

Request for extension of the project “Implementation of the ECPGR European Evaluation Network (EVA) on wheat/barley and vegetable crops (carrot, lettuce and pepper)” GenR 2019-2 with the addition of a Maize component and improved access to existing barley, wheat and maize evaluation data

Following the first meeting of the ECPGR Maize Working Group, held 2-3 December 2019 in Belgrade, Serbia, the opportunity has arisen to establish a maize network as an addition to the ongoing EVA project GenR 2019-2 and therefore a project extension is requested until 30 November 2022 with a budget increase of 299 736 EUR.

1. Background

At its 15th meeting in Thessaloniki, Greece (May 2018), the ECPGR Steering Committee approved the objectives of ECPGR for Phase X (2019-2023). Among these, objective 5 is aiming to promote the use of PGRFA and specifically the expected output 5.1 concerns the development of a European Evaluation Network for PGRFA.

Between 2017 and 2019, two ECPGR projects funded by Germany have set the basis for the formulation, consensus building and establishment of an agreed framework at ECPGR level for the implementation of a European Evaluation Network (EVA). The first project (GenR 2016-2) (Jan 2017 – May 2018), called “Private Public Partnerships (PPP) for the Use of Plant Genetic Resources for Food and Agriculture (PGRFA)”, involving representatives of the private and public breeding sectors from 18 European countries, promoted the development of a European Evaluation Network for its strategic importance for Europe with an opportunity to use PGRFA to facilitate adaptation of European agriculture to climate change and to contribute towards achieving related Sustainable Development Goals (SDGs). Subsequently, the 15th ECPGR Steering Committee meeting held in Greece 15-17 May 2018 endorsed the proposal for a European Evaluation Network and assigned to it the acronym EVA. Concomitantly, ECPGR and the European Seed Association (ESA, now Euroseeds) signed a Memorandum of Understanding for enhanced cooperation, in particular within the framework of EVA. The ECPGR Steering Committee also included the development of EVA among the ECPGR objectives for Phase X (2019-2023), specifically the generation of evaluation data throughout the European region and provision of such data to EURISCO.

A second project (GenR 2018-3) (Sep 2018 – Apr 2019), was dedicated to the organization of two ECPGR workshops for the preparation of a European Evaluation Network (EVA) on wheat/barley and a vegetable crop. The main criteria identified for the selection of exemplar crops were the potential impact in an overall variety development process (perception of missing diversity) and importance of final objectives (biotic/abiotic environmental adaptation, quality, diversification of production). An essential element was also the readiness of a group of actors to get committed and participate in the Evaluation Network, as well as the synergy with existing projects. With this regard, two workshops were held involving breeding companies, researchers and genebank representatives. General appreciation was expressed for the advantages deriving from the implementation of an ongoing programme dedicated to systematically genotype and evaluate European genebank accessions in multiple environments, adopting common protocols and sharing the resulting data on a central documentation system. There was also agreement to make these data publicly available outside the

specific crop consortia after an embargo period of three years. The cereal breeding companies were unanimous in identifying disease resistance as the most suitable and useful traits to be evaluated through the Network and agreed to carry out annual evaluation of a defined and limited amount of genebank accessions at their own cost. In the case of vegetable breeders, phenotypical, harvest and quality traits were also considered important for this exercise, together with disease resistance traits. Genebank managers agreed on the importance to provide minimum quantities of selected genebank accessions to the network for multiplication, genotyping and evaluation. It was considered a benefit for the genebanks to be able to serve users in a context that would make it possible to add genotypic and phenotypic information to their conserved accessions, at no cost for the genebanks. The Wheat and Barley workshop agreed to evaluate the same material in different environments of three macro-zones (north, centre and south Europe) and to focus on the following five crops: Spring barley, Winter barley, Spring wheat, Winter wheat, Durum wheat (only for southern region). During the vegetables workshop, three exemplar crops were selected, representing fruit (Pepper), leaves (Lettuce) and root (Carrot) products and interest was expressed towards evaluation of mainly landraces and possibly wild relatives. All materials under investigation will be pre-screened in the laboratory for susceptibility to respective critical diseases. After multiplication, the same material will then be field tested in multiple environments. All accessions of all crops are planned to be genotyped. The implementation of the wheat/barley and vegetables EVA Networks was then facilitated by the approval of a third project (GenR 2019-2)(July 2019-June 2022), covering the costs of coordination by the ECPGR Secretariat, upgrade of EURISCO, multiplication and genotyping of genebank accessions and travel funds to consolidate the networks. As of November 2019, 10 public institutions and 17 breeding companies from 14 countries undersigned the Letter of Agreement to participate in the wheat and barley EVA Network; similarly, 12 public institutions and 14 breeding companies from 12 countries undersigned the Letter of Agreement to participate in the vegetables EVA Network. First batches of accessions have been acquired from genebanks and provided to three institutions acting as multipliers respectively in the North, Central and South part of Europe.

Within the framework of German-funded project GenR 2019-5, the first Meeting of the ECPGR Working Group on Maize was held in Belgrade, Serbia, 2-3 December 2019. As an outcome, the WG expressed interest, availability and commitment to implement an EVA Network component for Maize, following the examples of the ongoing components on wheat, barley and vegetables.

In this context, it is proposed to extend project GenR 2019-2 to enable the implementation of the EVA-maize Network for three years under the Coordination of the ECPGR Secretariat. As part of this extension, the establishment of a maize crop consortium will be formalized, through signature of Letters of Commitment and Cooperation Agreements. Extension of the EVA initiative to maize will enable the newly formed WG on Maize to rapidly engage in adding value to the European maize genetic resources within an appropriate framework of public/private partnerships, with adoption of common standards, use of EURISCO and strengthening of the AEGIS collection.

It has also been pointed out that several regional or national publicly funded projects have taken place in the recent past, in which germplasm accessions of, inter alia, barley, wheat and maize have been evaluated, but the data generated are not easily accessible. It is proposed here to retrieve such type of data from the data originator, wherever possible, and prepare such data for inclusion into EURISCO, utilizing the appropriate Characterization & Evaluation EURISCO templates. One specific example

relates to the maize core collection that was characterized during the EU-funded 'GenRes 088' project (1997-2001).

Activities that will be carried out for this project are suitable to be documented for public awareness purposes, according to the ECPGR Communication strategy. A contribution is therefore requested towards the preparation of the ECPGR Jubilee Video, which is planned to be prepared in time for the 40th anniversary of ECPGR in October 2020.

Objectives of the extended project

- a) Kick-start the implementation of the European Evaluation Networks on maize under the coordination of the ECPGR Secretariat
- b) Formalize the evaluation network maize consortium through the signature of Letters of Commitment by the partners and finalize specific Cooperation Agreements
- c) Improve the functionality of the EURISCO documentation system to enable a dedicated intranet platform for the maize consortium, to display and analyze data for the partners under a three years embargo
- d) Perform evaluation for biotic and/or abiotic stresses of between 100-250 European genebank accessions of maize per year, in possibly 10 sites suitable for each of two maturity categories ('mid-late' and 'late'), for two years, for a total of at least 200 and up to a maximum of 500 maize accessions evaluated
- e) Use jointly agreed evaluation protocols (experiment set up; scoring methodology) and data collection standards (ontologies) for data collection
- f) Genotype all the accessions selected for evaluation
- g) Include the projects derived phenotypic and genotypic data in EURISCO
- h) Facilitate inclusion of evaluated accessions into AEGIS
- i) Include into EURISCO existing characterization and evaluation data from at least 100 accessions of wheat and barley and ca. 100 accessions of the European maize core collection.
- j) Contribute to the preparation of the ECPGR Jubilee Video

2. Activities

Activities will be carried out around three growing seasons, thereby starting a rolling cycle of evaluations that is expected to continue beyond the end of the current project, as follows (also see attached excel Table 1):

- Year 1 (2020): setting up of standards, acquisition, multiplication and redistribution of material (1st set)
- Year 2 (2021): first round of evaluation (1st set); second round of acquisition, multiplication and redistribution (2nd set)
- Year 3 (2022): second round of evaluation (1st set); first round of evaluation (2nd set); third round of acquisition, multiplication and redistribution (3rd set)
- Year 4 (2023) [extra budget]: second round of evaluation (2nd set); first round of evaluation (3rd set); fourth round of acquisition, multiplication and redistribution (4th set)

Extra budget activities are planned with the intention to give continuity to the network on a rolling basis. However, additional funds will need to be procured before extra budget activities can effectively be confirmed.

In more detail, the following activities will be carried out:

- i. Obtain signature of EVA-Letter of Commitment by the partners – identified potential partners are the following, but the list can be extended:
 - a. **Breeding companies/Commercial breeding programmes:** Arvalis, Euralis, Limagrain, RAGT-2n, Syngenta (France); KWS, Research & breeding Dottenfelderhof (Germany); Planta (Italy), MRI Zemun Polje (Serbia) Agrosa, Fito, Secobra Recherches (Spain); Getreidezüchtung Peter Kunz (Switzerland); Corteva (Multi).
 - b. **Genebanks/Research institutes:** Institute of Plant Genetic Resources, Tirana (Albania); CRI, Prague (Czech Republic); INRA, Gif-sur-Yvette and Montpellier (France), CREA-CI Bergamo (Italy), IPK, Gatersleben (Germany); INIAV, Braga and IPC, Coimbra (Portugal); Suceava Genebank (Romania); MRI Zemun Polje (Serbia); CSIC Pontevedra (Spain); Agroscope Nyon (Switzerland).
- ii. Extend list of partners
- iii. Annual meetings of consortium partners (first meeting inviting breeding companies to confirm their commitment, tentatively in March 2020)
- iv. Draft of the Consortium Agreement by the Secretariat, in consultation with partners and obtaining related signatures
- v. Agreement on traits to be evaluated during 2021, 2022 and (extra budget) 2023
- vi. Design of the evaluation experiments, coordinated by Task Forces (TF) to be defined
- vii. Selection at least 50 up to 125 accessions per year per each maturity group) (trials repeated for 2 years)
- viii. Dispatch by genebanks of agreed accessions (50-100 seeds) with SMTA to the multiplier institutes (unless multiplication can take place in the originating genebanks)
- ix. Multiplication of accessions by multipliers. Each accession will be multiplied per se as well as it will be crossed with a tester and the progeny of the cross will also be field evaluated by breeders
- x. Dispatch of multiplied accessions from multipliers to field evaluators with SMTA (possibly 10 locations per maturity group) and from multipliers to genotyping institute/service provider (INRA, France)
- xi. Agreement on evaluation protocols and data collection standards (ontologies), coordinated by Task Forces to be defined.
- xii. Definition of genotyping methodology (for example bulk of 15 plants and use of 50K SNP chip)
- xiii. Analysis of database requirements by EURISCO staff and provision of special functionalities (intranet platform for the partners, with 3 years embargo before making data widely public, etc.)
- xiv. Carry out field evaluation in multiple locations: the same 50-125 accessions tested for biotic and/or abiotic stresses (such as resistance to *Aspergillus*, *Fusarium*, *Helminthosporium*, tolerance to drought and cold) for each maturity group (mid-late and late), during growing seasons 2021, 2022 and 2023
- xv. Dispatch of evaluation data based on agreed standard exchange formats from all the evaluation sites to the central repository (EURISCO), after harvest 2021, 2022 and 2023
- xvi. Carry out the genotyping of selected accessions under evaluation and dispatch of genotypic data to consortium partners (ca. 250 per year per crop) for three years (INRA/service provider)

- xvii. Genotypic data analysis (INRA), phenotypic data analysis (CSIC) and data display through the EURISCO Intranet platform
- xviii. Promote inclusion of multiplied accessions into AEGIS
- xix. Use the EURISCO templates to transfer to EURISCO existing characterization and evaluation data of European maize core collection accessions (Partners of GenRes 88 project: INRA, France, IPK, Germany; NAGREF, Greece; CREA, Italy; CGN, The Netherlands; INIAV, Portugal; CSIC, Spain)
- xx. Use the EURISCO templates to transfer to EURISCO existing characterization and evaluation data of European wheat or barley accessions (partners to be identified)
- xxi. Preparation of short video clips to be filmed with professional equipment, based on the guidance provided by the “ECPGR Jubilee Task Force” and in line with the ECPGR Communication Strategy.
- xxii. Plan for Network continuation of rolling activities after the end of the project

3. Expected outcomes

- a) EVA Network on Maize established with Letters of Commitment and Consortium agreements signed by possibly 20 partners
- b) Evaluation for biotic and/or abiotic tolerance traits of 100-250 maize genebank accessions per year for three years in multiple locations (with each batch of accessions tested for two years)
- c) Genotyping of 250 genebank accessions per year for three years
- d) Provision of related genotypic and phenotypic data to a central repository and data made accessible through EURISCO, exclusively to consortium partners for three years, then open to the general public
- e) Increased number of project accessions entering AEGIS
- f) Existing characterization/evaluation data for ca. 100 wheat/barley and ca. 100 maize core collection accessions made available via integration in the EURISCO catalogue.
- g) Preparation of video clips for ECPGR Jubilee Video

4. Continuation of the EVA Network after the project

The crop specific activities initiated through this project are planned to ideally continue in the form of rolling cycles that can exercise their best effect if they remain active over multiple years, much beyond the duration of this project. For this reason, some activities that are meant to be carried out beyond the timeframe of this project have been included in the planning. Some activities will require additional budget (e.g. second round of evaluation of 2nd set and first round of evaluation of 3rd set of maize accessions during Year 4); the coordination of these activities complementing the outcome of the current project may only be carried out if additional budget sources can be identified by the project partners. Establishing a plan for the continuation of rolling activities after the end of the project is envisaged as a task of this project.

5. Chronogram of activities for the Maize component of EVA

| | 2019 | 2020 | | | | 2021 | | | | 2022 | | | |
|---|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Activity | Dec | Jan-Mar | Apr-Jun | Jul-Sep | Oct-Dec | Jan-Mar | Apr-Jun | Jul-Sep | Oct-Dec | Jan-Mar | Apr-Jun | Jul-Sep | Oct-Nov |
| Obtain signature of EVA-Letter of Commitment by the partners | | | | | | | | | | | | | |
| Extend list of partners | | | | | | | | | | | | | |
| Annual meetings | | | | | | | | | | | | | |
| Signature of Consortium Agreement | | | | | | | | | | | | | |
| Agreement on traits to be evaluated | | | | | | | | | | | | | |
| Selection of genebank accessions | | | | | | | | | | | | | |
| Dispatch of agreed accessions with SMITA to the multiplier institutes | | | | | | | | | | | | | |
| Multiplication of accessions by multipliers | | | | | | | | | | | | | |
| Dispatch of multiplied accessions from multipliers to evaluators with SMITA | | | | | | | | | | | | | |
| Design of the evaluation experiments | | | | | | | | | | | | | |
| Agreement on evaluation protocols | | | | | | | | | | | | | |
| Definition of genotyping methodology | | | | | | | | | | | | | |
| Analysis of database requirements by EURISCO staff | | | | | | | | | | | | | |
| Provision of special EURISCO functionalities | | | | | | | | | | | | | |
| Carry out evaluation in multiple locations with same accessions | | | | | | | | | | | | | |
| Dispatch of evaluation data based on agreed standard exchange formats from all the evaluation sites to the central repository (EURISCO) | | | | | | | | | | | | | |
| Carry out the genotyping of selected accessions | | | | | | | | | | | | | |
| Data analysis and data display through the EURISCO Intranet platform | | | | | | | | | | | | | |
| Promote inclusion of multiplied accessions into AEGIS | | | | | | | | | | | | | |
| Plan for Network continuation of rolling activities after the end of the project | | | | | | | | | | | | | |
| Transfer of existing C&E data of maize core collection accessions to EURISCO | | | | | | | | | | | | | |
| Transfer of existing C&E data of wheat and barley accessions to EURISCO | | | | | | | | | | | | | |
| Preparation of video clips for "ECPGR Jubilee" | | | | | | | | | | | | | |
| Final Report preparation | | | | | | | | | | | | | |