BREED & FEED

CREDIT Vibes

Deliverable 2.2 – Report on Data Management Plan	

Project Acronym:	CREDIT Vibes
Project full title:	TWINNING GREEN-EDITING VIBES FOR FOOD
Grant no:	101059942
Type of action:	Horizon Europe Twinning Western Balkans Special
Project start date:	01/01/2023
Project end date:	31/12/2025
Cordis link:	https://cordis.europa.eu/project/id/101059942

Abstract of deliverable:	This deliverable describes the data management procedures involved in the project. CREDIT Vibes provides a clear and comprehensive guide to the various steps involved in the processing of data collection, consent procedure, storage, protection, retention and destruction of data, and confirmation that they comply with national and EU legislation.

**Funded by
the European Union**

Contents

1. Data Summary

This Data Management Plan (DMP) guides the CREDIT Vibes Consortium in managing the data quality and protection issues that will arise along the project life. The DMP focuses on encouraging good data management as an essential element of best research practices. This deliverable describes the data management life cycle for all datasets to be collected, processed and/or generated by the research project, always in accordance with the "Guidelines on Data Management in Horizon Europe". The DMP describes, among others:

- the handling of research data during and after the project
- the type of data that will be collected, processed, or gathered
- what methodology and standards will be applied
- whether and how the data will be made (openly) accessible
- how the data is stored

The data reused, collected and generated in CREDIT Vibes is required to achieve the project objectives:

O1 - To develop a scientific roadmap for nutribreeding, innovative agro-technologies and high-quality nutriproducts

O2 - To develop a technology roadmap focusing on translating scientific excellence production into new approaches, services and consulting

O3 - To significantly boost productivity by enhancing workflow efficiency

O4 - To improve capability to compete for EU funding that help to support in the long-term the sustainability of MRI

O5 - To significantly improve Human Resource (HR) sector and train the new generation of highly-skilled staff capable of developing innovations and jobs of the future and their translation into the economy

O6 - To significantly improve dissemination, exploitation and collaboration

The majority of the data from CREDIT Vibes will be either collected or generated. In several occasions, reused data from open access repositories (Zenodo) or from past MRI experiments will be utilised to compare past crop trends (WP1) and assess the positive impact of CREDIT Vibes innovations.

Table 1.1 Types of data collected

	GROUP 1 (WP1) Technical Data	GROUP 2 (WP1, WP2 and WP3) Personal & non-personal data – trainings	GROUP 3 (WP4 and WP5) Personal & non-personal data – dissemination & management
Collected/generated data	Generated, collected data & reused data	Generated and Collected data	Generated and collected data
Origin(s)	Most of them based on field and experimental studies which will be performed during the project: • Data from soils characterization • Data from laboratory experiments • Data on crops (maize & soy beans) • Data of fertilizer (organic and inorganic) dosages • Data of above- and belowground biodiversity • Data from energy and mass balances as well as efficiencies	• Registration lists from internal staff training sessions • Attendance lists and personal data from international trainings, secondments and staff exchanges • Satisfaction surveys and training needs analysis (particularly for MRI staff) in their capacity building activities • Appearance in video/audio material during trainings • Registration information (personal data) of the users of the CREDIT Vibes platform (web)	Several, mainly contacts of partners, stakeholders and those generated in dissemination and communication activities (workshops, conferences, reports): • Data from dissemination and communication events • Partners contact information • Data from internal and external reports

Nature	Experimental data, field data, laboratory data, scientific reports & pre-existing data sets (open access) from Zenodo and MRI repositories. A detailed set of such data can be found in Appendix A.	Surveys & voluntary registration forms.	Minutes from meetings, workshops and conference. Specific dissemination data. Reports
Type	- Mixed media data (video –MP4, AV); - Visual data (images – JPG, PNG, BMP); -Numerical data Reference/canonical data Derived/compiled data /Experimental data (XLSX); - Quantitative data; - Qualitative data;	- Mixed media data (video –MP4, AV); - Visual data (images – JPG, PNG, BMP); - Quantitative data; - Qualitative data;	- Mixed media data (video – MP4, AV); - Visual data (images – JPG, PNG, BMP); - Quantitative data; - Qualitative data;
Purpose of the data	Objective 1	Objectives 2 and 3	Objectives 4 and 5
Size	To be evaluated during the course of the project. The expected size depends on the extent and the nature of the data that are made available.	To be evaluated during the course of the project.	To be evaluated during the course of the project.

Data Utility	• CREDIT Vibes consortium; • European Commission services and European Agencies; • EU National Bodies; • The general public including the broader scientific community; • Internal/external reports, deliverables, scientific report and publications, etc.	• CREDIT Vibes consortium; • European Commission services and European Agencies; • EU National Bodies; • The general public including the broader scientific community; • Internal/external reports, deliverables.	• CREDIT Vibes consortium; • European Commission services and European Agencies; • EU National Bodies; • The general public including the broader scientific community; • Internal/external reports, deliverables.

2. FAIR data

CREDIT Vibes data will be 'FAIR' - findable, accessible, interoperable and re-usable. These principles precede implementation choices and do not necessarily suggest any specific technology, standard or implementation-solution.

2.1 Findable data

CREDIT Vibes participates aims to make data open whenever possible, but as closed as necessary when taking into consideration personal data and privacy. If it affects personal confidentiality and privacy, data will not be shared publicly. However, each CREDIT Vibes beneficiary must ensure open access to all peer-reviewed scientific publications relating to its results. In addition to the peer-reviewed scientific publications, the CREDIT Vibes consortium will open the access to the project data as much as compatible with the exploitation plan.

Points to be addressed**:**

- Outline the discoverability of data (metadata provision)
- Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers?
- Outline naming conventions used
- Specify standards for metadata creation (if any). If there are no standards in your discipline describe what metadata will be created and how

Metadata provision and standards:

The metadata are a series of structured information, common to all the single measurement data in one data collection, which facilitate understanding, tracing and working with the data. In particular, metadata means a set of descriptive elements providing information on the "container of the data" (i.e. the title of a data collection, the abstract describing this data collection, etc.). For aggregated data, the metadata includes also information about the statistical method used for the aggregation. Metadata will be used to describe, discover and trace existing data collected by the CREDIT Vibes project and the data that will be generated by it over the next years.

Once the data are generated or collected, they will be made publicly available through uploading them in a data repository and made identifiable trough a PID (Persistent Identifier for Data, e.g. DOI) for each dataset and the associated metadata. The data

collected will include the PID, origin of the data, description of the data, purpose of the experiment, duration and location, and the size and scale (number of raw and processed/calculated parameters and number of values in each parameter including missing values).

Naming convention:

For metadata, dataset and template names we will define naming convention consisting in the following parts:

- A root composed by:
    o the short and meaningful name of the dataset/template
    o the acronym/short name of the data provider organisation(s)
- A suffix indicating the date of the last upload into the Repository in YYYYMMDD format.
- Each of these elements are separated by an underscore: _

2.2 Accessible data
Points to be addressed**:**

- Specify which data will be made openly available? If some data is kept closed provide rationale for doing so
- Specify how the data will be made available
- Specify what methods or software tools are needed to access the data? Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)?
- Specify where the data and associated metadata, documentation and code are deposited
- Specify how access will be provided in case there are any restrictions

Data, apart from that which includes sensitive data and general personal data affected by GDPR, or raising any ethical concerns (unless consented), will be shared. After publication, project's data will be deposited in a specific community created for CREDIT Vibes in the ZENODO repository (to be updated if needed with the revision of the DMP on M18). Partners may deposit restricted files with the ability to share access with others if certain requirements are met. These files will not be made publicly available and sharing will be made possible only by the approval of depositor of the original file. The ZENODO's repository system does not require any specific software and provides open access according to national and EU regulation. Only CREDIT Vibes partners will have permissions to upload datasets to the community.

For ease of access for partners, a direct link will be provided with metadata and direct link to all those datasets on (Cloud (NAS Server) Platform MRI.co.rs). Metadata will be located on a dedicated page of a shared folder which will remain active for a minimum of 5 years after the completion of the project.

In accordance with the Grant Agreement all research related data (excluding personal and sensitive data) will be stored for at least five years after the end of the research project (in case there is a high interest in the datasets or due to different national legislation, data may be stored for a longer period, which will be transparently discussed and approved within the consortium and relevant parties). Data that are used for publication will be stored at least five years after publication.

2.3   Interoperable data

Points to be addressed**:**

- Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability.
- Specify whether you will be using standard vocabulary for all data types present in your data set, to allow interdisciplinary interoperability? If not, will you provide mapping to more commonly used ontologies?

CREDIT Vibes will put efforts in producing interoperable data, allowing data exchange and re-use between researchers, institutions, organisations, countries. It means CREDIT Vibes is adhering to general standards for formats, as much as possible compliant with available (open) software applications, and in particular facilitating re-combinations with different datasets from different origins. The data and metadata, standards and methodologies the CREDIT Vibes project follows are with the aim to make the project data interoperable and standard vocabularies for all data types present in the project will allow inter-disciplinary and transdisciplinary interoperability. AGROVOC or GEMET common vocabularies are suggested since they compile most of the vocabulary regarding the agri-food sector and the related environmental aspects. In the unlikely case that uncommon or project-unique specific ontologies or vocabularies have to be used, CREDIT Vibes will provide mappings to more commonly used standard vocabularies for all uncommon data types to allow maximum interoperability. Any assumptions made, and the mapping steps to more commonly used vocabularies will be documented in a readme file and stored on (Cloud (NAS Server) Platform MRI.co.rs).

Data produced will use standard formats depending of the type of data (e.g. txt, .doc, .xlsx, .xlsm, .xml, .csv, .pdf, .jpg, .gif, .docx, .png, .svg, .json) and made compliant

with available (open) software applications, facilitating the recombination with various datasets from different origins. It is important to note that, when needed, data should be encoded in UTF8.

The following formats are suggested:

- .txt/.csv/.xml/.json (for data)
- .odf/.odc/.pdf/.ppt (for reports/presentations)
- .jpg/.png/.gif/.svg/ (for graphics)

2.4 Reusable data

Points to be addressed:

- Specify how the data will be licenced to permit the widest reuse possible
- Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed
- Specify whether the data produced and/or used in the project is useable by third parties, in particular after the end of the project? If the re-use of some data is restricted, explain why
- Describe data quality assurance processes
- Specify the length of time for which the data will remain re-usable

This section will be compiled throughout the course of the project, when we get more information on the datasets that are made available for CREDIT Vibes. However, whenever suitable, data will be Open Access licensed data (after considering of personal data, intellectual property rights and any additional legal and ethical requirements). Based on Open Access regulation, CREDIT Vibes aims to allow data to be re-used by third parties, but with restrictions if IPR or other rights demanding such restrictions. Copyright of the data are based on Horizon Europe guidelines and Digital Curation Centre (DCC), an internationally-recognised centre of expertise in digital curation with a focus on building capability and skills for research data management. CREDIT Vibes data licensing is still under revision and will be updated throughout the course of the project.

Research data resulting from the project will be deposited in the trusted repositories and made publicly available as soon as possible after analysis by the consortium and publication of the results, following the guidelines set forth in IP Strategy D2.1, Dissemination, Communication and Exploitation plan D4.1 and the Consortium and Grant Agreement. Data will be made available as soon as possible after data production or after appropriate processing and quality control that provides value and context to the data, and no later than the end of the project, so that metadata information is available and thus information about the data is discoverable. Data underlying a

scientific publication will be deposited no later than the time of publication and in accordance with standard community practices. However, there will be different access levels. For instance, research results that can reasonably be expected to commercialization or industrial exploitation, and/or that require a special protection due to confidentiality will not be put into the open domain. The dissemination level for different deliverables will depend on the sensitivity of the data content. Consequently, deliverables of the WP4 (D4.1) and WP5 have the sensitive dissemination level, while deliverables of the WP2 and WP3 have the public dissemination level.

Access to the research data will be dependent on any agreed 'embargo period' based on national and EU regulations. The 'embargo period' is applied to give time to publish the work or seek patents, were applicable and this will be as short as possible until the work is accepted for publication or patent, bearing in mind that research data should be made available as soon as possible. Data will be stored based on the contractual terms, until which it can be re-usable (all research related data will be stored at least for five years after the end of the research project). Because of the combined natural and social science nature of the data there is no time limit for its reusability.

Restrictions on data sharing

The principle of data sharing will be to maximize information flow through open access approach, in which all beneficiaries will have grant free access to results produced during the implementation of the CREDIT Vibes project. The open access approach will be extended to the scientific community only for non-confidential data. Nevertheless, confidential information should not be disclosed outside the Consortium, to avoid loss of IP protection rights and damage to disclosing beneficiary. In this sense the Consortium Agreement will regulate data management and restrictions on sharing should be strictly observed by CREDIT Vibes beneficiaries.

As confidential and non-confidential data will be stored in the (Cloud (NAS Server) Platform MRI.co.rs) system, parties that are not signatory of the consortium agreement will not be allowed to access data, unless signing separate Non-Disclosure Agreement (NDA). Therefore, separate NDA could be used to minimize restriction to data sharing with third parties.

Overview on CREDIT Vibes FAIR data principles inspired from Horizon Europe guidelines:

To be **F**indable:

- **F1**. (meta)data are assigned to a globally unique and persistent identifier: A DOI is issued to every published record on Zenodo.

- **F2**. data are described with rich metadata (defined by R1 below): Zenodo's metadata is compliant with DataCite's Metadata Schema minimum and recommended terms, with a few additional enrichments.

To be **A**ccessible:

- **A1**. (Meta)data are retrievable by their identifier using a standardized communications protocol: Metadata for individual records as well as record collections are harvestable using the OAI-PMH protocol by the record identifier and the collection name.
  - o Metadata is also retrievable through the public REST API:
  - - **A1.1**. the protocol is open, free, and universally implementable: See point A1. OAI-PMH and REST are open, free and universal protocols for information retrieval on the web.
  - - **A1.2**. the protocol allows for an authentication and authorization procedure, where necessary: Metadata are publicly accessible and licensed under public domain. No authorization is ever necessary to retrieve it.

- **A2**. Metadata are accessible, even when the data are no longer available:
  - o Data and metadata will be retained for the lifetime of the repository. This is currently the lifetime of the host laboratory.
  - o Metadata are stored in high-availability database servers, which are separate to the data itself.

To be **I**nteroperable:

- **I1**. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation: o Zenodo uses JSON Schema as internal representation of metadata and offers export to other popular formats such as Dublin Core or MARCXML.
- **I2**. (Meta) data use vocabularies that follow FAIR principles: For certain terms we refer to open, external vocabularies, e.g.: license (Open Definition), funders (FundRef) and grants (OpenAIRE).
- **I3**. (Meta)data include qualified references to other (meta)data: Each referenced external piece of metadata is qualified by a resolvable URL.

To be **R**eusable:

- **R1**. (Meta)data are richly described with a plurality of accurate and relevant attributes:

- Each record contains a minimum of DataCite's mandatory terms, with optionally additional DataCite recommended terms and Zenodo's enrichments.

- **R1.1**. (Meta)data are released with a clear and accessible data usage license:

  - License is one of the mandatory terms in Zenodo's metadata and is referring to an Open Definition license.
  - Data downloaded by the users is subject to the license specified in the metadata by the uploader.

- **R1.2**. (Meta)data are associated with detailed provenance: All data and metadata uploaded is traceable to a registered Zenodo user.

  - Metadata can optionally describe the original authors of the published work.

- **R1.3**. (Meta)data meet domain-relevant community standards:

  - Zenodo is not a domain-specific repository, yet through compliance with DataCite's Metadata Schema, metadata meets one of the broadest cross-domain standards available.

3. Other research outputs

These items are presented in FAIR principle discussions and in Appendix 1 (data types). This section will be updated during the project implementation if further items appear.

4. Allocation of resources

Data storage and preservation is the responsibility of the lead partner, and they will allocate the funds for it. Any costs for making CREDIT Vibes generated data FAIR and ensuring Open Access for publications is covered by the EU Grant funding. While the actual costs cannot be fully assessed at this stage (to be updated later on), funding will be secured to ensure full all data protocols required.

Regarding publication of results, one main route to open access is suggested:

- 'Gold' open access – the final published version of the article is permanently and freely available online for anyone to read.

In the context of research funding, open access requirements do not imply an obligation to publish results. The decision to publish is entirely up to the grant beneficiaries. Open access becomes an issue only if publication is chosen as a means of dissemination.

The DMP applies to all research of all consortium partners (universities, multi-actors, SME partners) and individually each researcher or research team employed or subcontracted will be responsible for managing their data adequately. Where CREDIT Vibes researchers plan to publish with co-authors outside of the project, they will make them aware of the CREDIT Vibes DMP requirements and data collection procedures and make sure that primary research data are stored to the same standard as required for Horizon Europe projects.

MRI leads the Data Management, which is the responsibility the project coordinator. The responsibility of MRI is to coordinate the specific data collection in accordance with this data management plan and for the data generated in WPs.

For an efficient curation, preservation and provision of access to the data collected or produced under the project, as is defined in the data management plan, during the project MRI is responsible for the data generated in their specific tasks and their management, storage and preservation. These data will may be also stored and accessed by everyone on the project intranet to ensure that these data can survive long-term changes in storage media, devices and data formats.

At the end of the project, the data without restrictions will be deposited in Open Science Data repositories or published in open access journals (in case of technical data, while no personal data will be disclosed).

All data, metadata, and other documentation is stored and backed-up via central storage system, which ensures data recovery in the event of an incident (i.e., data will be able to be recovered through previously made back-ups). Access to data during the project is controlled via authorization, as well as read and/or write permissions. With regard to protection policies and security measures, central data management system (Cloud (NAS Server) Platform MRI.co.rs) on information security will be complied with data protection handbook will be followed.

5. Data security

Data security is the responsibility of each partner but a coordinated set of recommendations is given:

- Back up your files/data regularly and use different media for it (external hard drives, computer hard drives, departmental server, etc.)
- Enable computer firewalls and keep antimalware software up-to-date and operational.

- Users must have access to the computers and/or servers via individual user accounts and not shared accounts.
- Collaborative networks/platforms/Intranets: Permission-controlled files so that users, depending on their status, can "read only", "write", or "execute" files. Computers connected networks should not store sensitive data, unless data is encrypted, so as to minimize network vulnerabilities.
- (Cloud (NAS Server) Platform MRI.co.rs)-based storage is useful as a secondary or tertiary storage location for your files. Research Data repositories (e.g. Zenodo) are recommended in this sense. However, this via is not recommended for sensitive or confidential data that will be encrypted or treated anonymously.

In CREDIT Vibes, the collection of personal data is minimised. In case of personal data, these will be stored in an internal database located in the local institutional servers of the corresponding leaders. No personal data will be shared on public (Cloud (NAS Server) Platform MRI.co.rs).

6. Ethics

The main ethical considerations for CREDIT Vibes resides in the part of the implementation actions where personal data is collected (i.e. platform registration requests in WP1, training/workshop participations in WP2,3 and dissemination/coordination actions in WP4,5). Any other data emerging from WP1 (or reused) will have only non-sensitive technical nature and is not prone to ethical considerations.

CREDIT Vibes's ethics strategy envisions the following considerations: Human beings, Personal Data and Data handling in non-EU countries (i.e. Serbia). Data handling as a principle will follow the do-no-harm approach and this will govern the entire ethics strategy for the project. All participants will voluntarily handle their personal data (i.e. restricted to name, email, age/education) by complying to institutional GDPR regulations.

Documents explaining the purpose and methods (including plans to share data) of the research, and an accompanying consent form (including to share data) will be prepared. A clear explanation of the purpose and processes involved in the research and rights to refuse participation will also be provided to each participant, as well as to those researchers will come into contact with through the participatory work. For this informed consent, prospective participants will be provided with information about the study before any consent to participation is sought.

They will be adequately informed about the:

- Aim of the study and methods to be used
- Institutional affiliations of the research and source of the funding
- The setting in which they are asked to participate (survey, workshops) and the duration and type of questions asked
- Anticipated benefits
- Potential risks and follow-up of the study; the description must demonstrate appropriate efforts to ensure fully informed understanding of the implications of participation
- Right to abstain from participating in the study, or to withdraw from it at any time, without reprisal
- Measures to ensure confidentiality of information provided, privacy and anonymity
- Full contact details of the Data Protection Officer of the Coordinator in case questions may

Confidentiality will be maintained by not sharing recordings, anonymising transcripts and ensuring that any information that could be used to identify participants is removed from transcripts, as well as concealed in written outputs. If there is any possible risk that a participant could be identified, they will be shown relevant sections of transcripts and/or reports to ensure they are satisfied that their confidentiality is maintained.

CREDIT Vibes will also comply with:

1. General Data Protection Regulation (Regulation 2016/679 EC)

2. European Convention on Human Rights (ECHR): Article 8

3. Treaty on the European Union (TEU) Article 6

4. EU Charter of Fundamental Rights of 7 December 2000

All procedure related to data management within Serbia (as non-EU country) will be in compliance with the laws of the countries and the GDPR. The research performed outside the EU is compatible with the Union, National and International legislation and could have been legally conducted in one of the EU Member States. Thorough guidance and monitoring from the experienced EU partners will be performed in order to ensure standard adherence) as the EU partners are directly involved in the actual research being performed in Serbia.

**Funded by
the European Union**

7. Other issues

Another important procedure in the DMP is to maintain a quality protocol, for this reason to ensure the "data quality" on the FAIR Data Management plan, each WP leader JOINTLY with the Data Management Plan LEAD, will follow and review the application of the DMP.

Without data standards and data quality, the data interoperability (data exchange and re-use between researchers and institutions) is not possible. Data fields and the content of those fields need to be standardized, and agreements on representations, formats and definitions of common data are needed. Therefore, in case metadata standards did not exist in a discipline, the WP leader ("data management task") will specify what kind of metadata will be created/adapted. If needed, the coordinator can provide alternative solutions, such as implementing general Metadata Standards and recommendations, Research Data Alliance providing a Metadata Standards Directory that follow the coordinator's internal data protocols.

Appendix 1. Detailed information on field/lab data to be collected/used/reused

TECHNICAL DATA TYPE 1.

Maize hybrids with added value, FAO group 550, multiplication and trials would be carried out exclusively in Serbia:

Multiplication of the material would start in April 2023, with the projection of the amount of seeds that would be sufficient to carry out trials in the 2024 and 2025 seasons. The experiment would be set up according to RCBD design in three locations in two years. Number of repetitions is 2.

Elementary plot of 4 rows with a total length of 5m. Marginal rows would be protective, they would not be included in the yield calculation only 2 inner rows will be harvested. Crop densities will be adjusted according to FAO 550 growing practice and mode of production.

Controlled self-fertilization would be carried out on the marginal rows for each genotype for the purpose of taking samples for biochemical analyses.

Trials would be set up in two modes:
1. Conventional production
2. Organic production

Both modes are in the close area with same soil type.

Barley would be sown as a cover crop. An experiment in organic production would be planted around with fennel- *Foeniculum vulgare* (trap plant). MRI would be responsible for trials.

Kernel biochemical analyses to be conducted:

TC – total carotenoids (mg βCE/kg),

TP – total phenolic compounds (mg GAE/kg),

TF – total flavonoids (mg CE/kg),

ANC – total anthocyanin (mg CGE/kg),

TAC – total antioxidant capacity (mmol Trolox Eq/kg),

 p-CA – total p-coumaric acid (mg/kg),

FA – total ferulic acid (mg/kg),

TPA – total phenolic acid (mg/kg).

For QPM maize: Kernels will be analysed for contents (%) of proteins, lysine and tryptophan content, starch, oil, amino acids, ash, cellulose and metabolic energy.

Agronomic traits

Yield, kg/ha rec. on 14% of moisture, lodging % and moisture content in harvest time

> **Phytopathological tolerance estimates will be assessed on:** Maize kernel infection with toxigenic fungi species and mycotoxin contamination will be monitored in three treatments:
>
>   - Protection against atoxigenic strains of fungi originating from Serbia
>   - Protection with a commercial biofungicide
>   - Control

Grade of grain infection at the time of harvest on a scale of 1-7 (raid et al, 1994) Quantitative and qualitative analysis of mycotoxins by ELISA test.

Activities in the field - assessment of cob infection with *Aspergillus* species, sampling and analysis of mycopopulation on maize kernels - 15 days (depending on the number of locations)

Activities in the Laboratory - Identification of phytopathogenic and toxigenic species of *Aspergillus* spp. Qualitative and quantitative analysis of total aflatoxins and aflatoxin B1 - 15 days

Activities in the field - assessment of cob infection with species of the genus *Fusarium*, sampling and analysis of mycopopulation on corn grain - 15 days (depending on the number of locations)

Activities in the Laboratory - Identification of phytopathogenic and toxigenic species of *Fusarium* spp. Qualitative and quantitative analysis of total trichothecenes and fumonisins - 15 days

**Funded by
the European Union**

TECHNICAL DATA TYPE 2.

MRI will supply KIS with OP varieties of flint grain type, a total of 8 varieties plus one commercial hybrid like check, belonging to maturity group of FAO 300. MRI will reproduce a sufficient quantity of seeds during 2023 in order to provide seeds for trials in 2024 and 2025.

The experiment would be set up according to RCBD design in 2 locations/ two years. Number of repetitions is 2.

Elementary plot of 4 rows with a total length of 5m. Marginal rows would be protective, they would not be included in the yield calculation, and only 2 inner rows will be harvested.

Controlled self-fertilization would be carried out on the marginal rows for each genotype for the purpose of taking samples for biochemical analyses.

Trials would be set up in two modes:

Conventional production

Organic production

Both modes are in the close area with same soil type.

Barley would be sown as a cover crop. An experiment in organic production would be planted around with fennel- *Foeniculum vulgare* (trap plant). MRI would be responsible for trials

Kernel biochemical analyses to be conducted:

TC – total carotenoids (mg βCE/kg),

TP – total phenolic compounds (mg GAE/kg),

TF – total flavonoids (mg CE/kg),

ANC – total anthocyanin (mg CGE/kg),

TAC – total antioxidant capacity (mmol Trolox Eq/kg),

 p-CA – total p-coumaric acid (mg/kg),

FA – total ferulic acid (mg/kg),

TPA – total phenolic acid (mg/kg).

Agronomic traits

Yield, kg/ha rec. on 14% of moisture, lodging % and moisture content in harvest time

TECHNICAL DATA TYPE 3.

SOYA BEANS

Task:

Conduct the evaluation of soybean genotypes on important agronomic traits and parameters of technological and nutritional grain quality, simultaneously grown in organic production (OP) and conventional production (CP) conditions.

Goal:

Identify and recommend the most productive, weed suppressive, disease resistant and drought tolerant genotypes suitable for OP, with the enhanced nutritional quality of the grain, suitable for industrial processing and feed production

2023. - Seed multiplication

2024. – Field trials will be set up in parallel systems of OP and CP, at Pančevo (Serbia) location. Varieties from the same MG will be tested in micro-trials, each consisted of two varieties (KTI-free and standard one) sawn in 4 rows with a 4 replications.

The following observations will be performed:
1. Phenological traits scoring (emergence, maturity)
2. Assesment of weed competitiveness, drought tolerance, disease occurrence
3. Seed yield and yield components measuring

2025 – Analysis of the nutritional quality of grain (protein and oil content, KTI level and activity, sucrose content, dietary fibers)

2.1 Collection or Reuse of Existing Data

Only new data will be collected/produced as part of the project. Reusing already existing data was considered and relevant existing data could be found that is in line with the project's aim and goal.

2.2 The types and formats of data will the project generate or re-use

The following table provides an overview of the types of data collected and how. The provenance of the data used in the project will be documented in a "readme" text file and word doc files.

Type of Data	New/Reused Data	Collection of Data
Inventory of value added maize hybrids and chosen genetic materials for working collection	Newly collected data within the project	Within the framework of value added hybrids, an inventory of 199 hybrids was formed based on 614 samples examined based on: grain properties, grain structure, physical characteristics of grains, grain structure, chemical composition of grains, field trials for monitoring agronomic properties. According to the mentioned criteria, the

		genotypes were selected for working collection.
Inventory of OP flint maize out of MRI Gene bank and chosen genetic materials for working collection	Newly collected data within the project	Within the framework of OP flint maize, an inventory of 62 local populations and 43 introduced populations (total 105 OP) was formed based on : grain properties, grain structure, physical characteristics of grains, chemical composition of grains, FAO maturity range, availability of good quality stock, field trials for monitoring agronomic properties and combining ability with an appropriate broad based testers. According to the mentioned criteria, the genotypes for working collection were selected.
Inventory of soya MRI varieties and chosen genetic materials for working collection	Newly collected data within the project	Within the framework of soya lines and sorts, an inventory of 42 Cultivars and advanced breeding lines developed in MRI and 40 Accessions collected from different breeding companies (Total 82 genotypes). Selection criteria for creating soybean inventory: A. Selection criteria for MRI cultivars and advanced breeding lines

		1. Maturity group suitable for production in local agro-ecological conditions 2. High and stable yield in heterogeneous environmental conditions (yield data are the result of two-year multi-location trials) 3. Favorable technological quality of grain (protein and oil content) important for processing industry
Field multiplication of working collection for maize and soybeans	Newly collected data within the project	In accordance to established field trial plans based on RCBD design seeds multiplication of the OP flint corn varieties, value added corn hybrids and soybean varieties was organized.
Setting up experiments in the regime of conventional and organic corn and soybean production to evaluate agronomic traits, yield, morphological characteristics.	Newly collected data within the project	Sowing and harvesting will be done by specially adopted agro/research machinery (Wintersteiger) in both production regimes in all locations. Side rows per each plot/genotype will be used for the field evaluation of diseases and insects attack and for the controlled pollination aimed to provide samples for the lab analyses. Trial data for the yield and moisture content will be processed based on excel 2010 and ANOVA.
Maize kernel infection with toxigenic fungi	Newly collected data within the project	Grade of grain infection at the time of harvest on a

species and mycotoxin contamination will be monitored in three treatments: - Protection against toxigenic strains of fungi originating from Serbia - Protection with a commercial biofungicide - Control		scale of 1-7 (raid et al, 1994). Quantitative and qualitative analysis of mycotoxins by ELISA test.
For maize: Kernels will be analysed for physical characteristics: hectoliter mass, absolute mass, density, flotation index, share of hard and soft fraction, resistance to grinding.	Newly collected data within the project	Samples for the grain physical characteristics will be collected for each genotype (maize from Project working collection) from all environments, provided by controlled pollination using standard procedures.
Chemical characteristics of maize and soybean grain: ash (%), total proteins (%), amino acids (mg/kg), starch (%), oil (%), celulose (%), sugars (%) TP – total phenolic compounds (mg GAE/kg), TF – total flavonoids (mg CE/kg), ANC – total anthocyanin (mg CGE/kg), Phenolic acids (mg/kg), total carotenoids (mg βCE/kg), TAC – total antioxidant capacity (mmol Trolox Eq/kg),	Newly collected data within the project	Samples for the grain chemical characteristics will be collected for each genotype (maize and soyabeans from Project working collection) from all environments, provided by controlled pollination using Kjeldahl method, Soxhlet extraction method, hot extraction method, spectrophotometric and HPLC methods.

For soybean: Kermels will be analysed for tripsin inhibitor (mg/g), urease (mg/g/min)		

Formats of data will the project generate:

- Mixed media data (video –MP4, AV);
- Visual data (images – JPG, PNG, BMP);
 -Numerical data Reference/canonical data Derived/compiled data /Experimental data (XLSX);
- Quantitative data;
- Qualitative data;

Type of Data	Data Category	Data Type	Data Nature
Yield, morphological traits	Quantitative, Qualitative	Experimental Derived/compiled Visual data (images, video)	Numerical Experimental
Maize kernel infection with toxigenic fungi species and mycotoxin contamination evaluation	Quantitative, Qualitative	Experimental Derived/compiled Visual data (images, video)	Numerical Experimental
Physical and chemical characterization of maize and soyabeans involved in the Project	Quantitative, Qualitative	Experimental Derived/compiled Visual data (images, video)	Numerical Experimental