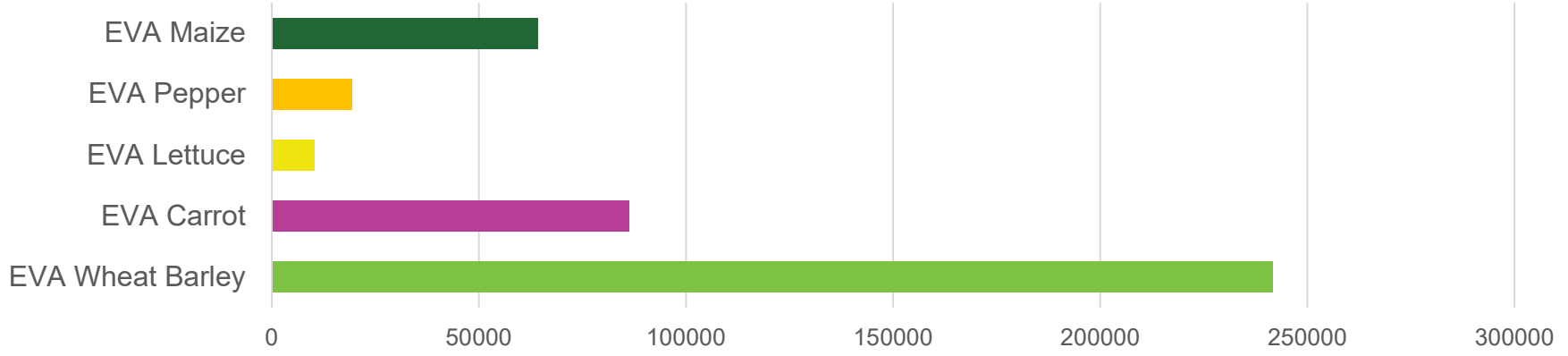
> 230 Traits evaluated



309 EVA trials



> 420.000 evaluation data points



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Evaluated accessions are genotyped. Data are stored in public databases

5

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

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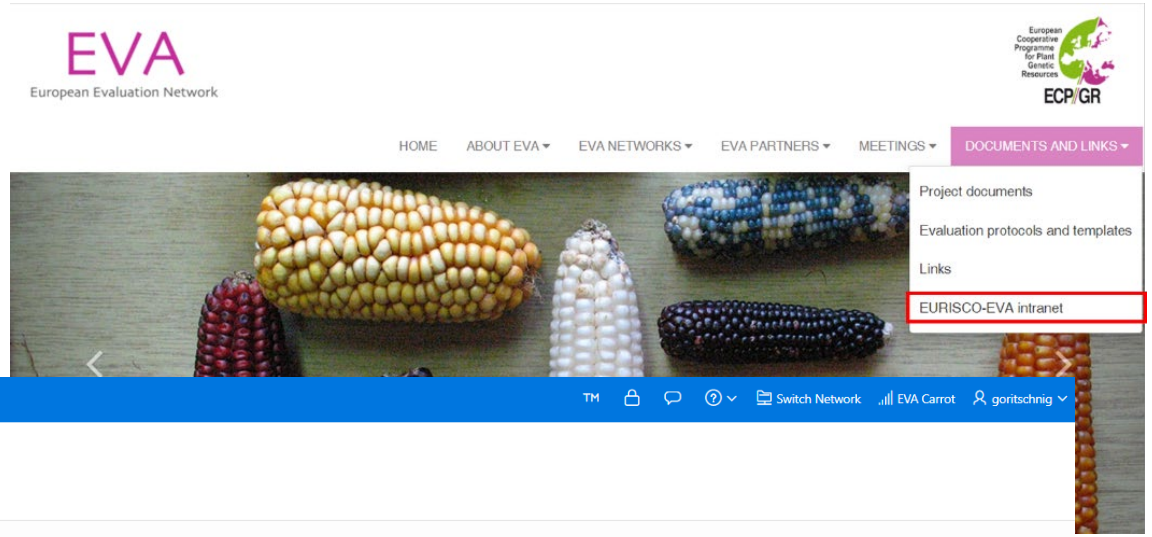
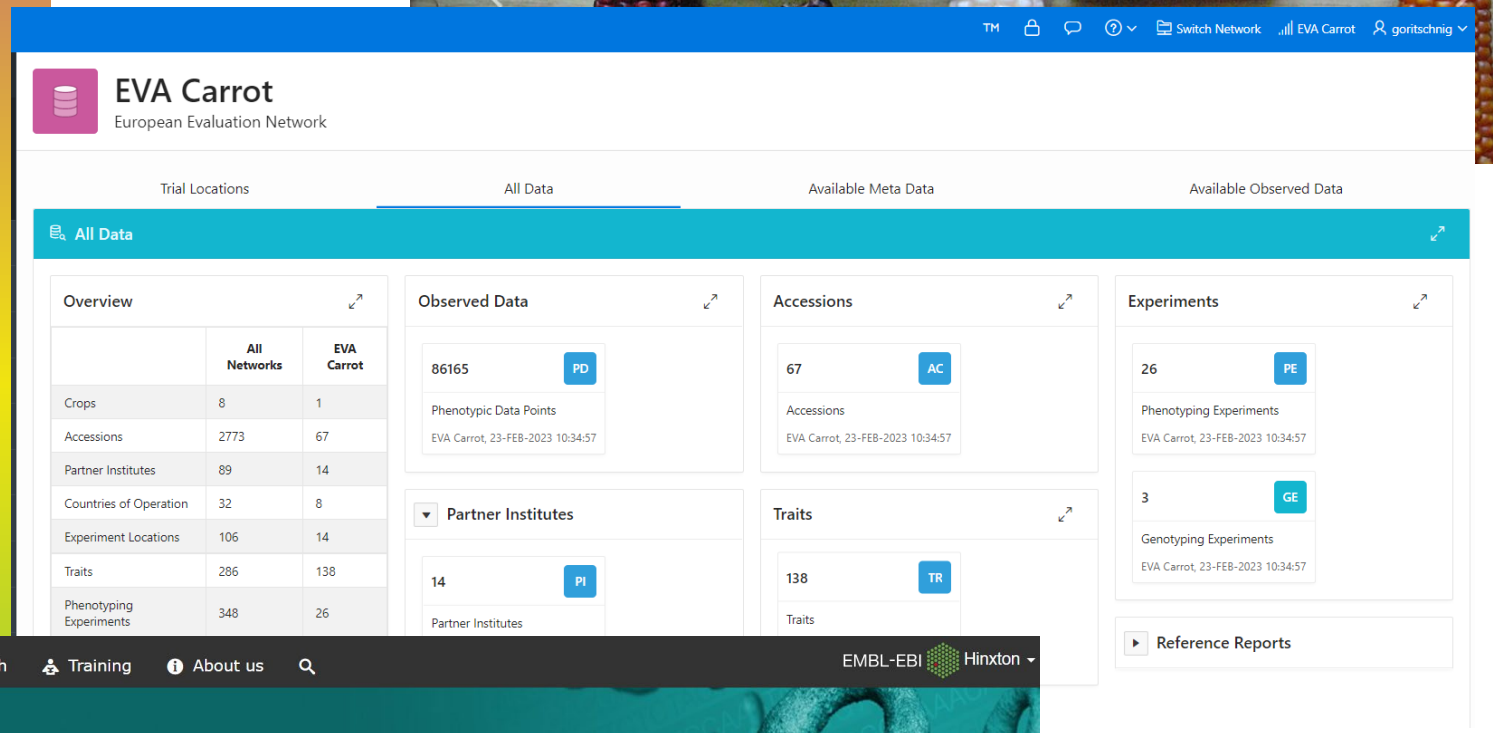
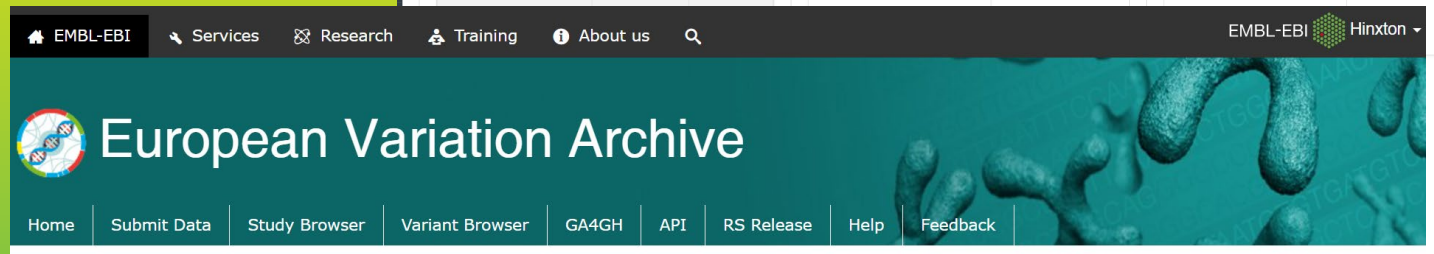
EVA Data management







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

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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

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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

48 trials, >64k data	EVA Maize	• SNP array genotyping - INRAE • Phenotypic analysis – all partners their trials, led by CSIC • Combined analysis – tbd, led by INRAE
210 trials >240k data	EVA Wheat and Barley	• SNP array genotyping - SGS • Phenotypic analysis – Task force for data analysis • Combined analysis – crop responsibles per zone (Luke, JKI, CREA-GB)
26 trials, >80k data	EVA Carrot	• Genotyping by GBS, WGS, SNP array – JKI • Phenotypic analysis – all partners their trials • Combined analysis – all partners for different traits, GWAS JKI
15 trials, >10k data	EVA Lettuce	• Genotyping by SPET – CREA-OF • Phenotypic analysis – all partners their trials, overall statistics Limagrain • Combined analysis – led by Limagrain/CREA-OF
20 trials >20k data	EVA Pepper	• SNP array genotyping – CREA-OF • Phenotypic analysis – all partners their trials • Combined analysis – tbd, led by CNR

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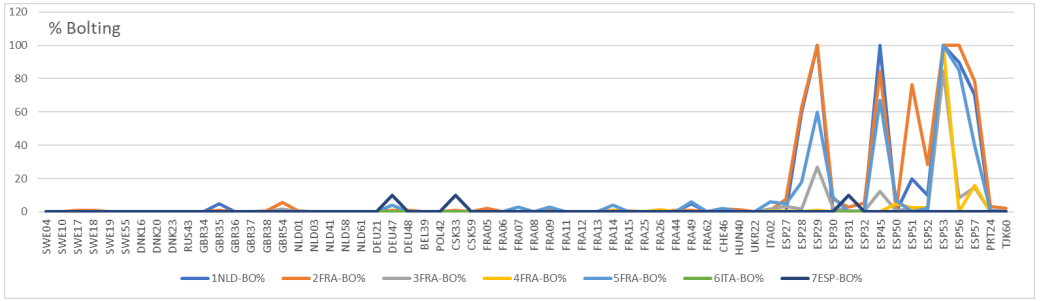
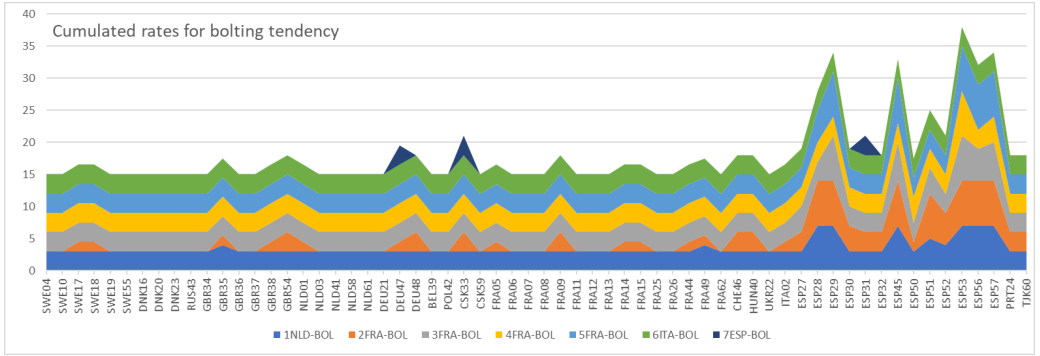
JOINT DATA ANALYSIS ADDS VALUE TO EUROPEAN CROP ACCESSIONS

Data analysis – phenotypic data

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

Photos: E. Geoffriau, Institut Agro Rennes-Angers, France





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)

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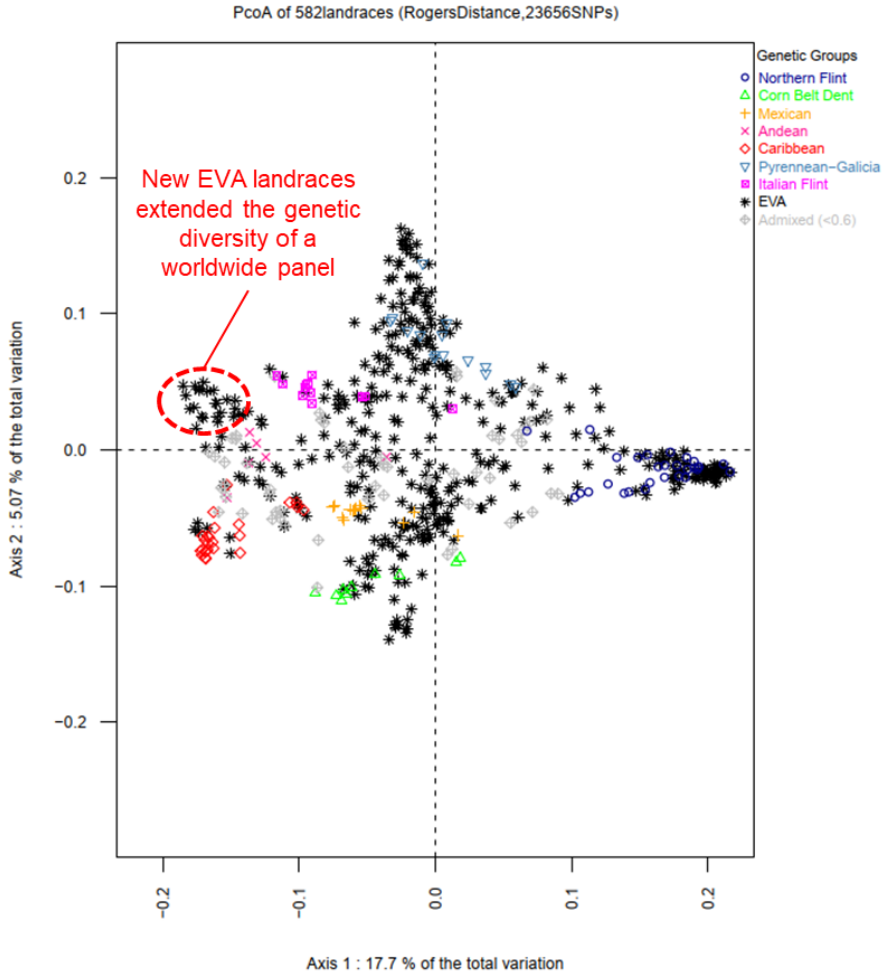
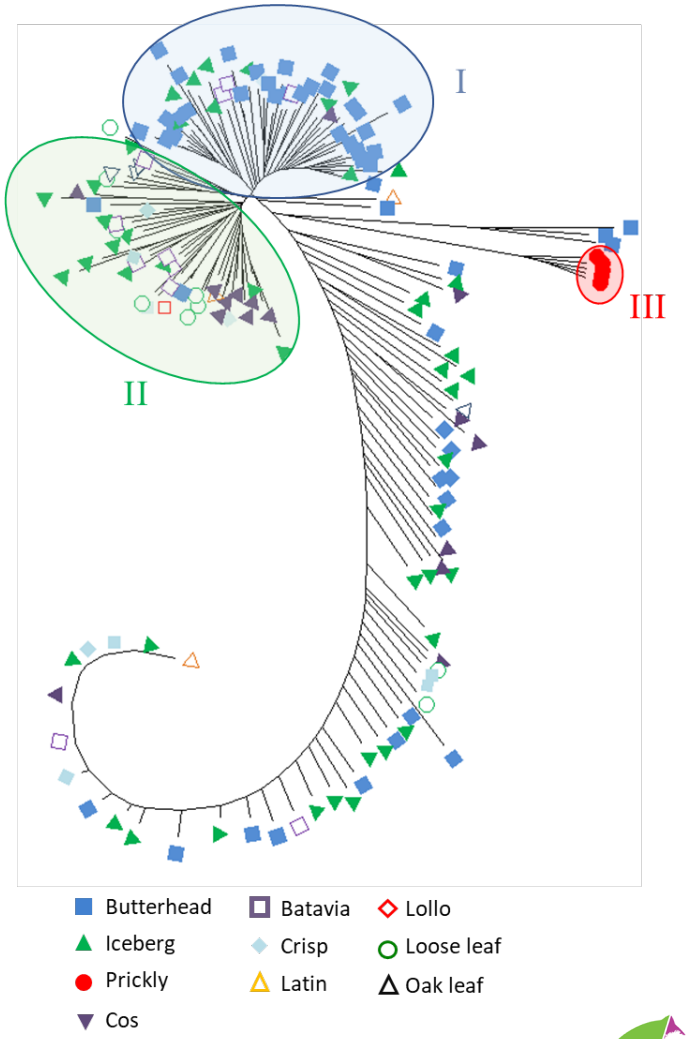
JOINT DATA ANALYSIS ADDS VALUE TO EUROPEAN CROP ACCESSIONS

Data analysis – genetic structure

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



D. Madur, INRAE, France



P. Tripodi, CREA, Italy

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JOINT DATA ANALYSIS ADDS VALUE TO EUROPEAN CROP ACCESSIONS

Genome-wide association in Lettuce

6 Models:

GLM

MLM

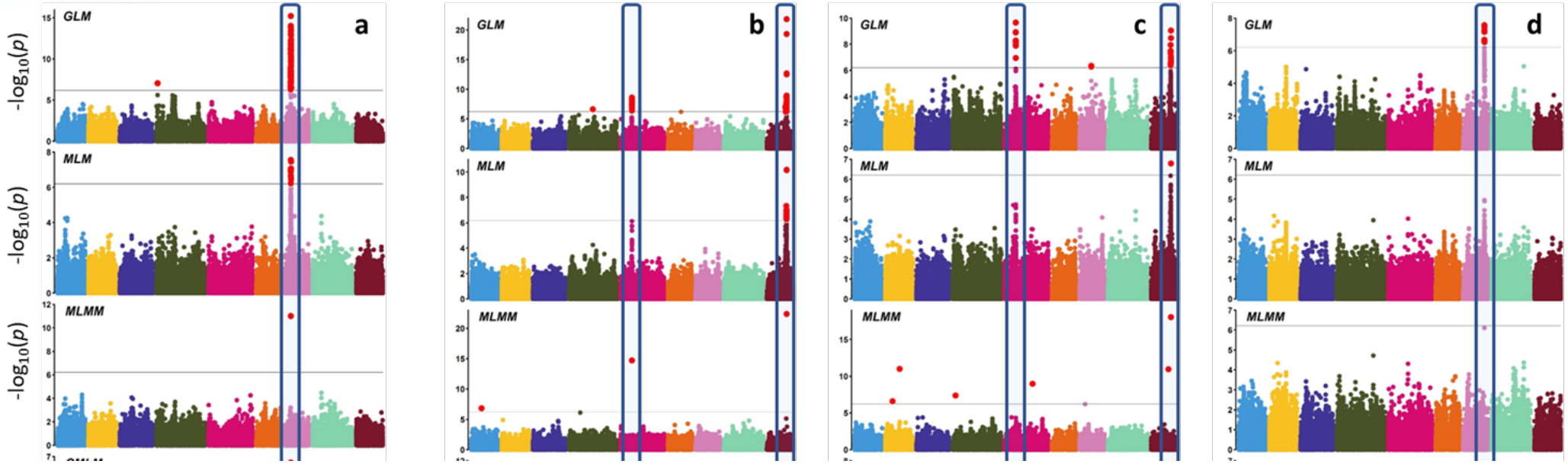
MLMM

a) Seed colour

b) Leaf anthocyanin

c) Outer leaf colour

d) Bolting time



Tripodi et al (2023) Frontiers in Plant Science.
https://doi.org/10.3389/fpls.2023.1252777

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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)

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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

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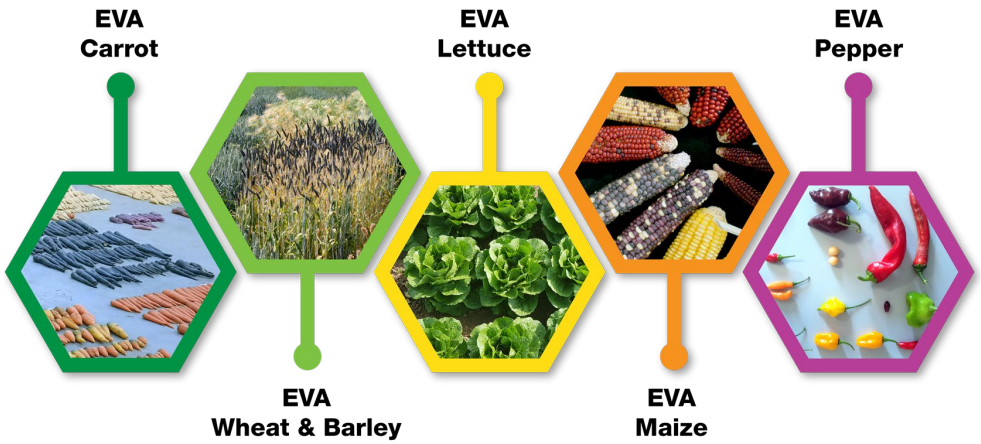
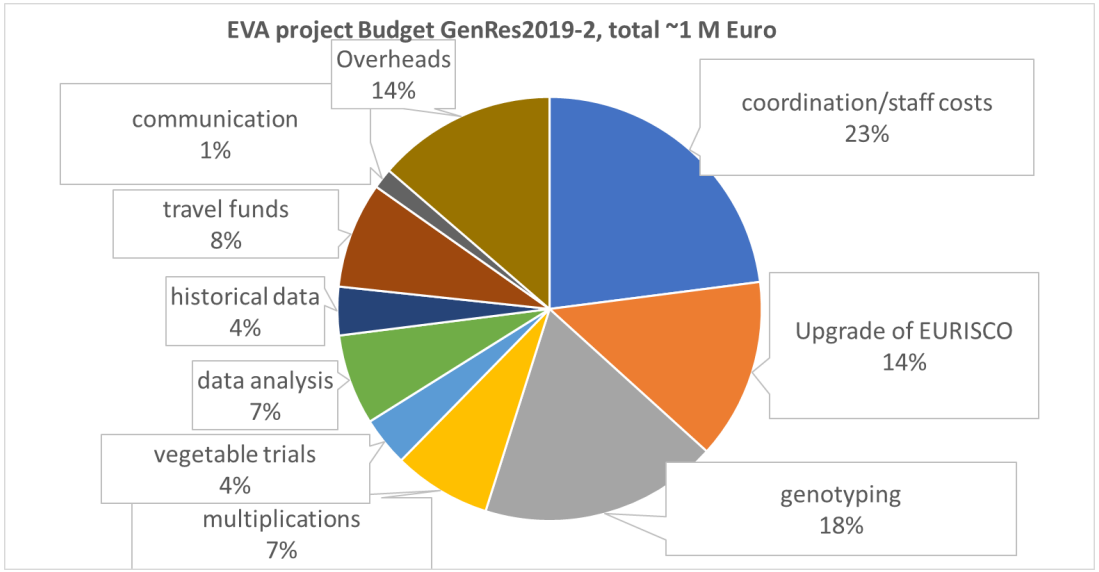
Funding options for activities in EVA Legumes

Funding sources for EVA



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

Federal Ministry of Food and Agriculture



Partners contribute in-kind to

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

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

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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)

Rete Semi Rurali

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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

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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

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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)

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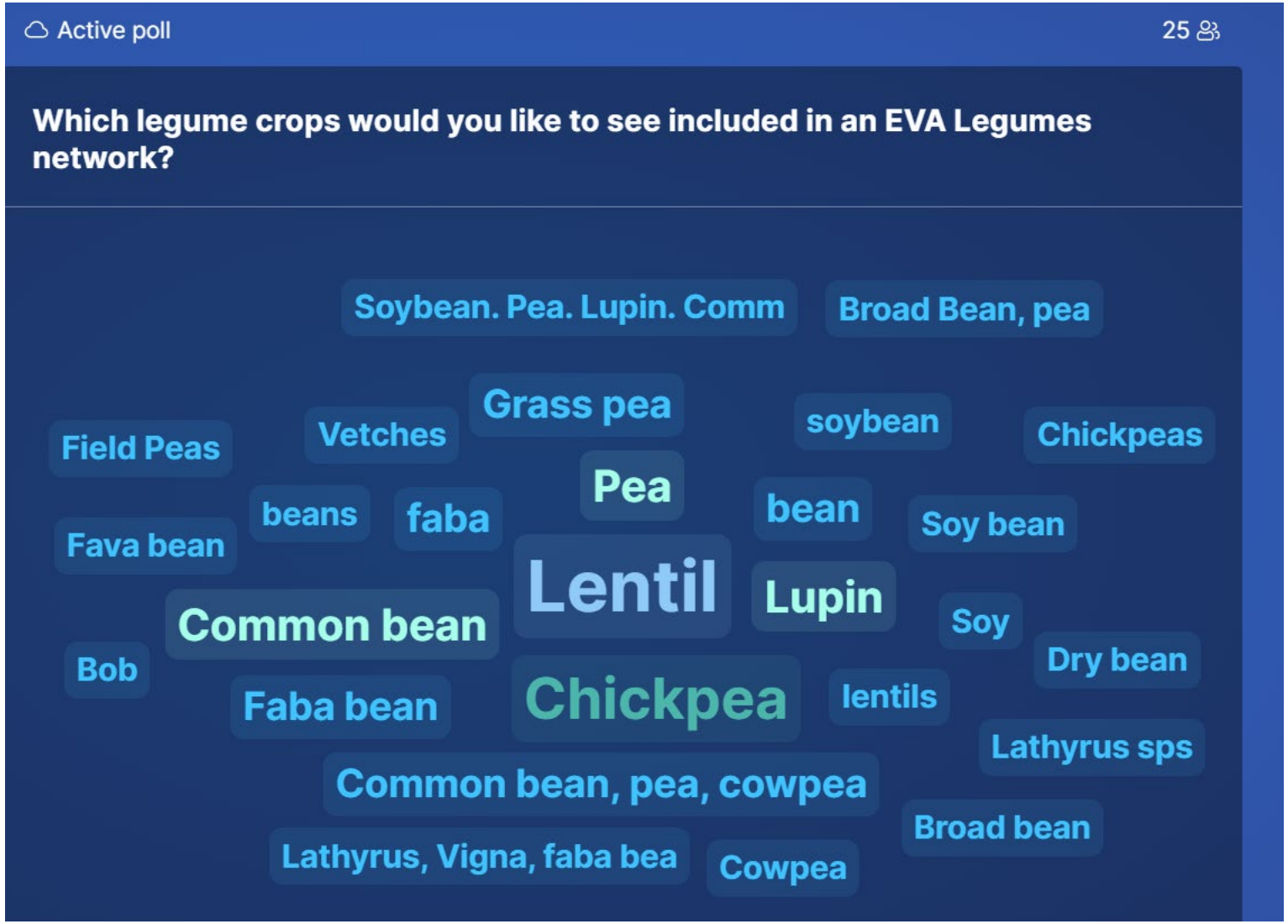
Next Steps

- **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

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THANK YOU