

CPVO co-funded R&D project

Creation of a Common Maize Data Base for DUS studies through a partnership between Czech Republic, Hungary, Slovakia and the Community Plant Variety Office

March 2014 – December 2015

Final report

Institution and Administrative Coordinator

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1. Introduction

The R&D project “Creation of a Common Maize Data Base for DUS studies through a partnership between the Czech Republic, Hungary, Slovakia and the Community Plant Variety Office“ was approved by CPVO in March 2014. The project followed-up a ring test with several common maize varieties which was conducted in all three countries in 2013. The project finished in December 2015, but CPVO prolonged it for two additional months in order to provide a final report.

Maize is one of the most important worldwide agricultural crop. Breeding companies produce hundreds of new maize varieties each year. To be protected or registered, the variety must be clearly distinguishable from any other variety whose existence is a matter of common knowledge, uniform and stable. To confirm these conditions each examination authority has to maintain a large reference collection of the common knowledge varieties relevant for its climatic and growing conditions. To guarantee the quality of the protection and registration, the reference collection must be updated regularly. The maintenance of such a reference collection is a time consuming and costly procedure and especially so in a crop with worldwide importance.

The Czech Republic, Hungary and Slovakia managed their own reference collections, but due to relatively similar climatic conditions a lot of common maize varieties were found. To improve a quality of the reference collection and DUS testing, minimize a duplication of work, facilitate an exchange of seed samples and share data among the countries it was agreed to create the common database of the maize varieties in the framework of the project co-funded by the CPVO.

The objective of the project was to produce the database which contains the harmonized morphological descriptions needed to improve and optimize the management of the maize variety reference collections. The joint database will be updated annually. Each partner will have free access to the database.

2. Course of the project

2013 – preparatory year

Serious co-operation of the partners started during 2013, preparatory year. The partners made an inventory of the maize varieties in the Common catalogue’s 30th consolidated version and in their reference collections and identified a number of common varieties.

A ring test with 10 hybrids and 10 lines was carried out, the varieties were assessed according to the CPVO TP/2/3 of 11.3.2010.

Two meetings were organised:

February 21, 2013, Brno, the Czech Republic

July 23 to 24, 2013, Tordas, Hungary

2014 – the first year

More active communication among experts continued and there was an exchange of knowledge in the observation of the varieties characteristics in the field conditions. Cooperation was also established in computer areas via e-mail and during the meetings on site.

A second ring test with the same 20 varieties plus 7 selected example varieties and 17 common varieties was performed.

The first idea for a structure of the database was outlined based on the presentation ES-FR-DE maize database, which already exists.

Two meetings were organized:

March 4, 2014, Bratislava, Slovakia

August 13 to 14, Veľký Meder, Slovakia

2015 – the second year

A third ring test was organised. In order to achieve a high level of the description's harmonisation, 32 varieties plus all 31 example varieties given in the current CPVO technical protocol were included in the test.

The final structure of the database was agreed. All data from official trials of all partners were fed into the database.

Three meetings were held:

March 10, 2015, Brno, the Czech Republic

August 10 to 11, 2015, Brno, the Czech Republic

November 26, 2015, Brno, the Czech Republic

Work done during all above mentioned meetings are described in details in minutes which are enclosed in this final report (Annex 1 to 7).

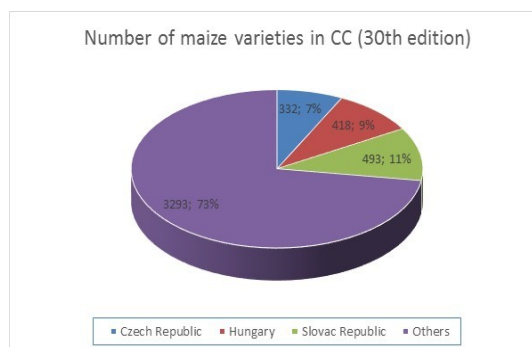
3. Description of the project

Task 1. Harmonisation of morphological descriptions

At the beginning the partners had to make an inventory of the varieties tested on their behalf, either for plant breeder's rights or registration purposes and to define the common varieties.

Number of varieties

Common catalogue	4 536
Czech Republic	332
Hungary	418
Slovakia	493



Number of entries in reference collection	Hybrid	Lines	Total
Czech Republic	2 762	2 001	4 763
Hungary	1 205	1 951	3 156
Slovakia	644	1 212	1 856
Total	4 611	5 164	9 775

Number of common varieties:

CZ-HU	26
CZ-SK	101
HU-SK	85
CZ-HU-SK	20

Experts compared the methodology, agreed on the protocol used and decided to set up a ring test. Based on the results from this preliminary ring test it was found that special attention should be paid to a set of example varieties, transformation of measurements to notes and harmonisation of assessments between observers.

A **selection of suitable example varieties** is the most important element how to harmonise the descriptions to a high degree.

The example varieties given in the CPVO technical protocol are mainly old lines which are no longer marketed or are not well known and easily accessible. Hungarian and Slovakian experts obtained the whole set of the example varieties in a framework of a previous co-operation with France and maintained them; Czech experts used only those freely accessible. It was agreed to determine the example varieties from the common varieties. The results from 2014 showed that this approach did not work efficiently. Due to this fact it was decided that all countries would use the example varieties mentioned in the CPVO technical protocol during the ring test in 2015. The Czech authority bought the complete set of the example varieties from GEVES. In order to determine a future possible effect of the testing place on example varieties states of expression, it was agreed to compare example varieties from all three partners side by side in a field trial in the Czech Republic in 2016.

Gained experience should be considered also as an important signal for a future revision of the CPVO technical protocol of maize regarding the example varieties (e.g. characteristic 37. Ear: colour of dorsal side of grain) and type of characteristics (e. g. characteristic 34. Ear: type of grain - location and environment effects).

In order to achieve a high level of harmonisation in observations of quantitative characteristics, a training on **the transformation of the measurements to notes** was organised during the year 2014. All experts used the same set of historical data for the transformation, the results were compared and differences found were explained. As a result the experts learned more how to read the scales of the other partners, in some cases the existing scales were modified accordingly.

To minimise a **variation due to different observers**, three field trainings focused on the problematic characteristics were organised.

The results of the performed ring tests showed that to obtain fully harmonised descriptions in all characteristics is impossible, thus the characteristics were classified as useful, highly harmonised or reliable to be included in the database, marked in green, the characteristic to be reconsidered, marked in grey and characteristics highly influenced by the growing conditions with a low level of harmonisation, marked in red. Finally all characteristics were included into the database with a clear indication of their importance from the perspective of the level of harmonisation. The use of individual characteristics is up to each partner.

GREEN Characteristics	
2. First leaf: shape of apex	16. Tassel: density of spikelets
3. Foliage: intensity of green colour	20. Tassel: length of main axis above highest lateral branch
4. Leaf: angle between blade and stem	22. Plant: length - different scale for hybrids and lines
5. Leaf: curvature of blade	23. Plant: ratio height of insertion of peduncle of upper ear to plant length
6. Tassel: time of anthesis	26. Ear: length
7. Tassel: anthocyanin coloration at base of glume	27. Ear: diameter
10. Tassel: angle between main axis and lateral branches	29. Ear: number of rows of grain
11. Tassel: curvature of lateral branches	34. Ear: type of grain
12. Tassel: number of primary lateral branches	36. Ear: colour of top of grain
13. Ear: time of silk emergence	37. Ear: colour of dorsal side of grain
14. Ear: anthocyanin coloration of silks	39. Ear: anthocyanin coloration of glumes of cob

GREY Characteristics

1. First leaf: anthocyanin coloration of sheath	19. Tassel: length of main axis above lowest lateral branch
9. Tassel: anthocyanin coloration of anthers	21. Tassel: length of lateral branch
17. Leaf: anthocyanin coloration of sheath	24. Leaf: width of blade
18. Stem: anthocyanin coloration of internodes	25. Peduncle: length

RED Characteristics	
8. Tassel: anthocyanin coloration of glumes excluding base	28. Ear: shape
15. Stem: anthocyanin coloration of brace roots	

Conclusion

The first version of the database contains the following:

Number of entries in the database	Inbred lines	Hybrids and OP
The Czech Republic	419	669
Hungary	539	324 + 4 open-pollinated
Slovakia	783	715

Number of unique entries in the database	Inbred lines	Hybrids
The Czech Republic	235	503
Hungary	364	242 + 4 open-pollinated
Slovakia	503	492

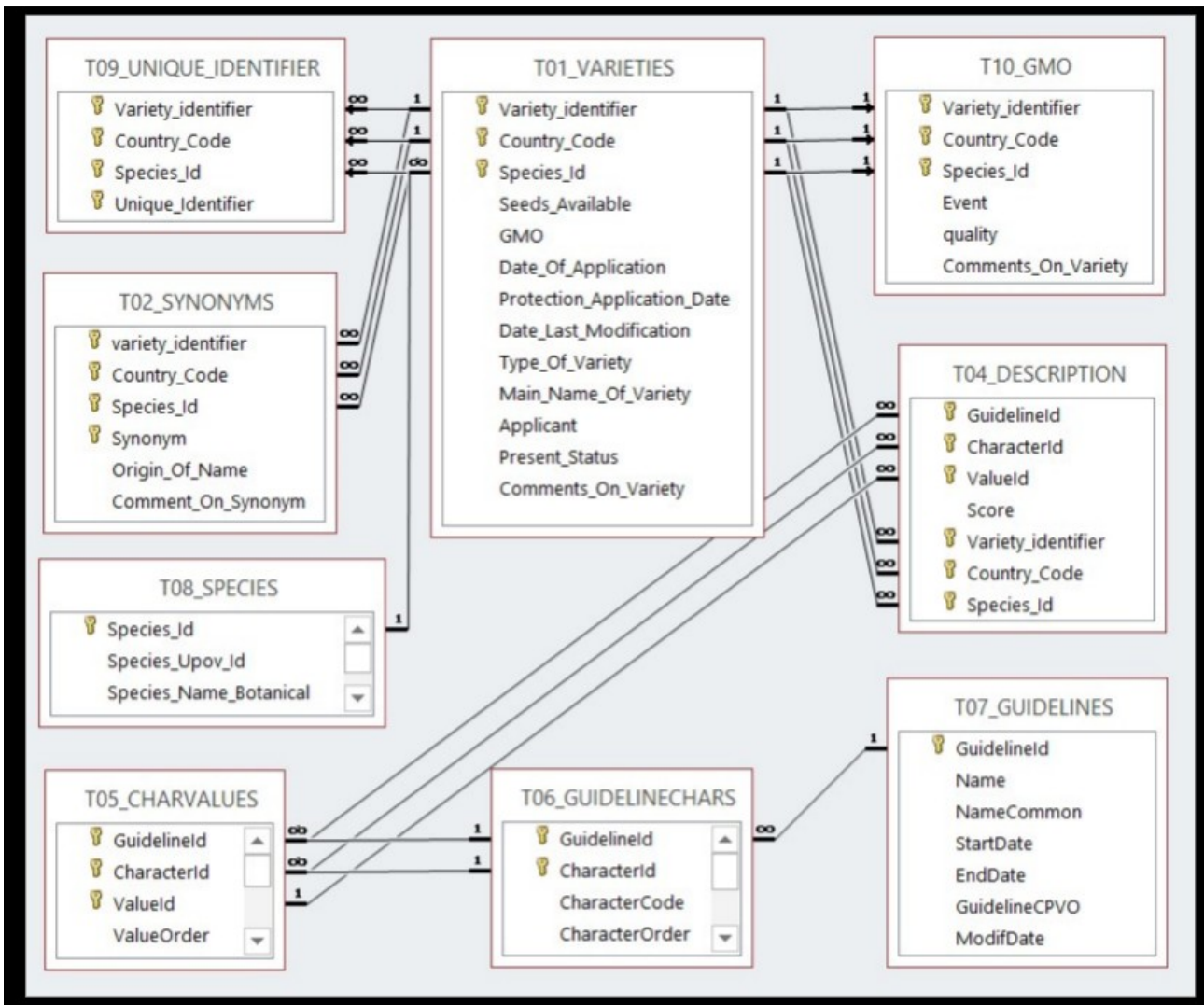
Number of common entries in the database	Inbred lines	Hybrids
The Czech Republic - Hungary	69	18
Hungary - Slovakia	165	75
Slovakia – the Czech Republic	174	159
The Czech Republic – Hungary - Slovakia	59	11

A relatively high level of the descriptions' harmonisation and methodology was achieved during the project. A deep study of methodology and an active discussion among partners also helped to understand each characteristic better and its expression in different climatic conditions. However, on the basis of work done, all partners are aware of potential limited factors in harmonisation and in interpretation of the descriptions.

Task 2. Structure of the database

The first common maize database created in a framework of the CPVO project by Spain, France and Germany has operated successfully since 2005. The aim of the CPVO is a future merging of this already existing database with the new database established by the Czech Republic, Hungary and Slovakia. To facilitate a fusion it was agreed to use the same medium and apply as much similar structure as possible.

After necessary modifications a following model was implemented into Microsoft Access and fed with the relevant data.



Each entry has a unique identifier created exclusively for the database; there are no connections with national identifications.

The language of the database is English but there is the option to implement national languages. Users were instructed and trained how to manage and use the database during the project. The expert from the Czech Republic is ready to prepare a manual if necessary.

The database will be updated annually. The first two cycles (2015 and 2016) will be carried out by the experts from the Czech Republic, who prepared the model. Further updates will be done according to the scheme agreed and described in the table 1.

Table 1. Database updating scheme

Period	Coordinator	Deadline	Update activity
2015	CZ	31.5.2015	Parties provide the assortment of the particular year including the status of each variety to the Coordinator.
		31.8.2015	The Coordinator makes the intersection of the varieties, proposes the unique identifiers and sends back the varieties with the unique identifier and with the updated status for comments
		30.9.2015	Parties agree or comment on the updated file
		31.1.2016	Parties provide the working descriptions to the Coordinator.
		28.2.2016	The Coordinator compiles the submitted descriptions and distributes the database with the fresh results to the Parties.
Starting point			
2016	CZ	31.5.2016	Parties provide the assortment of the particular year including the status of each variety to the Coordinator.
		31.8.2016	The Coordinator makes the intersection of the varieties, proposes the unique identifiers and sends back the varieties with the unique identifier and with the updated status for comments
		30.9.2016	Parties agree or comment on the updated file
		31.1.2017	Parties provide the working descriptions to the Coordinator.
		28.2.2017	The Coordinator compiles the submitted descriptions and distributes the database with the fresh results to the Parties.
2017	HU	31.5.2017	Parties provide the assortment of the particular year including the status of each variety to the Coordinator.
		31.8.2017	The Coordinator makes the intersection of the varieties, proposes the unique identifiers and sends back the varieties with the unique identifier and with the updated status for comments
		30.9.2017	Parties agree or comment on the updated file
		31.1.2018	Parties provide the working descriptions to the Coordinator.
		28.2.2018	The Coordinator compiles the submitted descriptions and distributes the database with the fresh results to the Parties.
2018	SK	31.5.2018	Parties provide the assortment of the particular year including the status of each variety to the Coordinator.
		31.8.2018	The Coordinator makes the intersection of the varieties, proposes the unique identifiers and sends back the varieties with the unique identifier and with the updated status for comments
		30.9.2018	Parties agree or comment on the updated file
		31.1.2019	Parties provide the working descriptions to the Coordinator.
		28.2.2019	The Coordinator compiles the submitted descriptions and distributes the database with the fresh results to the Parties.

CZ: 2019, 2022...

HU: 2020, 2023...,

SK: 2021, 2024...

4. Conclusion of the project

During the project period all partners worked efficiently and put a lot of effort into creating the new common database of the morphological descriptions of the maize reference variety collection.

The first version of the database contains 1392 distinct maize lines, 4 distinct open-pollinated varieties and 1467 distinct hybrids.

This new tool should help partners:

- to improve their reference collections' quality,
- to improve the efficiency of the maintenance of their own reference collection, each partner will be responsible for maintaining of the living reference collection suitable for its climatic conditions, the mutual exchange of seed samples will be applied on a request, when needed, which allow a decrease in cost of the reference collection management,
- to facilitate an identification of the reference varieties needed for the national and European listing and for the protection of Plant Breeders' Rights and consequently to enhance the quality of the DUS and to strengthen the protection

The database can also be used as a source of additional information (e.g. GMO, status of lines, synonyms) which could have also an impact on the final decision on a variety status.

Knowledge and experience gained during the project could also be re-utilized also for a future revision of the maize protocol.

The database is planned to be used from 2016. It will be updated regularly according to the agreement reached and its electronic version running in Microsoft Access will be available to all partners of the project (Annex 8).

To ensure that a long lasting co-operation will be also beneficial for all parties also after the project is finished, the partners signed an agreement in which rules for the future co-operation in the management of the maize database were defined (Annex 9).