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INFORMATION ON *ZEA MAYS* COMMON DATABASE

Document prepared by experts from France, Germany, Spain and the Community Plant Variety Office of the European Community (CPVO)

Summary

1. Many new varieties of maize are released each year by breeding companies. Among the conditions which have to be fulfilled to get a plant breeder's right, a variety must be Distinct, Uniform and Stable (DUS). To assess distinctness, the new variety is compared to reference collections containing the relevant varieties of common knowledge.

2. It becomes increasingly necessary to develop procedures which can improve the capacity to compare each new variety to an optimized set of varieties of common knowledge and so to safeguard the quality of the protection.

3. In the case of maize inbred lines, France Germany and Spain have a long history of cooperation between DUS experts. Each of the DUS examination centers has established a reference collection of inbred lines: with more than 4,000 entries in France, more than 2,400 in Spain, and more than 1,400 in Germany. The number of inbred lines is continuously increasing in the three countries.

4. Each country keeps the inbred lines which are adapted to the agro-climatic conditions of the country, plus a number of other inbred lines of common knowledge. Collections are not identical but a number of entries are in common.

5. Each country manages its own reference collection databases to run its fields trials. To minimize redundancies, reduce the functional costs and make the exchanges of seeds between countries easier, the partners decided to create a common database on a set of information they decided to share.

6. The creation of the database and its continuous use by the maize DUS experts from the three countries resulted from a collaboration between Spain, Germany, France and the Community Plant Variety Office of the European Union (CPVO).

7. This database contains harmonized morphological and biochemical descriptions according to the CPVO technical protocol which is based on the UPOV Test Guidelines. The database is updated regularly and is exclusively available to each partner.

Work done

8. To meet the objectives of the programme, the crop experts had to:

(a) Decide on the type of computer software that would be acceptable for all partners
(b) Agree on the rights to access and use of the information database
(c) Select the minimum set of information needed to run the project efficiently in the medium and long term
(d) Select a common set of example varieties,
(e) Harmonize the testing protocols,
(f) Identify the inbred lines common to several countries in order to establish the list of distinct inbred lines to be put in the common database.
(g) Decide on a method of organization to make the project useful for all partners

1) Setting principles for the database

9. The computer software selected is Access97® as unique common software to produce and exchange data and database updates. Each country decides at any time whether to use the database as a standalone, to link the common database to its own database, to upload/download from its database to the common database, etc.

10. The right to use the information is restricted to the technical officers of the three countries for the aim described in the project.

11. Each country has a large number of types of information for their own needs. It is important to select only information which is needed for the project, and to check that information from all partners is either harmonized, or at least understandable and usable by the others. Adding unnecessary types of information would increase the workload for updating information in coordination with partners, and could cause a deviation from the aim of the project. Restriction to the minimum set of information is a key to efficient usage. It allows a review of what is the minimum set of information, in order to add new information when necessary, to remove information which becomes unnecessary, and to update types of information when definitions, coding etc. need to change. An example of information that has evolved is the status of the line in the database.

2) Harmonization of the agronomical data

12. The selection of the example varieties that would be used by all three countries was considered as the most important task of the crop experts. It was a prerequisite to the comparison and the harmonization of variety descriptions.

13. Ring tests were organised to come to an agreement regarding the number and the nature of the example varieties needed to share the same references for most characteristics and expression levels. This work continues routinely to identify new example varieties allowing even more commonality and/or more characteristics on which the agreement is efficient.

14. Regarding the harmonization of the testing protocols, the agreement was easy to achieve, as the crop experts already had a long history of work in common.

15. Crop experts take into account the impact of the agro-climatic conditions on the notations by testing common inbred lines grown in Germany, France and Spain. They transformed measurements into notes and adapted their scales to obtain the same notes on the same inbred lines. The scales are now different between countries but the notes are the same and allow all three countries to use reliably each other's data. This system of "corrected scales for comparable notes" was very useful to homogenize the evaluation of some quantitative characteristics.

16. The identification of common inbred lines is a key feature.

More than 8000 inbred lines are registered in Table T01 of the database.

After the identification of the common lines, more than 6,300 distinct inbred lines were identified.

As lines present only in one country, there are more than
500 inbred lines from Germany,
1,300 inbred lines from Spain,
2,600 inbred lines from France.

17. Among the common inbred lines identified by the experts, approximately 1,500 are common to two countries and less than 100 are common to the three countries.

18. The descriptions of all these inbred lines have been put in the common database which now provides an almost exhaustive representation of the parental lines of commonly known maize varieties in Europe and a good representation of the variability of maize in the world.

19. In conclusion, the harmonization of the technical protocol has been achieved and common descriptions are now available for all three countries. DUS experts also have a better sense of which characteristics are more reliable or more susceptible to different ecological conditions.

3) Harmonization of the electrophoresis data

20. Harmonization on a selection of maize varieties was performed between the three countries.

21. To comply with the actual requirements of the UPOV and CPVO guidelines, the common database contains descriptions of isozyme characteristics expressed only as notes.

22. If regulation evolves, the database could be adapted to include descriptions of the genotype of the inbred lines. A description of the genotypes could also be added if regulation eventually includes the use of molecular markers.

4) Design of the common database

a) Creation of the structure

23. In close collaboration, the partners created a database model, after having selected the data that it would contain, and agreed on a common data dictionary.

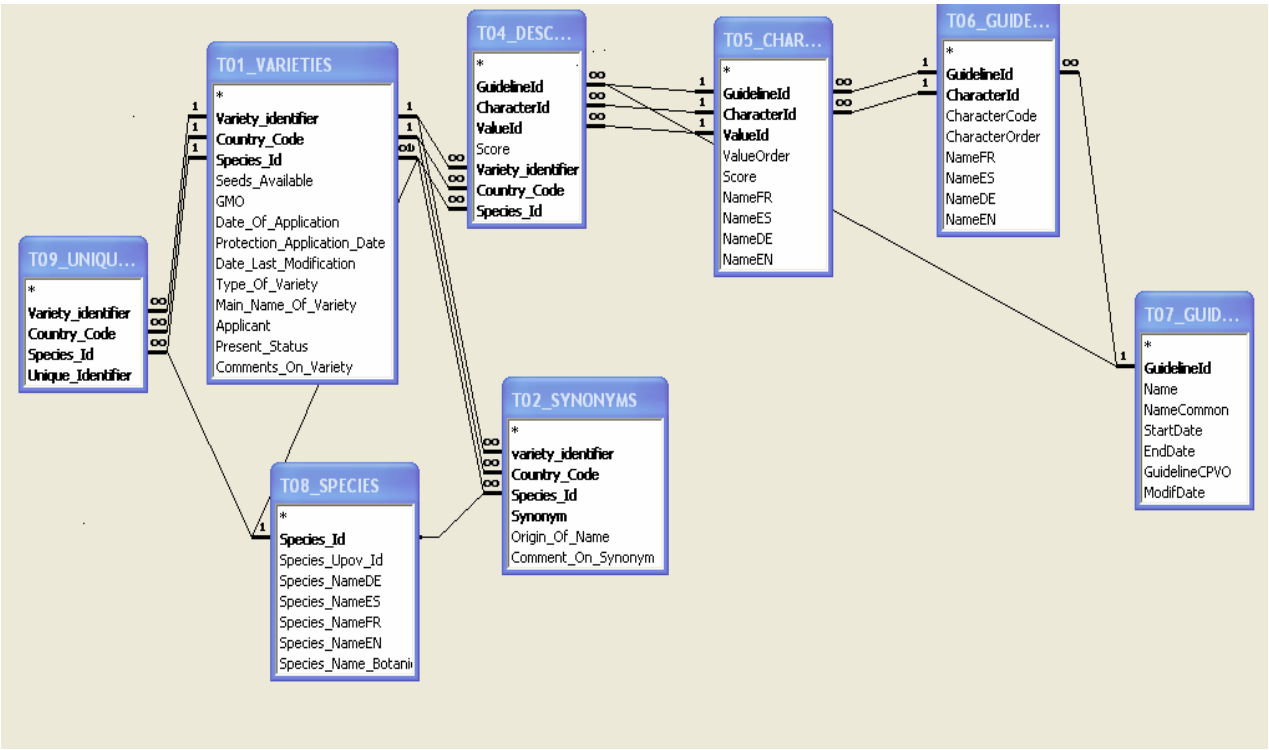
24. The protocol used in the common database was defined following exactly the database model and the data structure used by CPVO.

25. The common database is kept at each partner's premises and Access97 is used as an exchange tool between countries.

26. In this way, the national databases and the common database are physically disconnected, with easy connection with each other's database as necessary.

27. The updates are provided on a CD-ROM which is circulated among partners after each update.

Figure 1: Structure of the SFG maize common database



28. A unique identifier is given to each distinct inbred line. When the same inbred line exists in 2 or 3 countries, the same unique identifier is given to the 2 or 3 entries by the crop experts. This identifier is neither the breeder's reference, nor the country's identifier. For each line, each country keeps its own identifier to facilitate links with its own database.

b) Updating of the common database

29. At each update, partners extract the totality of their data and a new database is entirely re-created. The former databases are kept. To identify the changes in the common database, partners compare former and new database by SQL (or other language) queries.

30. The updating is done according to a yearly procedure described in Table 1. The updating is performed in three phases that generate each year three "versions" of the common database.

Table 1: Yearly Data Base updating procedure

(3 phases of updating per year generating 3 database "versions" (SFG DB v. A, B and C) each year)

Database version	Deadline	Update activity
	28/02/year	Definition of identifiers agreed between crop experts for each new line.
SFG DB v.A	05/03/year	Distribution of updated T09
	01/06/year	Sending of update of status and addition of new lines to coordinator
SFG DB v.B	10/06/year	Distribution of new database by coordinator for B
	15/12/year	Sending of new descriptions to coordinator for C
SFG DB v.C	20/12/year	Distribution of new database by coordinator for C

31. The three countries share the responsibility of the coordination of the different phases of the updating procedure. A schedule is defined as described in Table 2.

Table 2: Schedule for coordinating countries

(3 phases of updating per year generating 3 database "versions" (SFG DB v. A, B and C) each year)

Year	SFG DB v.A (05/03/year)	SFG DB v.B (10/06/year)	SFG DB v.C (20/12/year)
2004	-	-	SPAIN
2005	FRANCE	GERMANY	GERMANY
2006	SPAIN	FRANCE	FRANCE
2007	GERMANY	SPAIN	SPAIN
2008	FRANCE	GERMANY	GERMANY
etc…	**…**	**…**	**…**

Conclusion

32. This common database is an example on how cooperation between countries willing to work closely together on a well defined aim is easy to settle and efficient in routine.

33. From an information technology (IT) perspective, the agreement on the aim, the data dictionary, the rights to access and use of information are needed before launching the database production. The database model shall be as simple and generic as possible.

34. From a DUS expert's perspective, the involvement of DUS experts of all partners at the same level of input and interest is a key for the duration of the cooperation.

35. The conjunction of crop and IT expertise is necessary to establish a safe and sustainable solution.

36. The added value of such a development is clearly the structure of the database and the basic principles of its management which can be used for other crops.

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