Report of a Network Coordinating Group on Cereals

Ad hoc meeting - 7- 8 July 2000 - Radzików, Poland

L. Maggioni and O. Spellman, *compilers*

European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR)

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The European Cooperative Programme for Crop Genetic Resources (ECP/GR) is a collaborative programme among most European countries aimed at ensuring the long term conservation and facilitating the increased utilization of plant genetic resources in Europe. The Programme, which is entirely financed by the participating countries and is coordinated by IPGRI, is overseen by a Steering Committee (previously Technical Consultative Committee, TCC) composed of National Coordinators nominated by the participating countries and a number of relevant international bodies. The Programme operates through ten broadly focused networks in which activities are carried out through a number of permanent Working Groups or through *ad hoc* actions. The ECP/GR networks deal with either groups of crops (cereals, forages, vegetables, grain legumes, fruit, minor crops, industrial crops and potato) or general themes related to plant genetic resources (documentation and information, *in situ* and on-farm conservation, technical cooperation). Members of the Working Groups and other scientists from participating countries carry out an agreed workplan with their own resources as inputs in kind to the Programme.

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IPGRI, Via dei Tre Denari 472/a, 00057 Maccarese (Fiumicino), Rome, Italy

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Part I. Discussion and recommendations

Introduction

A. Aniol, Director of Research at the Plant Breeding and Acclimatization Institute (IHAR), welcomed all the participants to Radzików. He mentioned that IHAR is a scientific unit designed for research in breeding and seed production of major field crops. He said that the Institute, which is under the direction of the Ministry of Agriculture and Rural Development, is currently undergoing a time of rapid transformation and changes. He praised the importance of hosting a genebank within the institute, as a valuable source of genetic material. He finally wished all the participants a fruitful and pleasant meeting.

After welcoming participants on behalf of IPGRI, L. Maggioni thanked IHAR for hosting the meeting and for providing the local transportation, meals and the social dinner as input in kind to the Programme. Following a brief self-introduction of the participants (Appendix II), L. Maggioni reminded the Group of the objectives of Phase VI of ECP/GR and mentioned that Armenia had recently joined the Programme, becoming the 34th country participating in the Programme. He also reported that during the first two years of Phase VI all ECP/GR Crop Networks had organized their respective Network Coordinating Group (NCG) meetings and that the Cereals NCG was the last of this series to meet. He mentioned that the main objective of the present meeting was to review the progress of the Cereals Working Groups (*Avena*, Barley, Wheat) and of the European cereals databases (*Avena*, Barley, Maize, *Secale*, *Triticale* and Wheat), and to plan future activities to be carried out within the Network. Regarding the GENRES projects recently approved for funding by the EU, he informed the Group that complementary funds for the participation of non-EU countries (Cyprus, Czech Republic, Israel, Poland, Romania, Russia, Slovakia) to the first two meetings of the GENRES barley project had been secured. A project proposal for complementary activities to be carried out by non-EU countries had also received partial support from a few European governments. Finally, he also mentioned that the participation of experts from Poland and Russia in the first meeting of the *Avena* project had also been funded by ECP/GR.

The ECP/GR Coordinator invited the Group to make proposals for the attention of the Steering Committee on ways to use available funds for the Network activities (approximately US$ 19,500 remaining from the cereals NCG meeting budget and US$ 12,500 to be used for small technical meetings). Among the possible targets of these funds, he mentioned support for the following: a) the under-funded non-EU project for barley; b) a non-EU project for *Avena*, to be proposed; c) a start-up meeting for the Wheat Working Group. Among the possible subjects for small technical meetings, he mentioned the discussion of a proposal made by the Israeli Group member A. Korol, on pre-breeding of barley. Mention was also made of a concept note prepared by the Federal Office for Agriculture, Switzerland, for the creation of an International centre of competence for underutilized crops. Finally, he distributed a letter for information to the Group, sent by Y. Anikster, Israel, proposing the creation of an international centre for *in situ* conservation, to be established at Ammiad, Israel.

The ECP/GR Coordinator briefly summarized the outcome of the recent meeting of the *in situ* and on-farm conservation task forces. Their intention to prepare project proposals for ecogeographic surveys of wild relatives at the European level and for the *in situ* conservation of wild cereals raised the Group's interest. The Group was informed that these two project proposals were being coordinated respectively by N. Maxted (n.maxted@bham.ac.uk or nigel.maxted@dial.pipex.com) and by Y. Anikster (cereal@post.tau.ac.il) and that potential partners were welcome to join the initiative. Regarding *in situ* conservation of wild cereals, it was also mentioned that a project was

being funded in the Fertile Crescent by the Global Environmental Facility of the UNDP, involving, as executing agencies, ICARDA, the governments of Lebanon, Jordan, Syria and the Palestinian Authority.

Discussion

The Group discussed how ECP/GR could improve efforts for public awareness and the production of posters for the Networks was proposed. It was also requested that the information on the Cereals Network be presented on the web pages in an attractive way.

Recommendation

Posters/brochures should be produced to increase public awareness on the activities of ECP/GR and its specific networks. Templates could be produced by IPGRI and distributed to interested genebanks/institutes. The text in the templates could be translated into the local language by the receiving institutes, complemented with pictures of local activities, and printed in loco.

Working Groups and ad hoc *activities*

Presentations were made by the respective Chairs and Database (DB) managers on the progress and future perspectives of the Working Groups on *Avena*, Barley and Wheat and of the European Databases on *Avena*, Barley, Maize, *Secale*, *Triticale* and Wheat. A. Boyat gave an account of the progress made by the EU funded GENRES project on maize landraces and A. Michalová, representing the ECP/GR Minor Crops Network, presented a review of other cereals and pseudo-cereals genetic resources in Europe, the extent of existing expertise and potential areas of collaboration for conservation and use at a regional level. The complete presentations are given in Part II of the present report. The discussion following the presentations and the agreed recommendations are reported below:

Avena Working Group

Discussion focused on the importance of multiplying the material (especially wild species) needing to be regenerated and safety-duplicated. The lack of funds dedicated to this expensive task was mentioned as a constraint in most cases. The Group reiterated that rationalization of the collections did not mean throwing anything away, but rather focusing efforts on ensuring availability of the samples of primary accessions (most original samples), to be seen as a priority over their real or probable duplicates. Examples of "duplicates" that are not identical were, however, quoted as a possible complicating factor. The option of recollecting instead of regenerating was said not to be practicable in most cases, due to the frequent changes, either of land use (urbanization and cultivation) or of climatic conditions, occurring in the original collecting sites.

Barley Working Group

Discussion focused on the importance of including pedigree data in the Central Databases and the need to agree on a standardized system. It was mentioned that the use of ancestor tables would be preferable to the introduction of a standard notation system. The availability of specific free software, such as the International Crop Information System (ICIS) was noted and the Network members were encouraged to evaluate this system for reliability and user friendliness. The URL for ICIS information is http://www.cgiar.org/icis/documentTDM.htm

Recommendation

The DB managers of the Cereals NCG should closely look at the International Crop Information System (ICIS) software, which allows the inclusion of pedigree data in the databases. This

software is freely available from CIMMYT and could be adopted for use by the cereals DB managers. DB managers are invited to exchange their views by correspondence.

Wheat Working Group

In the **discussion**, the incompleteness of the databases with respect to important passport descriptors was highlighted as a problem, since even collection numbers are sometimes missing. The need to have the best possible passport data, before starting to collect characterization/evaluation data, was expressed. It was remarked that, without some important passport descriptors, it was not possible to identify duplicates on the basis of passport data. It was commented that the contents of the CCDB and the completeness of passport data are the responsibility of the contributing genebanks, not of the CCDB managers whose role would be to pinpoint missing or obviously incorrect data.

Regarding the possibility for the Central Crop DB manager to correct evident mistakes in the data, it was suggested that the original accessions table be maintained unaltered, and an additional table with corrected data be made available to the user.

The Group expressed its favour to including additional passport and characterization data in the Multi-Crop list.

Maize *ad hoc* Group

Discussion focused on the risk of considering putative duplicates as real duplicates. Great care should be taken when RFLPs are used to check duplicates among outcrossing species, since the result would vary with the RFLPs in use.

It was clarified that the European Maize Database (EMDB) did not include hybrids, since it would be easy to reconstruct them if their parents were known.

Regarding the database of the European Union maize landraces (EUMLDB), which was built in the context of the EU funded maize GENRES project, A. Boyat clarified that only data of accessions originated in the participating countries were included.

Recommendation

It was appreciated that activities on the development of the EMDB have progressed after a period of stasis and that the institute of Zemun Polje, F.R. Yugoslavia, developed a standardized Entry page offering access to on-line available data. D. Jelovac acknowledged that the user friendliness of the EMDB still needs improvement and announced that in the near future he will take charge of addressing existing problems and improving data accessibility.

The Group agreed on the usefulness of the integration of the EUMLDB data in the EMDB. A. Boyat explained that the EU project data could be delivered to Zemun Polje for inclusion in the EMDB, provided the countries owning the accessions give permission to do so. The Group recommended that the owner countries facilitate the integration of the data. D. Jelovac agreed to send a request, also on behalf of the cereals NCG, to the countries participating in the EU project, requesting permission to include the EU maize landraces data in the EMDB. The request for data would also be extended to the other European countries.

Crop Working Group Process Analysis

As a result of a discussion on the general progress made by the cereals Working Groups in the different areas identified by the individual crop Working Group process analysis table (Annex VIII, report of the Seventh Steering Committee meeting), the following recommendations were agreed upon:

Recommendations

Documentation

The group acknowledged that the main progress made by the Working Groups was in the area of documentation, however, the need to continue adding information, especially pedigree data and characterization and evaluation data was identified. It was also pointed out that passport data are not always complete and need further work.

It was recommended that, following the example of Avena *and Barley, all the cereals DB managers add "state 6: Genetic stock[1]" to the Multi-Crop descriptor SAMPSTAT. DB managers are also encouraged, in a coordinated effort, to promote agreement for the inclusion, in the respective databases, of additional relevant passport or characterization descriptors to the Multi-Crop list.*

The NCG recommends that institutions that have not responded to the request for data send the missing data to the CCDB and that IPGRI be involved in the request for data if difficulties arise.

It was recommended that some basic standards for CCDB search options be developed and that the Documentation and Information Network takes this issue into consideration.

The introduction of the use of GIS (Geographic Information Systems) by the CCDB managers for the analysis of germplasm distribution was recommended. The need to improve the quality of geo-references was stressed.

The need to facilitate links, and to move towards integration of European data, with other national and international databases was expressed. Non European collections and databases are a valuable source of additional accessions of European origin and of relevant characterization and evaluation data. The cereal DB managers are encouraged to start initiatives in this direction, identify any problems and discuss possible solutions within the NCG.

The convenience of starting activities at the horizontal level for the development of non-crop specific standards for characterization/evaluation and for the creation of an algorithm program for pedigree analysis (to be compared with the current development of ICIS) was emphasized.

Collecting

Further collecting activities were considered necessary to fill gaps in the collections.

Collaboration

The importance of the Vavilov collection, St Petersburg, Russia was recognized and continued support to the Institute was recommended.

Emergency

The problem of the unavailability of funds for regenerating material, especially of wild species was mentioned.

The need was expressed to implement a system at the Cereals Network level for the safety-duplication of all unique accessions.

In situ *conservation*

Strategies for in situ *conservation of the most endangered wild relatives should be identified.*

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[1] "State 6: Genetic stock" is defined as: (1) Any plant with special traits like disease resistance and mutants isolated by breeders / germplasm botanists. (2) A variety or strain known to carry specific gene(s); whereas:
"State 4: Breeder's line" is defined as: Line resulting from at least five generations of sequential inbreeding, self fertilization or back-crossing accompanied by selection within and between lines so that the individuals are considered to be homozygous, or nearly so.

Coordinating the future development of the databases

I. Faberová and L. Maggioni, partners in a project proposal submitted to the EU for funding, briefly reported on its recent approval. The objective of this project, called EPGRIS (European Plant Genetic Resources Information Infra-Structure) will be to promote the creation of national plant genetic resources inventories by offering coordination and technical support to the national documentation systems and to create a European Search Catalogue (EURISCO). The catalogue will contain passport information of plant genetic resources maintained *ex situ* in Europe, and will be frequently and automatically updated from the national PGR inventories and easily accessible via the Internet. It was mentioned that, while the European Central Crop Databases will initially be the main source of data for the European catalogue, at the end of the three-year project, the catalogue should ideally become the most updated and immediate source of all the passport data. It will therefore be possible to directly retrieve from the catalogue all the necessary passport data to develop new central crop databases.

Several questions were raised, expressing concern that the European catalogue could be a duplication of the existing Central Crop Databases and doubting that its development could take place as quickly as planned, or that the automatic maintenance would be very easy. Partners in the project explained that the introduction of a mechanism for automatic updating was one of the main objectives of the project. Such a result would be expected to dramatically reduce the current workload of the Central Crop Database managers for data gathering. They would, however, be expected to dedicate more time to the organization of crop specific characterization data and to data analysis.

Quality standards

C. Germeier introduced the issue of regeneration standards and rationalization of collections (see presentation in Part II).

In the **discussion**, C. Germeier clarified that the ISO 9000 system is based on transparency of methodologies, rather than enforcement of an agreed standard. To adopt the ISO system for quality standard improvement, genebanks would need to appoint a quality manager and publish a handbook of internally applied standards. Criticism was raised, mentioning that it was difficult enough to actually maintain the material and that it would be impossible to redirect funds towards improving the transparency of an activity that was under funded. In response it was argued that genebanks have a reason to exist if they can document what they do and therefore acquire trust within the genetic resources community.

Recommendation

It was recommended that the genebanks cooperating with the Cereals Network adopt the principles of the ISO 9000[2] (see paper of C. Germeier in Part II of this report) and that they develop their own quality guidelines for cereal collections and publish them.

Genebanks who have already developed internal protocols are encouraged to send copies to C. Germeier, to be used for further distribution and discussion within the Network.

Sharing of responsibilities

W. Podyma summarized the status of the debate on sharing responsibilities within the ECP/GR Networks and gave an account of the different proposals made by the Working

[2] Norme Internationale, ISO 9000. Quality management and quality assurance standards - Guidelines for selection and use. 1987. Reference number ISO 9000: 1987 (F). International Organization for Standardization.

Groups. He invited the Cereals Network to proceed a step further in the implementation of an agreed mechanism (full presentation in Part II).

In the **discussion** that followed, concern was expressed that the mechanism proposed would require too heavy a workload for the Central Crop DB managers.

The approach proposed by the *Prunus* Working Group was mentioned as an option that could reduce the workload of the DB managers. In this approach, the curators offer to take responsibility for a list of accessions and it is not the DB manager's task to suggest that each curator accepts responsibility for a list of primary accessions.

The essential role of the DB manager in any mechanism of shared responsibility was, however, stressed. The DB manager was said to be in the best condition to analyse the data and pinpoint gaps or duplications remaining after the curators have assumed responsibility for their own list of accessions. It was therefore proposed that this sharing of responsibility exercise start from both ends (curators and DB managers).

The importance that eventually the same agreements be reached for all crops was stressed, in order to avoid genebanks dealing with many crops having to follow different mechanisms depending on the crop.

The importance of the National Coordinators being involved in the process of accepting responsibility was also stressed and the Group was made aware that in some cases countries will be waiting for the outcome of the international negotiations before taking any decision.

Finally, it was mentioned that descriptors for the identification of primary accessions and the corresponding maintainers would have to be included in the EURISCO catalogue.

Recommendation

Step 1) *Chairs of the Working Groups on* Avena, *Barley and Wheat and Database managers of the Maize,* Secale *and* Triticale *Databases inform the respective Working Group members and genebank curators of the initiative and encourage its implementation.*

Step 2) *The genebank curators offer to take responsibility, for maintenance and distribution to* bona fide *users, of a list of accessions (suggested criteria: material of local origin, unique material) and inform the DB manager of their detailed offer.*

Step 3) *DB managers combine the lists received from curators and identify gaps in the responsibility net.*

Step 4) *The Network Coordinating Group reviews the progress made and makes further recommendations.*

Handling of characterization and evaluation data in crop databases

This topic was introduced by H. Knüpffer (see full presentation in Part II). He noted two main problems related to characterization and evaluation data in central crop databases:

1. How to sensibly summarize results from various tests carried out under different conditions and using different methodologies, even for the same traits.
2. He wished that a crop-independent database structure be developed for maintenance of characterization and evaluation data, irrespective of whether they are the result of trials following descriptor lists agreed upon or not, such as the approach followed by GRIN and CGN. He proposed that a small documentation meeting be organized to discuss these issues and that biometricians and statisticians be involved.

During the following discussion, it was mentioned that it would be necessary to reach agreement on a common concept for entering the data, before any systematic analysis of the data could begin.

The existence of large amounts of evaluation data in the literature was also pointed out, although their interpretation was said to be tricky. The serious constraint mentioned was that in most cases it would not be possible to track down the specific accessions included in the study.

The French experience in handling evaluation data was presented by A. Le Blanc (see full presentation in Part II).

Future operation of the Cereals Network

A proposed mode of operation for the Cereals Network during the next three and a half years of Phase VI was agreed as follows (**to be submitted to the Steering Committee for approval)**:

- *The operation of the* Avena, *Barley and Wheat Working Groups will continue under the direct coordination of the respective Chairs, who will be responsible for initiating activities, maintaining an open channel of communication with all Group members and monitoring the progress of the respective groups. Recommendations made during this meeting will be a baseline for the Working Groups' activities.*

- *It was acknowledged that some members of the Barley and* Avena *Working Groups would have the opportunity to meet in conjunction with the EU GENRES project meetings. A proposal was made to hold a one day meeting (3 December 2000) of the Working Group on Barley (sixth meeting), jointly with the Barley GENRES meeting from 4 to 6 December in Fiorenzuola d'Arda, Italy. Attending members not already funded by the EU, would be supported by ECP/GR.*

- *It was agreed that the newly established Working Group on Wheat would need a start-up meeting, to be funded from the available budget of the Cereals Network.*

- *A project proposal for characterization and evaluation, complementary to the EU funded GENRES project on Barley, was submitted in early 1999 by the ECP/GR Secretariat to a number of European governments. Considering that pledges were only received for about half of the required amount, the Group agreed to propose that US$15,000 be allocated from available funds to complement the funds raised so far.*

- *It was considered that the proposal made by A. Korol for a project on pre-breeding of barley would need to be further discussed. A small meeting to further elaborate and discuss the project was proposed as a satellite meeting to the GENRES barley meeting planned in Fiorenzuola d'Arda, Italy (December 2000). It was agreed that ICARDA experts as well as scientists from Moldova be invited for this meeting. It was agreed that this project was of a different nature to the other components of the non-EU Barley project and that its implementation would require raising specific funds.*

- *Any other remaining funds would be reserved, in case the opportunity were to arise in the future, for a small meeting to advance the preparation of a project proposal for the* in situ *conservation of wild cereals.*

- *The Group agreed on the need to hold a Cereals Network meeting in 2003, to review the progress made by the Cereals Network and to plan for its future. The expected*

participation, based on the priority given by the ECP/GR member countries to the cereal crops, was said to be of about 43-44 attending members.

- *A small technical satellite meeting of 4-5 experts on the standardization of evaluation data should precede the Cereals meeting. Experts in biometrics and statistics should be invited to help address the problems related to entering evaluation data in the databases and to analyze these data. Results of this meeting will be presented during the Cereals Network meeting. H. Knüpffer agreed to share the responsibility for the technical organization of this satellite meeting with the ECP/GR Secretariat (selection of participants, preparation of background documents, definition of the agenda).*

Table 1. Summary table of the proposed use by the Cereals Network of available funds. Available funds: ca. US$ 19,500 (savings) + US$ 12,000 (small technical meetings)

Crop	***Activity***	**Beneficiaries**	**Amount (US $)**	**Responsible organizer**	**Location and date**
Barley	Evaluation and documentation activity, complementary to GENRES	Non-EU countries: Cyprus, Czech Republic, Poland, Romania, Russia, Slovakia	15,000	Barley GENRES project coordinator and ECP/GR Secretariat	n/a.
Wheat	First meeting of the Working Group	15 attending members	10,000	WG Co-Chairs	Czech Republic, year 2001
Barley	Meeting for the preparation of a pre-breeding project proposal	2 additional participants to barley EU project meeting (Moldova + ICARDA)	1,500	Barley GEN RES project coordinator and ECP/GR Secretariat	Fiorenzuola, Italy, December 2000
Barley	Sixth meeting of the Working Group, jointly with GENRES project meeting	5 Attending members	5,000	Working Group Chair and Barley Database manager	Fiorenzuola, Italy, December 2000
TOTAL			**31,500**		

Part Ⅱ. Presented papers

Progress report of the ECP/GR *Avena* Working Group

J. Mike Leggett
Institute of Grassland and Environmental Research, Plas Gogerddan, Aberystwyth, UK.

This paper describes the progress made by the Avena *Working Group since its Fifth meeting (Vilnius, Lithuania, May 1998). The text in italics refers to the workplan and recommendations made on that occasion.*

The European Avena *Database (EADB)*

The Group recognized how essential it is that the European Avena *database be as complete as possible to ensure the database's integrity. Passport data, as well as any additional characterization and evaluation data, were to be sent to the EADB manager before December 1998.*

Passport data and some characterization/evaluation data which had been sent to EADB many years ago from IGER UK as hard copy was resubmitted in electronic format. Data have also been submitted by NGB and VIR.

With regard to the rationalization of existing collections, the Group recommended that no accessions be discarded, based on the identification of probable duplicates by means of database analysis alone, unless there is definitive evidence of genetic duplication. Alternatives for rationalization of collections should be further investigated. This is ongoing.

Christoph Germeier (EADB) informed the author that there are still indications of data duplication. Inconsistencies in these records have to be cleared up with the data donors in the course of a further update, which is planned for this and next year.

He is currently attempting to harmonize the structures of all databases held by the BAZ genebank, especially for the EADB and IDBB (International Database of Beta), according to an enhanced and strictly relational database architecture, including evaluation data and literature references.

Canadian Avena *Database*

The Group recommended that the Chairperson and the ECP/GR Coordinator explore the possibility of including the data from the Canadian and American genebanks collection data into the EADB.

The chairman of the *Avena* Working Group contacted Axel Diederichsen (Canadian Genebank) who had already independently contacted C. Germeier and Lothar Frese at BAZ. He agreed that it would be very useful to join the European and Canadian databases and he would support all efforts to do so. He suggested that a proposal should be drawn up on how we might proceed. Recently, a cooperative project between the BAZ Gene Bank and the Saskatoon Research Centre, Plant Gene Resources of Canada has been initiated to set up an International *Avena* Database (IADB), which will include Canadian, American and Australian accession data. The cooperation will begin with a visit of C. Germeier (BAZ Gene Bank) to Canada in July this year.

Survey of EU oat workers

It was agreed that each Group member conduct a survey of workers interested in oat so that we would know who is doing what and thus avoid possible duplication of effort. The information might also lead to closer collaborative projects.

To date, some 31 responses of varying detail have been received. It is perhaps important to bear in mind that many of those working on *Avena*, do so on a part time basis.

EU Project EC 1467/94. Opportunities for resubmission to the third call

It was recommended that the Group make an attempt to produce a viable submission, since the available funds from all sources directed to Avena *genetic resources are so scarce. There was an obvious need in the first instance to identify a coordinator.*

It was proposed that a suitable topic would be the phenotypic/genotypic assessment of landraces selected from within the EADB but encompassing different member states.

It was agreed that the author (M. Leggett) make an effort to find a coordinator for the project.

Andreas Katsiotis, Agricultural University of Athens, was persuaded to take up the position of coordinator. A project including five partner countries, (Germany, Greece, France, Sweden, and UK) was submitted and was successful.

The project entitled "Evaluation and enhancement of *Avena* landrace collections for extensification of the genetic basis of *Avena* for quality and resistance breeding" will record designated characterization and evaluation data on 1500-2000 accessions grown in the five different environments and will also be screened using molecular markers.

It is perhaps worth mentioning that the finalization of the project occurred at a politically delicate moment within the Commission (the time the EU commissioners resigned when everything became sensitive) and the contracts were therefore not agreed till over a year after the proposed starting date

The initial meeting of the partners in Paris during March this year allowed some of the protocols and timetabling for the project to be agreed.

Avena *Working Group members*

The Group recommended that IPGRI tries to identify an Italian contact person to join the Avena *Working Group***.**

Luigi Cattivelli, of the Istituto Sperimentale per la Cerealicoltura, Sezione di Fiorenzuola d' Arda, has accepted an invitation to join the *Avena* Working Group.

Due to the importance of Morocco as a centre of diversity (if not origin) for the genus, the Group recommended that every effort be made to encourage the participation of Morocco as observers at future ECP/GR Avena *Working Group meetings and that every effort be made to look into the possibility of initiating* in situ *conservation projects in relevant areas in Morocco.*

An invitation to join the *Avena* Working Group (as an observer) was extended to Nezha Saidi, National Gene Bank, INRA Morocco. Nezha has confirmed that she would be prepared to represent her country with regard to *Avena* genetic resources. There is a possibility that Morocco may join the ECP/GR Programme in the near future, making it easier to consider and implement sites for the *in situ* conservation of target species in certain areas of Morocco.

Landraces

The Working Group recommended that development of core collections for landraces and varieties be continued.

This work is being undertaken by Igor Loskutov at the Vavilov Institute, St. Petersburg, Russia.

Opportunities for a peer review of the quality of Avena *European collections*

The Working Group favoured the general concept of the ISO 9000 system. This concept is mainly based on transparency, reached through documentation of internal routines. The documentation system is used to provide information to the public (i.e. the genebank community) and to members to be reviewed. All participation should be voluntary. In this case, the purpose of the review committee would be to assist genebanks in their work on improving standards, rather than controlling them.

Interest in this concept was to be conveyed to the Chairperson of the Avena *Working Group before the ECP/GR Steering Committee meeting in Braunschweig, Germany, 29 June and 4-5 July 1998.*

The Braunschweig meeting overtook any significant action by *Avena* Working Group members.

Collections

*The Working Group agreed that it was essential that further collections of the important tetraploid species (*A. insularis*) should be made, combined with further efforts to collect the missing diploid, and to fill gaps in the geographic collection of all wild* Avena *species.*

Further populations of *A. insularis* have been identified in Tunisia, which extends the known range of this most recently discovered tetraploid species of wild oat.

National / international protection of Avena

The Group recommends that the Spanish member looks into the possibility of including A. murphyi *into the Bern convention list of endangered species. He is also encouraged to establish contacts with suitable Spanish authorities and to raise awareness regarding the precarious nature of some Spanish wild oats.*

Since *A. murphyi* is an endemic species of Cadiz province in Andalucia, Spain, Marcelino Pérez de la Vega contacted the Environment Minister of the Regional Government of Andalucia (in Spain the control and protection of wild species is competence of Regional Governments). The species is already included in the list of endangered species in Andalucia and they have the responsibility for any further step.

M. Pérez de la Vega and Dr. García, Universidad de León, in collaboration with Dr. Valdes, Universidad de Sevilla, collected some samples of *A. murphyi* in a few localities in Cadiz during the late spring of 1999. A new search was planned for May 2000. *A. murphyi* was found in a few places and in general only isolated individuals of two populations. Seeds have been planted for multiplication.

Research on population genetic structure, comparing Spanish and Moroccan materials, is being carried out in León by a Moroccan graduate student.

Similarly, due to the uniqueness and importance of A. insularis, *the Group recommended that when an Italian contact person was identified, he/she would be encouraged to contact the appropriate Italian authorities to protect these unique sites and to take the necessary measures to place* A. insularis *on the Bern convention red list of endangered species.*

The recent appointment of L. Cattivelli will enable this avenue of protection to be pursued.

Regarding the inclusion of new species in the Bern Convention, L. Maggioni attended, as observer, a meeting of the Group of Experts on the Conservation of Plants in Strasbourg, France in March 1999. He mentioned that "it will be increasingly difficult to amend Appendix I of protected species of the Bern Convention in the near future. It is

the intention of the Contracting Parties, and especially the European Union, to first comply with existing obligations and not to further extend the list of species to be protected and their respective habitats."

It is thus not clear how useful it will be to recommend new species for the list. It might be more effective to recommend that countries introduce local measures for appropriate protection.

Future tasks for the Avena *Working Group*

It is necessary to continue to rationalize and update the EADB, and continue to explore the means by which links to non EU Databases can be established, especially with regard to the Canadian and American databases.

Clearly some steps have been taken by the Spanish *Avena* Working Group member and local Government Officials to protect *A. murphyi*. Now that a member representing Italy has joined the Group, he will be asked to contact the relevant Italian authorities to ensure *in situ* protection of the endangered species *A. insularis.*

Further attempts to collect in those geographic areas where there are gaps in the collections are clearly needed.

There is need for further characterization and evaluation so that breeders will be able to obtain the information they require from the EADB.

Safety-duplication is urgently needed for the wild collections. Lack of funding is the major constraint in producing safety-duplicates. At the same time, much of the collected material is rapidly approaching the time when regeneration is necessary, and there is no funding to undertake this task.

ECP/GR Barley Working Group: Review of the Group Progress and Future Perspective

Helmut Knüpffer[1] and Roland von Bothmer[2]

[1]*Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany.*

[2]*Department of Crop Science, Swedish University of Agricultural Sciences, Alnarp, Sweden.*

Introduction

The ECP / GR Barley Working Group has held five meetings in Gatersleben, Germany, in 1983, 1986, 1989, 1993 and 1997, respectively. The backbone of the Barley Working Group is the European Barley Database (EBDB). In the present report, information on the activities of the Group is presented, with emphasis on the progress made since the fifth meeting (1997) and recommendations to the Cereals Network. The following topics are briefly discussed: the European Barley Database (EBDB), handling of pedigree data, the EU project on barley genetic resources, the international Barley Core Collection (BCC), evaluation of PGR, wild species, and sharing of responsibilities for conservation.

European Barley Database

The first version of the EBDB was developed between 1984 and 1987 (Knüpffer 1988), and resulted in the publication of the European Barley List (Knüpffer 1987). It contained passport data of 55,000 barley accessions from ca. 35 genebanks in Europe. Methods for the identification of potential duplicates based on passport descriptors were developed, and "duplicate groups" were identified. The second version (Knüpffer and López 1999) was built up in 1997, when additional manpower became available for six months. Within the framework of the EU project on barley genetic resources (1999-2002), further work on updating and extending the EBDB is being done. The fifth meeting of the Barley Working Group (Maggioni *et al.* 1999) made some recommendations with respect to further development of the EBDB.

The following progress was made:

- The updates received from July to September 1997 were included in the database, and a request was sent to additional contributors for their passport data in 2000.
- Identification of possible duplicates and unique accessions among cultivars of European origin was started, using parallel accession numbers in different collections and accession names. The basis for this is assigning unique identifiers to accessions in the EBDB, compared with major non European collections such as ICARDA, USDA and the Canadian genebank (Enneking 2000). Possible duplicates identified in the first version of EBDB (1987-1989) will be taken into account in version 2.
- The identification of duplicates between genebanks allows links to be established between accessions and their evaluation data accessible in the respective databases. Cooperation with the International Crop Information System (ICIS) is envisaged.
- Verification of passport data with national experts, and feedback to genebanks, will be carried out when potential duplicates of European origin have been identified.
- Pedigree information is included in some contributors' data sets, but needs to be standardized and stored in a well designed database. ICIS offers this possibility. Three printed sources of barley pedigree data and other cultivar-related information are available (Arias *et al.* 1983, Baum *et al.* 1985, Baumer and Cais

2000), and scanning of these data with the aim of importing them into a database was started, with the permission of the respective authors.

- The botanical nomenclature for wild and cultivated barley was standardized, based on relevant literature (Mansfeld 1950, Lukyanova *et al.* 1990 for infraspecific names in cultivated barley, Bothmer *et al.* 1995 for wild species). In relation to this exercise, the descriptions and synonymy of 216 botanical varieties of *Hordeum vulgare* from Mansfeld (1950) and Lukyanova *et al.* (1990) were translated into English from German and Russian, respectively, and organized in a database. The composition of the EBDB by species, and by botanical varieties of *H. vulgare*, is given in Tables 1 and 2, respectively.
- Other work in progress is: standardization of collecting site information and completion with geographical coordinates, harmonization of donor, breeder and other institution or person acronyms with FAO / IPGRI codes (INSTCODE.DBF), and compilation of a list of barley-relevant expedition / collector acronyms.
- The partly updated EBDB was handed over to ZADI, Bonn, for replacement of the former EBDB prototype; a WWW database is planned to be established at IPK's own server.
- The EBDB was adapted to fit with the IPGRI "Multi-Crop Passport Descriptors", including barley-specific data elements. Contributors to the EBDB are encouraged to use this agreed exchange format for their passport data contributions.

In light of the EU project EPGRIS (European Plant Genetic Resources Infra-Structure) that has recently been accepted by the European Commission, and in which a centralized passport database for all genetic resources accessions preserved in European genebanks will be created at IPGRI in Rome, the ECP / GR Central Crop Databases will take on a new role.

Table 1. ECP/GR European Barley Database. Composition by species (as of July 2000), in decreasing order of frequency

***Hordeum* species**	**Accessions**
vulgare L. s.l.	75,845
spontaneum Koch	8,762
sp. – unknown or not indicated	3,723
bulbosum L.	147
murinum L.	137
chilense Roem. et Schult.	77
marinum Huds.	71
agriocrithon Åberg	52
lagunculiforme (Bacht.) Bacht. ex Nikif.	46
jubatum L.	30
brevisubulatum (Trin.) Link	26
patagonicum (Haumann) Covas	8
cordobense Bothmer *et al.*	7
brachyantherum Nevski	6
roshevitzii Bowden	6
secalinum Schreb.	6
stenostachys Godr.	6
bogdanii Wilensky	5
procerum Nevski	5
comosum Presl	4
muticum Presl	4
pusillum Nutt.	3
spontaneum Koch x *H. vulgare*	3
capense Thunb.	2
depressum (Scribn. et Sm.) Rydb.	2
lechleri (Steud.) Schenck	2
parodii Covas	2
vulgare L. s.l. x *H. spontaneum*	2
arizonicum Covas	1
flexuosum Steud.	1
fuegianum Bothmer *et al.*	1
intercedens Nevski	1
pubiflorum Hook. f.	1
spontaneum-type	1
tetraploidum Covas	1
Total	**88,996**

Table 2. ECP/GR European Barley Database. Composition of cultivated barley by varieties (as of July 2000), in decreasing order of frequency

***Hordeum vulgare*, varieties**	**Accs.**
no infraspecific name given	56,076
hybernum Vib.	6,739
nutans (Rode) Alef.	6,065
coeleste L.	616
parallelum Körn.	503
deficiens (Steud.) Körn.	498
densum Sér.	341
erectum (Rode) Alef.	308
nigripallidum Regel	296
rikotense Regel	254
himalayense (Ritt.) Körn.	245
nudum (L.) Alef.	225
medicum Körn.	217
subviolaceum Körn.	205
steudelii Körn.	197
nigrum (Willd.) Link	183
hybernum-deficiens	141
nigrescens Körn.	116
revelatum Körn.	93
nudipyramidatum Körn.	85
coerulescens Sér.	81
hypatherum (Vav. et Orl.) Mansf.	75
abyssinicum (Sér.) Körn.	72
trifurcatum (Schlecht.) Wender.	68
violaceum Körn.	67
subpyramidatum (Orl.) Mansf.	66
brevisetum Regel	63
horsfordianum Wittm.	62
viride (Vav. et Orl.) Mansf.	60
harlani (Vav. et Orl.) Mansf.	57
subparallelum (Orl.) Mansf.	56
atterbergii Körn.	53
deficiens-hybernum	49
duplinigrum (Körn.) Mansf.	49
breviaristatum (Vav.) Mansf.	48
nigrinudum (Vav.) Mansf.	48
japonicum (Vav. et Orl.) Mansf.	47
asiaticum (Vav.) Mansf.	45
nigricans Sér.	45
duplialbum Körn.	38
subnudipyramidatum (Orl.) Mansf.	35
seringei Körn.	34
breve Alef.	33
macrolepis (A. Br.) Körn.	32
atroviolaceum Mansf.	31
tibetanum (Vav. et Orl.) Mansf.	29

***Hordeum vulgare*, varieties**	**Accs.**
griseinudum (Vav. et Orl.) Mansf.	28
africanum (Vav.) Mansf.	26
gymnanomalum Körn.	26
inerme Körn.	26
neogenes Körn.	26
persicum Körn.	24
subviolaceum-deficiens	23
glabriparallelum (Orl.) Mansf.	22
hypianthinum Körn.	22
acachicum Giess., Hoffm. et Schottenl.	21
leiorrhynchum Körn.	21
nigripallidum-steudelii	21
haxtoni Körn.	20
addisabebae (Vav. et Orl.) Mansf.	19
atratum (Vav. et Orl.) Mansf.	17
copticum (Vav.) Mansf.	17
cornutum Schrad.	17
nudideficiens Körn.	17
gracilius Körn.	16
nudihaxtoni (Körn.) Mansf.	16
nuditransiens (Körn.) Mansf.	16
dundarbeyi Zhuk.	15
subinerme Körn.	15
nigrum-steudelii	14
ibericum (Vav. et Orl.) Mansf.	13
latiglumatum Körn.	13
asmaricum (Orl.) Mansf.	12
nipponicum (Vav. et Orl.) Mansf.	12
pyramidatum Körn.	12
daghestanicum (Vav. et Orl.) Mansf.	11
pavoninum (Körn.) Mansf.	11
subhaxtoni (Körn.) Mansf.	11
angustispicatum Körn.	10
decorticatum Körn.	10
nutans-pallidum Trof. et Luk.	10
schimperianum Körn.	10
zeocrithideficiens (Vav.) Mansf.	10
9 varieties with 9 accessions each	81
10 varieties with 8 accessions each	80
6 varieties with 7 accessions each	42
9 varieties with 6 accessions each	36
5 varieties with 5 accessions each	25
12 varieties with 4 accessions each	48
19 varieties with 3 accessions each	53
19 varieties with 2 accessions each	38
47 varieties with 1 accession each	47
218 different botanical variety names	**19,771**

Handling of Pedigree Data in PGR databases

During the 1997 meeting of the Barley Working Group, an *ad hoc* group on this topic was created, and its recommendations were published in the Report. The problems related to the handling of pedigree data in PGR databases was considered not to be barley-specific, but an important issue for all major crop species. For most crops, there is no official worldwide registration authority for cultivars, where cultivar names and details of the breeding history, including pedigrees, would have to be registered. Therefore, for different cereals and other crops, attempts have been made to compile existing information. For example, a database for wheat pedigrees exists at the genebank in Prague-Ruzyne, Czech Republic, as a result of cooperation with Russian scientists, and a catalogue was issued (Martynov 1992-1996). Three similar publications for barley are

known (Arias *et al.* 1983, Baum *et al.* 1985, Baumer and Cais 2000). Two different notation systems for pedigrees are being used in databases. The task force was requested to recommend one of them for use in central crop databases. It was recommended that pedigree and other cultivar-related information be collected and included in the EBDB as far as available.

The collation of pedigree information for a particular crop needs concerted action across regions worldwide. Examples of existing approaches are those of SINGER (CGIAR) and ICIS-IBIS (CIMMYT-ICARDA). The EBDB would benefit from linking with these international approaches. The Working Group recommended the creation of an ECP/GR-wide unified approach within the Cereals Network and the development of algorithms and computer programmes for pedigree data handling (tree creation, pedigree analysis). It was proposed to initiate discussions with other ECP/GR Working Group chairs and Database managers about approaches to pedigree information collation and management, with wide involvement of crop specialists in collation and verification of pedigree information. It was also proposed that a discussion document be developed.

The need for standardization of pedigree information registration is illustrated by the diversity of notations in some accessions in the European Barley Database (Table 3).

Table 3. ECP/GR European Barley Database. Examples of different pedigree notations for some cultivars

Cultivar	Accession name as in EBDB	Pedigree
Alpha	Alpha	P:Manchuria/Champion of Vermont
	Alpha	P:2*Ager/Ceres
	Alpha	(Ager/ Ceres)/ Ager
	ALPHA	2*AGER/CERES
Atlas	Atlas	S:Coast
	Atlas	P:Breustedt 6129/Breustedt Schladener
	Atlas	Mutant SS55 / Diamant
	Atlas	Mutant SS 55/Diamant
	ATLAS	BREUSTEDT 6129/BREUSTEDT SCHLADENER
	ATLAS	PURE LINE FROM COAST
Carmen	Carmen	P:Domen/Carlsberg 2
	Carmen	P:Domen/Carlsberg
	Carmen	Domen/ Carlsberg
	CARMEN	DOMEN/CARLSBERG II
Diamant	Diamant	M:Valticky
	Diamant	X ray mutant z Valticky
	Diamant	M.R.G.Valticky
	DIAMANT	MUTANT OF *
Mars	Mars	P:Minnesota 462/Peatland
	Mars	ST 9060/70 / Abed Lofa
	Mars	St 13259/Hor 2957//Abed Lofa
	MARS	BORDIA/KENIA/FRISIA
Opal	Opal	P:Binder/Gull
	Opal	(Ametyst / Palestine)/ Sladar
	Opal	Ametyst/Palestine 10//Sladar
	OPAL	AMETYST/PALESTINE 10//SLADAR
Prima	Prima	P:Weihenst.254-650/Tscherm 2-Zeil.Winteg
	Prima	Triumph/Cambrinus
	Prima	(Probstdorfer Massa/ Vogelsanger Gold)/ (Rebekka 3/ Birgit)
	PRIMA	W254-650/TSCHERMAKS ZWEIZEILIGE WINTERGERSTE
Sonja	Sonja	P:Tria/Malta
	Sonja	P:Tria/Malta
	Sonja	(Tria/Malta)
	SONJA	TRIA/MALTA
Spartan	Spartan	P:Michegan 2 Row/Black Barbless
	Spartan	P:Diamant/Valticky//Monte Cristo/Ekonom
	Spartan	(Monte CHristo / Valticky)/ Ekonom)
	Spartan	Diamant/Valticky//Monte Cristo/Ekonom
	SPARTAN	DIAMANT/VALTICKY//MONTE CRISTO/EKONOM

EU project on barley genetic resources

The Working Group had encouraged IPK to resubmit a project proposal to the EU programme on genetic resources (Regulation no. 1467/94), focussing on evaluation of the Barley Core Collection and improving the European Barley Database. The second submission in 1998 was successful, and the three year project GENRES CT 98-104 on "Evaluation and conservation of barley genetic resources to improve their accessibility to breeders in Europe" (http://barley.ipk-gatersleben.de/), with 28 partners started in April 1999.

Seven non EU countries whose participation in the project could not be funded by the EU are associated with the project, and their attendance to project meetings is covered by ECP/GR. In addition, small complementary projects are about to be implemented with the support of several European governments.

Barley Core Collection

The international Barley Core Collection (BCC) started from an initiative of the ECP/GR Barley Working Group. At the 1989 meeting it was proposed to create a "synthetic" (Brown 1959) barley core collection made up of accessions selected from European genebank holdings. A BCC task force further developed the concepts and discussed them with more than 100 specialists worldwide. At the Sixth Barley Genetics Symposium in Helsingborg, Sweden, in 1991, it was recommended to extend the scope and develop an international BCC. An international committee was formed to develop the BCC and monitor its progress. Its members are responsible for the selection of BCC accessions and their multiplication and distribution to users (see Knüpffer and Hintum 1995, Anon. 1996). The following BCC subsets have meanwhile been created and are available for evaluation and research purposes (*cf.* also Table 4): "European subset" (298 accessions; created by G. Fischbeck, Munich, now maintained by IPK Gatersleben), "East Asian subset" (380 accessions; K. Takeda and K. Sato, Kurashiki, Japan), "Americas subset" (152 accessions; H. Bockelman, Aberdeen, USA), "West Asia and North Africa subset" (285 accessions; J. Valkoun, ICARDA), "Australia and Oceania subset" (11 accessions; M. Mackay, Tamworth, Australia). Partly available are: "*H. vulgare* spp. *spontaneum* subset" (J. Valkoun) and the "Other wild species subset" (R. von Bothmer, Alnarp, Sweden). An "Ethiopian subset" could not yet be established. A report of the present state of the BCC will be presented at the BCC workshop held before the Eighth International Barley Genetics Symposium in Adelaide, Australia, and in a forthcoming publication (Knüpffer *et al.*, in prep.). Progress in the establishment of the BCC is slower than initially anticipated, due to the high workload of the voluntary cooperators. There are no additional funds available for the BCC maintenance and distribution. BCC accessions are increasingly being requested by researchers and breeders for evaluation and diversity studies. An overview of ongoing work will be given in the papers mentioned.

Table 4. The International Barley Core Collection (BCC) - available subsets of cultivated barley (*H. vulgare*) at IPK Gatersleben, Germany (as of July 2000).

Subset	Accs.	Country of Origin
Europe (298)	35	(unknown?)
	3	ALB – Albania
	1	ARM – Armenia
	9	AUT – Austria
	2	AZE – Azerbaijan
	1	BEL – Belgium
	6	BGR – Bulgaria
	1	BLR – Belarus
	2	CHE – Switzerland
	1	CYP – Cyprus
	8	CZE – Czech Republic
	45	DEU – Germany
	5	DNK – Denmark
	10	ESP – Spain
	5	FIN – Finland
	25	FRA – France
	15	GBR – United Kingdom
	5	GRC – Greece
	8	HUN – Hungary
	1	IRL – Ireland
	10	ITA – Italy
	5	KAZ – Kazakstan
	1	KGZ – Kyrgystan
	1	LTU – Lithuania
	14	NLD – Netherlands
	1	NOR – Norway
	7	POL – Poland
	2	PRT – Portugal
	7	ROM – Rumania
	28	RUS – Russia
	9	SWE – Sweden
	3	TJK – Tajikistan
	2	TKM – Turkmenistan
	10	UKR – Ukraine
	4	UZB – Uzbekistan
	6	YUG – Yugoslavia F.R.
WANA* (285)	19	AFG – Afghanistan
	2	ARE – United Arab Emirates
	4	ARM – Armenia
	5	AZE – Azerbaijan
	2	CYP – Cyprus
	17	DZA – Algeria
	10	EGY – Egypt
	1	GEO – Georgia
	26	IRN – Iran
	10	IRQ – Iraq
	10	JOR – Jordan
	5	LBN – Lebanon
	11	LBY – Libya
	40	MAR – Morocco
	7	OMN – Oman
	15	PAK – Pakistan
	1	SAU – Saudi Arabia
	31	SYR – Syria
	3	TJK – Tajikistan
	3	TKM – Turkmenistan
	58	TUR – Turkey
	5	UZB – Uzbekistan
E. Asia (380)	15	BTN – Bhutan
	105	CHN – China
	65	IND – India
	75	JPN – Japan
	67	KOR – Korea
	50	NPL – Nepal
	3	PRK – Korea (North)
Americas (152)	6	BOL – Bolivia
	2	BRA – Brazil
	31	CAN – Canada
	7	CHL – Chile
	1	CHN – China
	5	COL – Colombia
	2	DEU – Germany
	9	ECU – Ecuador
	1	FIN – Finland
	1	GBR – United Kingdom
	12	MEX – Mexico
	13	PER – Peru
	1	SWE – Sweden
	1	TUR – Turkey
	6	URY – Uruguay
	54	USA – USA
Oceania (11)	11	AUS – Australia
Total	**1,126**	

***** West Asia and North Africa

Evaluation of PGR

The 1997 Barley WG meeting recommended to continue and extend the evaluation activities in order to improve the accessibility of well documented material to breeders. This should also include molecular evaluation. Existing evaluation data should be made available and accessible to breeders, researchers and genebanks in all countries participating in ECP / GR.

This was in line with activities in the EVA project (1996-1999) carried on in Germany, aimed at the establishment of a national information system on evaluation data, with particular reference to barley (Harrer 1999). Within this project, IPK registered historical observation data on more than 30 characters of its barley collection, and BAZ registered

detailed disease resistance data. The above mentioned EU project also focuses on joint and coordinated evaluation of barley genetic resources.

Wild species

The Barley Working Group recommended that national programmes increase their efforts in conservation, evaluation and utilization of wild *Hordeum* species. It encourages the further development of breeding techniques for wide crosses together with pre-breeding programmes to improve the utilization of extended genepools. In the case of closely related taxa (e.g. *H. vulgare* subsp. *spontaneum*) and landraces, this could be achieved through the initiation of composite cross programmes ('dynamic genepools'). Finally, the Group recommended that *H. vulgare* subsp. *spontaneum* and landraces should be the main object of evaluation in the EU project, which was followed in the actual project.

Sharing responsibilities for conservation

During the meeting of the Barley Working Group, an *ad hoc* group was formed to develop ideas related to this topic, and a summary paper (Weibull *et al.* 1999) can be found in the Report. The Working Group recommended the establishment of a "decentralized European Barley Collection", and that individual collections should identify accessions of national origin, to be considered as "primary holdings". The following workplan was proposed:

- for each original accession, the EBDB manager should suggest a genebank as "primary collection holder";
- national commitment should be sought for long term conservation and access to these accessions. It is understood as a custody, not as ownership;
- national programmes should provide the EBDB manager with a list of those accessions for which the country takes responsibility;
- EBDB manager should record the "holder of primary collection" of each accession in the database

The responsibilities of the holders of primary collections would include:

- ensuring the long-term maintenance according to international standards;
- ensuring safety-duplication and timely response to germplasm requests;
- handling problems such as temporary shortage of seeds; responses to requests for "all accessions";
- providing unrestricted access to *bona fide* users within ECP/GR; developing an appropriate MTA;
- giving priority to characterization, evaluation and documentation of the "primary collection".

The EBDB manager would, in this context, have the following responsibilities:

- to facilitate the repatriation of germplasm;
- to update the database every 1-2 years;
- to rapidly forward any seed requests to the "primary collection" holders;
- to maintain information about the degree of safety-duplication within the network.

The Weibull *et al.* (1999) list also proposed responsibilities for the genebank hosting safety-duplicates and for the ECP/GR Barley Working Group.

Recommendations from the Barley Working Group to the Cereals Network

The Barley WG recommends that many of the above issues be discussed and standardized among all cereals, because they are not specific to barley alone. Joint

activities and questions of scientific management of plant genetic resources are relevant for all cereal crops.

- In light of EPGRIS, Central Crop Databases will take on a new role, concentrating on crop-specific data (characterization and evaluation) and crop-specific problems such as identification of duplicates and links between genebank information systems to improve access to characterization and evaluation data;
- Problems related to statistical processing of, and database design for genebank-specific observation data, and of evaluation data from various sources need to be solved not only for barley – this is discussed in more detail under "Handling of characterization and evaluation data";
- Handling of pedigree data is a topic of interest for other cereal crops (and, more generally, many other crops), therefore, the database-methodological approaches should be the same. The crop-specific part consists in gathering the relevant information and processing it for inclusion in the respective databases;
- Questions of sharing responsibilities between genebanks by designating "primary holders", as discussed above, should be solved in the same way for all cereals (and desirably for many other crops as well). This would lead to the desirable situation in which genebank curators deal with the same procedures for all crops;
- Handling of EU projects on genetic resources, and the inclusion of non EU partners in the activities and funding of such projects, should be addressed in the Cereals Network;
- Since some of the above activities require additional staff and funds, fundraising for methodological and networking aspects is considered an important issue for the Cereals Network.

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Barley Working Group Process Analysis

This table is based on the "Crop Working Group Process Analysis" table developed at the Seventh meeting of the Steering Committee of ECP/GR (1998). Status reports with relation to the Barley Working Group on each of the topics are given in italics.

Activities	Conservation		Documentation	Collecting	Characterization and evaluation	Collaboration
	Regular	Emergency				
Minimum	Uniform standards for regeneration, multiplication and conservation adopted. *Standardization of regeneration, multiplication and conservation techniques considered unnecessary as long as good quality is guaranteed (EU Barley Project).* Duplicates and synonyms identified based on available information. *Activity started on the basis of EBDB, including available data from non European sources and published inventories of barley cultivars and lines. Ongoing.* Unique material identified. *Possible after assignment of unique identifiers, as a result of linking EBDB with various other DBs.* Most appropriate methods of conservation determined.	Regeneration needs identified. *Started for genebanks participating in EU Barley Project.* Procedures for emergency regeneration established. *Started for genebanks participating in EU Barley Project.* Safety-duplication implemented. *Will follow after identification of duplicates and designation of "primary collection holders", depending on common approach developed for Cereals Network.* Emergency regeneration carried out. *Started for genebanks participating in EU Barley Project.*	European database established. *EBDB established at IPK Gatersleben.* Database manager nominated. *DB manager: H. Knüpffer, with the assistance of D. Enneking (EU Barley Project.)* Passport data included. *Yes. Additional passport data being requested.* Protocol for updating data elaborated. *Data exchange preferably in IPGRI "Multi-Crop Descriptor" format, but so far other formats also accepted.*	Genetic diversity of crops inventoried based on available data. *Not yet. Genetic diversity can be estimated only if genetic information is included in the database which is not yet the case (and at present not feasible for the EBDB given the workload and staff constraints).* Gaps and potential needs for collecting identified. *Can be done on the basis of "country of origin", will be improved with better geographical data (after addition of coordinates).*	Descriptor lists for (preliminary) characterization and evaluation agreed. *IPGRI descriptor list for barley; within EU Barley project methods for evaluation have been standardized.*	Priorities for complementary activities identified in collaboration with other relevant actors. *See recommendations from the Cereals Network meeting (July 2000, Radzików) on pedigrees, sharing of responsibilities and other topics; cf. also EPGRIS and its implications for a new role of CCDBs.*

Activities	Conservation		Documentation	Collecting	Characterization and evaluation	Collaboration
	Regular	Emergency				
Undecided			Database accessible through Internet *EBDB WWW prototype at ZADI server (Bonn, Germany); new version of EBDB handed over to ZADI for replacement of prototype; WWW-EBDB planned at IPK Gatersleben.*		Descriptor lists for (further) characterization and evaluation finalized. *IPGRI Barley Descriptor List; agreements within EU Barley Project.* Core collection established. *Barley Core Collection (BCC) initially as ECP/GR initiative (Barley WG 1989); evolved into an International BCC; BCC being established.*	
Additional	Appropriate alternative or complementary *ex situ* conservation strategies implemented. *Barley is not suitable for cryo or* in vitro *preservation. Perennial wild barleys are being kept in some genebanks as* ex situ *field collection.* *Discussion for European network of* in situ *conservation of wild cereals (including wild barley) started within Cereals Network. No need or possibility is seen for in situ conservation of barley landraces in Europe.*		Characterization data included. *Links between EBDB and databases of characterization data are being established.* Evaluation data included. *Links between EBDB and databases of evaluation data are being established.* Crop-specific links with other programmes, networks and databases established. *Linking with other barley programmes and databases (e.g., ICIS-IBIS, ICARDA, CIMMYT, USDA, Canada, Japan) in progress within the EU Barley Project.*	Collecting activities, where needed, carried out. *Collecting activities based on recommendations from thorough studies of the EBDB have not yet been initiated.*	Characterization of collection carried out. *This is routine procedure during multiplication and regeneration in some larger genebanks.* Evaluation of collection experiments carried out. Pre-breeding (base broadening) undertaken. *Discussions about a pre-breeding project complementary to ECP/GR Barley WG activities and EU Barley Project will be continued in December 2000.*	Above priorities implemented. *Not yet.* Collaboration with other regions established. *Started (cf. under Documentation, Additional).*

General comments

1. The ECP/GR Steering Committee (1998) has attempted to develop a matrix which distinguishes minimum and additional tasks for Working Groups. The Process Analysis is meant for guidance of ECP/GR Working Groups in determining their activities and the relative priorities of these activities, given the limited available budget.
2. For the moment no agreement has been reached on some activities, which are located in the segment 'Undecided'. The matrix should be regarded as preliminary and will be finalized by the Steering Committee in 2001 after an extensive consultation process within countries and within the ECP/GR Working Groups.
3. The above Crop Working Group Process Analysis considers both *ex situ* collections and on-farm/in-garden/*in situ* populations. It is realized that the matrix still focuses strongly on *ex situ* activities. The Working Groups are requested to carefully address alternative and complementary approaches.
4. Management of collections and populations of various crops has different requirements. Also, different institutions participating in the Working Groups may have different priorities. This process analysis may therefore have to be adapted by individual Working Groups.
5. All activities of Working Groups assume sharing of responsibilities. This aspect has not been separately mentioned.

Specific comments

Conservation

6. Alternative and complementary strategies include cryopreservation, *in vitro* conservation and *ex situ* field conservation.

Documentation

7. Internet may provide database information downloadable or on-line searchable.
8. Links with other programmes includes those of the informal sector.

Collaboration

9. Other relevant actors include other ECP/GR Networks and Working Groups.

ECP/GR Wheat Working Group and European Wheat Database progress report

Iva Faberová[1], *Annick Le Blanc*[2]
[1]*Research Institute of Crop Production, Prague-Ruzyne, Czech Republic,*
[2]*Groupe d' Etude et de Contrôle des Variétés et des Semences, Le Magneraud, Surgères, France*

Introduction

Wheat is considered the most important cereal crop and the necessity to document existing collections is obvious. The need for a European survey of genetic resources in wheat collections arose in the early nineties. All activities concerning wheat Plant Genetic Resources in Europe have been supported and promoted by ECP/GR. The results of these activities were the submission of the wheat catalogue project to the EU Commission, the availability of the European Wheat Database on the Internet and the establishment of the ECP/GR Working Group on wheat.

Wheat Working Group

The Wheat Working Group (WWG) is one of the youngest ECP/GR Working Groups. It was established in July 1998. The first *ad hoc* Group meeting took place in March 1996 in Paris. During this workshop results of the preparatory phase of the European Wheat Database were presented, the submission of the EU Wheat catalogue project was discussed and two co-chairs were elected. According to results of the first questionnaire, altogether 235 000 accessions are held in European wheat collections. At present the Wheat Working Group consists of 27 members and one observer representing 32 countries.

European Wheat Database

The European Wheat Database (EWDB) has been developed since 1995 by two database managers, each collecting data from one European "sub-region": EU region and non EU region, including Israel. The database structure was finalized in August 1996 and during 1996, 1997 and 1998 passport data on 127 000 accessions were collected by both database managers. The data conversion started in 1997 and the first EWDB on-line web application has been available on the Internet since June 1998 (74 703 records). At present passport information on a set of 93 569 wheat accessions is available (http://genbank.vurv.cz/ewdb/). Eleven thousand records are nearly ready to be included in the Internet application. About 50 % of European wheat collections will be documented in the EWDB. Although this proportion is comparable with other Central Crop Databases, there is a need to increase the percentage of documented accessions and improve the data quality as much as possible. There are still countries with large wheat collections that have still not contributed to the EWDB. Database managers would like to start a new data request initiative to improve the unfavourable rate.

The degree of completeness of the EWDB passport data is presented in Figure 1. The low percentage of information gathered concerning status, pedigree, donor number and other number is quite evident.

Figure 1. Completeness of EWDB passport fields (total 93569 records)

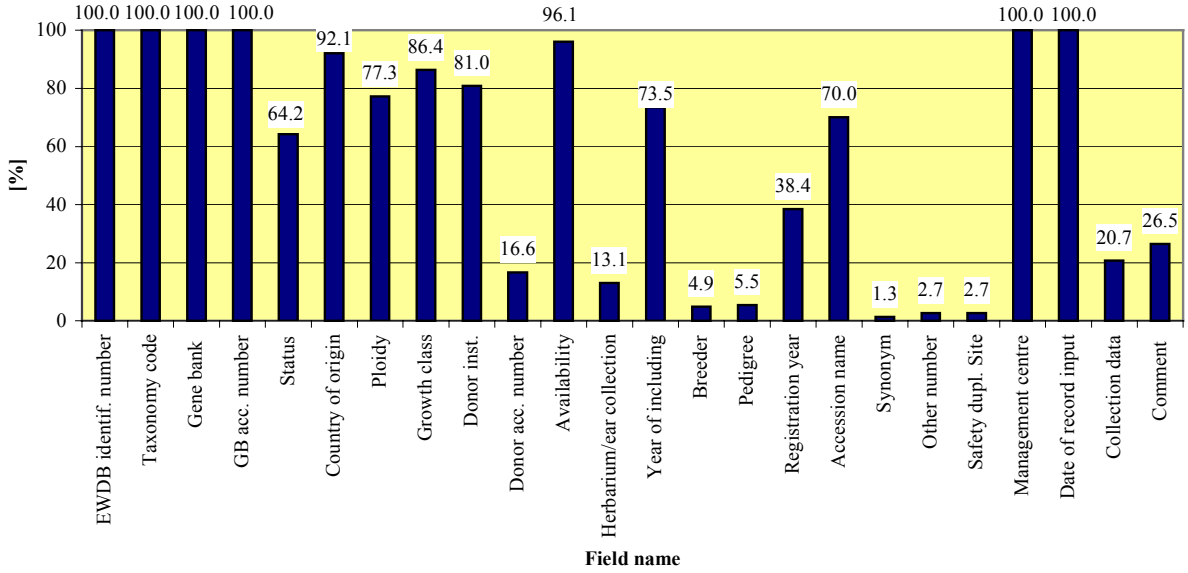
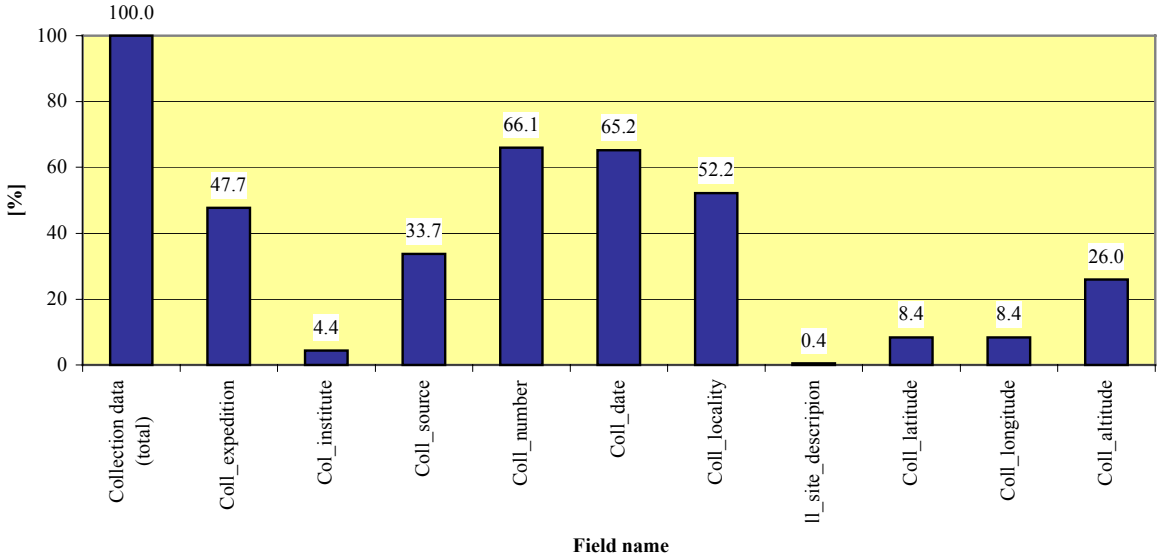


Figure 2 shows the degree of completeness of expedition data in the EWDB. The low percentage of such important data as collecting number, collecting date, locality or geographic coordinates is unsatisfactory and should be improved.

Figure 2. Completeness of EWDB expedition data (total 19389 records)



EU Wheat Catalogue Projects

Preparation of materials for the submission of the wheat project to EU Commission in 1995 by the French coordinator was the starting point for further cooperation of all European countries in the field of wheat collections. In the first call 14 EU member countries were included as participants. The completeness of the project was ensured by the additional partner 15 - RICP Prague - which represented all non EU countries as a voluntary participant without financial support. The improved EU wheat project was resubmitted by the French project coordinator in the second and third calls in 1996 and 1998. Despite it receiving a positive evaluation by the EU Commission, it was not approved for funding.

Search for additional support

Database managers were successful in submission of the bilateral French-Czech project Barrande 1997-1999, which was supported by the Ministries of Education and was dedicated to the mutual exchange of short time visits which were essential to strengthening the collaborative management of the EWDB. Similarly, the French partner is involved in the PECO NEI INRA project for the year 2000, which is supported by the French Ministry of Foreign Affairs.

Future plans

The next task will be conversion and presentation of all collected data and the effort to include the rest of the wheat passport information into EWDB. Austrian, Greek and complementary French data concerning durum wheat are to be taken into consideration in the near future. The priority will be also the improvement of passport data quality and the inclusion of characterization/evaluation data, at least for the set of selected descriptors. The EWDB Internet application should be enlarged to include the characterization and evaluation data. The possibility of an EWDB on-line update will be examined.

Methods for the establishmer Field name)ased on the available data, should be developed to enable orientation in ctions.

The search for the additional financial support by the new bilateral French-Czech project Barrande 2001 will be continued.

Table 1: Number of wheat accessions - estimation and present situation of the EWDB EU "sub-region" (countries under French coordination)

Country	Contributor Instcode	Declared number of accessions (1996)	Number of collected records (1998)	Available on-line (2000)
Germany	DEU001, DEU146	32308	29081	16757
France	FRA051, FRA040	5607	5125	1949
The Netherlands	NLD037	5260	5308	5123
Spain	ESP004	3155	2814	2814
Greece	GRC001	2455	170	0
Austria	AUT001	2045	884	0
Nordic countries	SWE002	1371	621	614
Italy	ITA004	>31000	0	0
United Kingdom	GBR011	7202	0	0
Portugal	PRT004	3992	0	0
Belgium	BEL001	367	0	0
EU sub-total		**94762**	**44003**	**27257**

Table 2: Number of wheat accessions - estimation and present situation of the EWDB Non EU "sub-region" (countries under Czech coordination)

Country	Contributor Instcode	Declared number of accessions (1996)	Number of collected records (1999)	Available on-line (2000)
Russia	RUS001	35213	34808	34808
Poland	POL003	11177	10397	10397
Turkey	TUR001	10365	3048	3046
Hungary	HUN003, HUN020	10149	6691	5461
Czech Republic	CZE122	9429	9421	9421
Romania	ROM007	9139	798	0
Bulgaria	BGR001	6672	10043	0
Switzerland	CHE001, CHE071	6604	4715	0
Yugoslavia	YUG002	3413	1504	0
Slovakia	SVK001	2384	2616	2616
Latvia	LVA001, LVA012	677	566	566
Lithuania	LTU001	300	7	7
Cyprus	CYP004	80	80	80
Belarus	BLR001	?	19	0
Israel	ISR001, ISR002, ISR003, ISR004	14592	0	0
Albania	ALB002	9650	0	0
Ukraine	UKR001	8100	0	0
Croatia	HRV015	2319	0	0
Estonia	EST001	30	0	0
Non EU sub-total		**140293**	**84694**	**66402**

Table 3. Total number of wheat accessions estimated in Europe and number of records documented in the EWDB

	Estimation (1996)	Records gathered (1999)	Available on-line (2000)
EU countries	94762	44003	27257
Non EU countries	140293	84694	66402
Europe total	235055	128697	93659

European *Secale* Database

Wieslaw Podyma
National Centre for Plant Genetic Resources, Plant Breeding and Acclimatization Institute, Radzików, 05-870 Blonie, Poland

A first ECP/GR *ad hoc* meeting on *Secale* was held in Jokioinen, Finland, in August 1982. At that time, the Group designated the Polish Gene Bank as a crop germplasm centre for rye and recommended collation of passport data from other European rye collections. The first edition of the rye catalogue comprised passport data of rye accessions maintained in 11 genetic resources centres. The pioneer work carried out at the Plant Breeding and Acclimatization Institute (IHAR) was edited under the auspices of the ECP/GR Secretariat in 1984 (Serwinski and Konopka 1984). As the first of its kind, the rye catalogue was used as a reference as well as a model for other European databases.

The second edition was initiated in 1995. Results of the work were presented during the ECP/GR *Secale* Genetic Resources Workshop, which was held in Warsaw, Poland, 5-6 July 1996 (Gass *et al*. 1998). Up to now 20 institutions provided data to IHAR Radzików. In all, 9 901 records containing passport data were provided to the European *Secale* Database.

The database structures and data formats were different. As a first step, a unified structure of the database was designed. From the data provided, the most common descriptors were chosen and data files from all collections were transformed using the unified structure. Less frequent descriptors, often specific for a single database, were included into 'wide' descriptors containing related data. The adopted database structure contains 29 descriptors, which are based on the multicrop passport descriptors (Lipman *et al*. 1997). Preliminary identification of probable duplicates was carried out using KWIC index (Knupffer 1988, 1989). Thirty-three percent of accessions maintained in *Secale* collections throughout Europe can be initially identified as duplicates (Podyma 1998).

The database has been transferred to the Internet (www.ihar.edu.pl/gene_bank/secale/secale.html) and is available from the ECP/GR website (http://www.ecpgr.cgiar.org/Databases/databases.htm).

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European central maize database: an essential tool for maize genetic resources management

Jasmina Muminović, Drazen Jelovac and Gordana Radović
Genebank for Maize, Maize Research Institute 'Zemun Polje', Belgrade-Zemun, F.R. Yugoslavia

Introduction

The principal activities of a genebank comprise collection, characterization, evaluation and conservation of plant genetic resources. As a final result of a systematic approach to plant genetic resources management a proper documentation system should be established. Within the European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR) various activities have been organized in order to improve the management of plant genetic resources, thus leading towards their more comprehensive utilization.

At the meeting held in Rome, in May 1996 (Lipman *et al.* 1997a), the initiative for establishing a central maize database was supported by all 18 participants from 16 countries. The Maize Research Institute 'Zemun Polje' was designated as a host of the European Maize Database (EMDb). Furthermore, specific actions and necessary steps that should be undertaken were recommended at the meeting.

Within ECP/GR various activities have been organized in order to improve the management of plant genetic resources, thus leading towards their more comprehensive utilization. In 1996, the Genebank for Maize, within the Maize Research Institute 'Zemun Polje', was designated the host of the EMDb.

Data collecting and standardization

The International Maize Genetic Resources Network initially took into consideration passport and primary characterization data. A descriptor list, used for the creation of the EMDb, was prepared in accordance with the "Descriptors for Maize" (CIMMYT/IBPGR, 1991). In addition to the basic passport and collecting data, descriptors for the most frequently required traits have been included. This refers to traits not strongly influenced by environmental conditions and which can be compared for classification of material characterized in different agroecological conditions and in different years.

Until June 2000, eight institutions provided data to the Maize Research Institute (Table 1). The EMDb now comprises data of more than 9 800 maize genotypes in total and is available to all participants of the EMDb Project.

Table 1. Institutions contributing to the European Maize Database

Institution	Country	No. of accessions
Bundesamt für Agrarbiologie	Austria	23
Institute of Plant Genetic Resources "K.Malkov"	Bulgaria	464
Genebank Institute for Crop Production	Czech Republic	914
Centre for Genetic Resources	The Netherlands	488
Banco Portugues de Germoplasma Vegetal	Portugal	900
ZeaInvent	Slovakia	135
Aegean Agricultural Research Institute	Turkey	1 506
Maize Research Institute "Zemun Polje"	F.R. Yugoslavia	5 437
	Total:	**9 867**

Data were provided mainly on DOS-formatted 3.5" diskettes or by Email (in two cases data were obtained as printouts). All the files were easy to process since the standardization of data was already agreed upon at the meeting in Rome and managed

in response to recommendations made at the meetings held in Budapest, in October 1996 (Lipman *et al.* 1997b), and in Montpellier, in March 1997 (Coordination meeting of the EU funded project RES GEN 088 on Maize landraces genetic resources). The standardization allowed the following data formats to be used: ASCII text format, dBase, Fox, Excel and Access.

Country abbreviations used in the EMDb are in accordance with the recommendations of the FAO Country List (FAO/IPGRI 1982), modified according to further FAO directions.

Database Structure

The structure of the passport data field list in the Database complies with the guidelines of the IPGRI/FAO Multi-Crop Passport Descriptor List. Since the requests of the Database users might demand further changes in the structure of the rest of the descriptor fields, the database structure remains open to adjustments.

Database content

A preliminary survey of the data assembled in the EMDb shows that the Database contains data on local populations (47%), breeder's lines (34%) and 3% of synthetic populations and composites, while data on the genetic composition of 1 527 accessions (16%) have not been provided. The origin of 7 716 maize accessions (93%) conserved in European genebanks, is known. Those accessions originated from fifty countries worldwide: 84% of accessions are from Europe, 7% from North America, 5% from Asia, 3% from South America and 1% of accessions came from Africa. While examining these data it is necessary to bear in mind a large number of duplicate accessions that certainly exist in European genebanks.

The accessions can be differentiated according to the altitude of the collecting site. Thus, 25% of accessions have been collected up to 500 m, 11% at altitudes from 500 to 1000 m and 2% have been collected at altitudes above 1000 m. The data on the altitude of the collecting site for the rest of the accessions in the EMDb (62%) have not been provided.

Two institutions supplied data for earliness (recorded by the number of days to silking and tasseling) for 2 948 accessions. According to them, 7% of accessions can be referred to as early, 83% as medium and 10% as late types. The same two institutions provided data for kernel type for 3 054 accessions. Regarding this trait 1% of accessions are floury, 1% are semi-floury, 11% are dent, 25% are semi-dent, 28% are semi-flint, 34% are flint, and less than 1% of accessions are pop and sweet types.

Benefits of the EMDb

The EMDb was intended to compile all available data from the European genebanks. The objective of the first stage was to create a complete picture of the current state of the European maize germplasm collections. Further steps should therefore include the incorporation of data that are missing in the existing descriptors or, depending on requests of participants, introduction of some additional traits. Identification and minimization of duplicates in European collections could then be performed. Conservation of maize genetic resources in Europe will thus be rationalized and brought to a much higher level of efficiency. Entire variability of maize germplasm conserved in European genebanks would be available for research or utilization.

The data already incorporated to the EMDb were forwarded to all maize specialists in Europe, particularly to the participants of this joint project. In addition, the data were made available on-line on the Internet and all the participants were informed about the website (http://www.mrizp.co.yu/emdb).

ECP/GR National Coordinators of 26 European countries were also informed about the idea and the progress in the EMDb. Further and more detailed information about the

EMDb may be obtained directly from the National Genebank for Maize, at the Maize Research Institute "Zemun Polje" (see Appendix I. List of Participants for full contact details).

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Implementation of the European network for evaluation, conservation and utilization of European maize landraces genetic resources

Armand Boyat
INRA (UR GAP) Génétique et Amélioration des Plantes, Domaine de Melgueil, Mauguio, France

Introduction

The RES GEN 088 project, funded by the European Union and coordinated by J. Dallard, INRA Mauguio, France, aims to constitute a European network (France, Germany, Greece, Italy, the Netherlands, Portugal and Spain) for the conservation, evaluation and use of population varieties of maize cultivated in the past. The private sector is associated with this project through the participation of "Pro-Maïs", an association bringing together all maize breeders working in western Europe.

The first objective was to establish an exhaustive inventory of these genetic resources held by each country, to describe them using ecogeographic passport data and to characterize them using primary agromorphologic descriptors. The output is a European database on the maize populations (EUMLDB) accessible to the public.

A second step of agromorphological characterization allowed each country to define a representative national collection of its own populations (NMLRC).

The whole population of these national collections is being characterized using RFLP markers in order to define the European representative collection of maize populations (EUMLCC). This "core-collection" will basically be used for exchange purposes and will be the subject of regular regeneration. This European collection will also be evaluated for a number of criteria specific to the Agricultural Community Policy in order to promote a durable agriculture. Some of the criteria will concern aptitudes of tolerance for the biotic (*Sesamia*) and abiotic (drought) factors, diversification of the uses and identification of qualitative traits (digestibility of the plant, oil, proteins and starch content of the grain).

Background

Since the introduction of maize in Europe five centuries ago, great differentiation occurred in maize landraces according to environments and farmers' needs. Adaptation of landraces to the many niches of European countries for many years explains the large variability which can be observed today (Brandolini 1969). However, most of them have a flint kernel, which is a typical character of European maize landraces. Today, highly productive hybrids have replaced landraces and are obtained by crossing inbred lines chosen in complementary heterotic groups. For northern and central Europe, the most common groups are European flint x American dent. During the fifties, the first European inbred lines were derived from European landraces by selection. They bring specifically early vigour and cold tolerance to the hybrid, in combination with dent material. The 'Lacaune' landrace has been at the origin of the inbred lines F2 and F7, very largely used in the hybrids adapted to the climatic conditions of northern Europe. Thus, European landraces could be a source of variability for diversification and preservation of the environment: as a source of pest tolerance (European corn borer virus), drought tolerance, cold tolerance, grain quality (human use, poultry breeding).

Today, native landraces are no longer cultivated except in the highland of northwest Spain and Portugal. Many landraces were collected by national research organizations of different European Union and east European countries during past years. Although a recent meeting took place in order to explore the availability of eastern and western European countries to cooperate in a common database of maize germplasm, no coordination exists for the conservation of maize genetic variability. Seven countries:

France, Germany, Greece, Italy, Portugal, The Netherlands and Spain decided to elaborate a common programme to conserve, evaluate and use their maize landraces genetic resources.

The objectives of the project are to:

- organize a transnational European network for the conservation of maize landraces according to a common protocol;
- optimize the utilization of genetic resources by evaluating a collection which contains, with a minimum of repetitiveness, the maximum possible genetic variability of European maize landraces (core collection);
- evaluate the core collection for criteria required by the objectives of the Common Agricultural Policy (CAP).

Since main factors in the structure of genetic variability among maize landraces are earliness, geographic origin and morphological traits, a first sorting of maize landraces collections has to be carried out by each partner. Maize curators have updated the maize European database according to a common database and have defined a collection with limited redundancy based on data previously recorded and on their own knowledge of populations.

Following that, the European maize landraces core collection will be constituted by analysing the genetic structure of all aggregated populations based on molecular polymorphism. Compared with genetic variability of morphological traits, molecular polymorphism is independent of environment. Moreover the molecular polymorphism (RFLP) of inbred lines reveals a genetic diversity structure in agreement with the origin and heterotic groups from which the lines were derived (Melchinger *et al.* 1990; Livini *et al.* 1992; Burstin *et al.* 1994). Validation of the use of RFLP for population structure studies has been made recently (Dubreuil et Charcosset, 1996). This core collection will be characterized for the adaptive traits, which are in agreement with the CAP fulfilment and can be considered as a prebreeding step for the use of maize genetic resources.

After this step, redundancy in genetic diversity is limited and the global cost of conservation of maize landraces in Europe will be reduced. Moreover, the core collection by its characterization and its representativeness will improve the use of the maize genetic resources held in the total collection. Breeders will have rapid access to genetic variation of a desirable trait for sustainable agriculture and industrial uses.

It would be interesting if information obtained on evaluated landraces further to seeds requests, came back to enrich the European maize database. People requesting accessions are systematically dealt with according to landrace availability. This knowledge on maize landraces is open to non governmental organizations (NGO) and associations via the maize database on Internet'

East European countries have collections with high numbers of maize landraces because of their cultivation until recently and due to a strong concern for conservation of genetic resources. This germplasm has been well maintained until recent years. The present situation is such that conservation of this material is not nowadays a high priority in these countries and this germplasm might be lost. The estimated number of these landraces is high, between 2 000 and 4 000 accessions, that is to say equal or higher than those of western European countries. An inventory of all the European maize genetic resources is planned with the help of ECP/GR. Partners of the present project are included in this action and a collaboration has been established through satellite meetings organized by the ECP/GR Programme.

First results of the project

Summary of the European maize landraces genetic resources survey

During the first year a report from each participant has enabled an overview of maize landrace germplasm conservation inside the European Union to be drawn up.

Generally, collecting was carried out during the sixties, when hybrids were present, though not yet to a large extent, and all the maize-cropping regions are represented. The number of ears collected by sample varies from 1 to 20, more often from 5 to 10, in all countries. This number is low. However, as a high number of populations have been collected by region, it can be expected that a large part of genetic variability has been rescued. We can therefore consider that our collections are representative enough of the initial genetic diversity and are worth dealing with.

The total number of native maize landraces has been scored for each country as follows: France: 272; Germany: 15; Greece: 201; Italy: 562; Portugal: 900; Spain: 932; Total: 2882.

Conservation and regeneration

Conservation equipment is generally good enough but some countries do not yet have satisfactory long-term conservation equipment in agreement with IPGRI recommendations. This situation results in frequent regeneration, which increases the risks of genetic drift and the global conservation cost. The amount of seeds conserved is very variable, from 12 balanced samples of 600 kernels to less than 700 bulked kernels for a landrace.

Regeneration varies largely according to the country. The number of ears varies from 200 derived from full-sib crossing to 20 ears derived from half-sib crossing. With this last method, the effective size can be very low, as there is no control of pollen. Thanks to the present programme, some landraces intended to be entered in the core collection should be regenerated in a satisfactory way.

Elaboration of the maize landraces database (EUMLDB)

During the first year, a descriptor list was set up (Table 1.), taking into account different requirements:

- maize descriptors list and IPGRI format, 1990;
- standards defined at the Budapest meeting for Multicrop Passport Descriptors;
- specific needs of the RES GEN 088 project.

List of descriptors (passport and primary data) of the European Union maize landrace database (EUMLDB) (Passport data are also valid for the National Maize Landrace Representative Collection (NMLRC) and the European Union Maize Landrace Core Collection (EUMLCC)):

Passport data

1 Institute code (INSTCODE)
2 Accession number (ACCNUM)
3 Collecting number (COLLNUM)
4 Species (SPECIES)
5 Accession name (ACCNAME)
6 Synonym (SYNONYM)
7 Country of origin (ORIGCTY)
8 Region of origin (ORIGREG)
9 Subregion of origin (ORIGSRG)
10 Location of collecting site (COLLSITE)
11 Latitude of collecting site (LATITUDE
12 Longitude of collecting site (LONGITUDE)
13 Elevation of collecting site (ELEVATION)
14 Collection date (COLLDATE)
15 Status of sample (SAMPSTAT)
16 Collecting source (COLLSRC)

17 Donor institute (DONCODE)
18 Donor number (DONNUM)
19 Other number (OTHERNUM)
20 Memo (REMARK)
21 Year of last regeneration (REGYEAR)
22 Amount of seeds available (SEEDAVL)
23 Type of collection (COLLTYPE)

Primary descriptors
24 Kernel type 1 (KERTYPE1)
25 Kernel type 2 (KERTYPE2)
26 Kernel type 3 (KERTYPE3)
27 Kernel colour 1 (KERCOLO1)
28 Kernel colour 2 (KERCOLO2)
29 Kernel colour 3 (KERCOLO3)
30 Cob colour 1 (COBCOLO1)
31 Cob colour 2 (COBCOLO2)
32 Number of kernel rows (AVERAGE) (NOKEROA)
33 Number of kernel rows (MAXIMUM) (NOKEROM)
34 Ear shape (EARSHAPE)
35 Growing degree units to female flowering (GDUFEM)

The data had been merged at the end of 1997 using an MS Access package. During 1998, a user-friendly application was set up to allow anyone to:

- consult the passport data and primary descriptors of any European landrace(if the accession number is known);
- search landraces meeting a number of specified criteria (passport data and primary descriptor);
- obtain any useful information about the location and address of the genebank involved in its conservation.

Besides this, it allows issues to be easily exported to Excel or Word files.

Elaboration of National Maize Landraces Representative Collections (NMLRC)

In order to structure the variability of the European maize landraces, and subsequently to set up national core collections, new agromorphological descriptors were scored and used in addition to primary descriptors. The characters were selected both for the scientific relevance and economic feasibility of their recording. They were not the same for all countries but the higher the number of characters, the more accurate the estimation of genetic distances has been. The following traits were used:

- plant traits: ear height, plant height, stalk diameter, presence or lack of anthocianine, tillering index;
- leaf traits: leaves upper ear number, length of ear's leave, width of ear's leave, leaf angle, leaf colour, nerve colour;
- root traits: secondary roots number, root lodging;
- panicle traits: tassel length, tassel ramification number, growing degree units to male flowering;
- ear traits: ear prolificacy, husk cover, peduncle length, ear length, ear diameter, cob diameter, arrangement of kernel rows, ear damage;
- kernel traits: number of kernels per row, kernel length, kernel type, 1000 kernels weight.

Using passport data, primary and secondary descriptors, each country has constituted its National Maize Landraces Representative Collections (NMLRC). The most common way has been to structure the variability using principal component analysis, selecting principal components to obtain clusters of landraces and then sampling inside clusters to identify several populations representing the most part of the variability of the cluster.

The total landraces constituting the NMLRC is close to 400:

France 80; Germany 15; Greece 50; Italy 90; Portugal 70; Spain 90.

Elaboration of the European Union Maize Landraces Core Collection (EUMLCC)

The interesting thing about molecular techniques is their independence from environmental effects and the fact that the results are little influenced by the kind of plant organ or by the development stage. Two kinds of genetic markers are used: 32 RFLP markers scored on 2 sets of a mixture of 15 individual plants' DNA per landrace, and 18 isoenzymatic loci scored on 15 individual plants per landrace. This characterization has been achieved by recording data.

For the 400 maize landraces that make up the NMLRC, we have gathered different types of characters: passport, morphological, molecular, qualitative and quantitative. The disposability of such different types of characters allows us to study a methodology to build a germplasm core collection by the comparison of several strategies. By the use of the MSTRAT programme we intend to maximize the allelic or phenotypic richness - the so-called M strategy helps to define samples for a core collection by maximizing the number of observed alleles at the marker loci. This method has been recently extended to both qualitative and quantitative variables. The EUMLCC will be elaborated at the end of 2000 and constituted by about 100 landraces.

Evaluation of the European Union Maize Landraces Core Collection (EUMLCC)

EUMLRC accessions were evaluated for NIRS digestibility during 1998 and 1999 in Spain.

All the accessions of the EUMLCC will be evaluated for some criteria required for a sustainable agriculture and diversified maize industry during 2001.

Diffusion of results and materials

Full project description, last results, MSTRAT software for constitution of core collections and EUMLDB are available on the Internet at: http:/www.ensam.inra.fr/gap/resgen88.

At the end of the project, the European core collection of maize landraces will be an active collection and will be distributed immediately as widely as requested. Conditions of diffusion will be in line with international agreements and any requests will be satisfied making use of a Material Transfer Agreement (MTA).

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The European *Triticale* Database (ETDB)

Gert Kleijer
Station Fédérale de Recherches en Production Végétale de Changins, Nyon, Switzerland

Progress report

A first contact in 1997 with the different European genebanks holding *Triticale* accessions indicated that in 14 European countries, 12 323 accessions of *Triticale* are conserved. Data have been received from 8 countries, Austria, Czech Republic, Germany, Latvia, Russia, Slovakia, Spain and Switzerland, representing 5 988 accessions. These data concern only passport data.

The wheat database, developed by A. Leblanc, has been used as a basis for the European *Triticale* database.

Not all the received data could be included in the ETDB. For the moment the data of Austria, Latvia, Switzerland and part of the accessions of Russia are included, representing about 2000 accessions. For most of these accessions the database contains 12 passport data.

Ideally, introduction of the received data should be completed by the end of this year and the genebanks that have not yet sent their data should also be contacted in an effort to complete the ETDB by the end of the year. At the same time we will try to make the ETDB available on the Internet. After the introduction of all the data some statistical analyses can be carried out.

Review of minor cereals and pseudo-cereals in Europe

Anna Michalová
Research Institute of Crop Production, Praha – Ruzyne, Czech Republic

The ECP/GR Minor Crops Coordinating Group, formed in 1999 (*Ad hoc* meeting - Turku, Finland), includes different types of minor crops (cereals, fruits, vegetables, legumes, industrial crops etc.). The agreed workplan consists of the following two actions:

- identification of a list of crops/species which should become the focus of the Minor Crops Network activity and selection of one or two from them for priority action;
- compilation of information about *ex situ* and *in situ* conservation, distribution and level of utilization of the priority crops, list of experts/institutions, ongoing activities, etc.

It is expected that these activities will be completed by December 2001.

The present activity of the Sub-Group on Minor Cereals is preparing a questionnaire to be sent to the European National Coordinators. The aim is to collect available information about minor cereals or pseudo-cereals species, their distribution throughout the region and the level of utilization at local or sub-regional level, the status of availability of germplasm in genebank collections, the level of genetic erosion of the minor species, experts/institutions working on these species, activities on these species, relevant publications, etc.

According to the preliminary gathered information, altogether 18 crop species of hulled wheats and other minor wheat species, semi-perennial rye, naked barley and naked oat, sorghum, millets and buckwheat have been included in the 'Open list of minor cereals and pseudo-cereals in Europe'. This has been published for the first time in the Report of a Network Coordinating Group on Minor Crops (Michalová 2000) and it is proposed again here (Table 1) as a working document open to revision.

Table 1. Open list of minor cereals and pseudocereals in Europe suggested for the attention of the ECP/GR Minor Crops Network

Crops/species	***Botanical name***
Cereals:	
Hulled wheats	
1 Einkorn	*Triticum monococcum* L.
2 Emmer	*Triticum dicoccon* Schrank (Schuebl.)
3 Spelt wheat	*Triticum spelta* L.
Other wheats species	
4 Polish wheat	*Triticum polonicum* L.
5 Club wheat	*Triticum compactum* Host.
6 Turgidum wheat	*Triticum turgidum* L.
7 Carthlicum wheat	*Triticum carthlicum* Nevski
8 Macha wheat	*Triticum macha* Dekapr. et Menabde
Rye	
9 Semiperenial rye	*Secale cereale* L., var. *multicaule* Metzg.
Barley	
10 Naked barley	*Hordeum vulgare* L., subsp. *distichon* (L.) Koern., var. *nudum* L.
Oat	
11 Naked oat	*Avena nuda* L.
Sorghum and millets	
12 Sorghum	*Sorghum bicolor* (L.) Moench
13 Common millet	*Panicum miliaceum* L.
14 Foxtail millet	*Setaria italica* (L.) P. Beauv.
15 Barnyard millet	*Echinochloa frumentacea* (Roxb.) Link.
16 Foxglove	*Digitaria sanguinalis* (L.) Scop.
Pseudocereals:	
Buckwheat	
17 Common buckwheat	*Fagopyrum esculentum* Moench
18 Tartary buckwheat	*Fagopyrum tataricum* (L.) Gaertn.

On the basis of the preliminary information, buckwheat and millet should be considered as priority minor cereals. Both of these crops meet the 'Criteria for Minor Crops' referred by the Coordinating Group on Minor Crops (risk of genetic erosion, economic importance, regional or sub-regional distribution, traditional crops in Europe, indigenous origin, the use of the crops, the present use of the PGR for plant breeding or other research, the level of available genetic diversity).

Within Europe, some relatively large national collections of buckwheat and millet exist but up to now no international databases have been created. The situation is relatively better with the PGR of other cereals (hulled wheats, naked forms of barley and oat and also semi-perennial rye), which are traditionally included in the collections of major cereals and have also been included within the scope of existing ECP/GR Cereal Working Groups.

The author considers the following as priority actions:

- to begin by collating existing information related to genetic resources of all species of minor cereals;
- the creation of European databases: buckwheat and millet are proposed crops for initial development;
- the creation of a web page on minor cereals, to be regularly updated, where anybody could view the current status and progress made;
- to identify contact persons in countries with the aim/possibility of eventually forming a working group for minor cereals in Europe;
- to identify a source of financial support (e.g. programmes and projects funded within the EU 5th framework).

Potential areas of further collaboration for conservation and use at a regional level

- promotion of public awareness of minor cereals;
- organizing of country, regional or international conferences, symposia, workshops, seminars;
- cooperation with NGOs, attraction of their interest preferably to local, traditional minor crops;
- focusing on *in situ* / on-farm conservation in accordance with national PGR conservation priorities.

Connection between the Cereals and Minor Crops Network

The following actions are proposed as a result of a close interaction between the Minor Crops and the Cereals Network:

- testing of availability and completeness of data concerning minor crops in European cereal databases and identifying gaps (hulled wheats, other neglected wheat species, naked barley and naked oats and semi-perennial rye);
- use of available data for the establishment of a European Minor Cereal Database.

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Regeneration standards, rationalization of collections and safety-duplication

Christoph U. Germeier and Lothar Frese
Federal Centre for Breeding Research on Cultivated Plants (BAZ) – Gene Bank, Braunschweig, Germany

ISO 9000 - concepts

ISO9000 is a series of generic (not specific) standards relating to the design and effective documentation of an internal quality management system (http://www.asq.org/stand/types/iso9000.html). They do not themselves specify the technology to be used for implementing quality system elements. Basic standard texts (ISO 8402 (1994), ISO 9000-1 (1994), ISO 9000-2 (1997), ISO 9000-4 (1993), ISO 9001 (1994), ISO 9002 (1994), ISO 9003 (1994), ISO 9004-1 (1994), ISO 9004-2 (1991), ISO 9004-3 (1993) ISO 9004-4 (1993)) are available from the International Organization for Standardization. Additional information and a list of standards is provided on their web site (http://www.iso.ch). Design and implementation of the quality system complying with the requirements of ISO 9001 will typically require (http://www.isoeasy.org/faq10.htm):

- writing a quality manual, describing the implemented quality system at a high level;
- writing procedure documents to describe how work in the organization is carried out;
- creating a system to control distribution and re-issuance of documents;
- designing and implementing a corrective and preventive action system to prevent problems from recurring;
- identifying training needs for most positions in the organization;
- calibrating measurement and test equipment;
- training staff in the organization on the operation of the quality system;
- planning and conducting internal quality audits.

Thus ISO 9000 standards basically imply documentation of internal quality standards and they make these transparent to staff and collaborators, and eventually to customers and the public (Ortmann & Platzek 1996). Normally an internal production handbook has to be developed. We suggest that this kind of information could also be provided by a computer database system to staff and customers via Intranet and Internet. Thus this discussion may be principally addressed to the database managers, who may discuss and possibly agree on entities, attributes and entity-relationship models for these purposes. A database model is presented here for data relating to quality of maintenance, increase and viability testing derived mainly from 'FAO/IPGRI Genebank Standards' (Anonymous 1994) and 'A genebank handbook for regeneration of accessions' published by Sackville Hamilton & Chorlton (1997).

Rationalization of collections

Rationalization of collections is a precondition for achieving high quality maintenance standards with limited resources. This can be achieved through identification of duplicates and subsequent reduction of the number of accessions in the active collection in order to minimize regeneration and seed viability monitoring work. However, the elimination of probable duplicates from the base collections is not recommended.

Among European genebanks three basic strategies for rationalization of collections by sharing of responsibilities are under consideration (Gass and Begemann 1999):

- concentration on specific geographic origin;
- concentration on specific crops;
- an accession-wise decision procedure.

Bücken and Frese (1999) introduced a differential and hierarchical storage management of established large-sized genebanks. With some modifications, mainly in terminology and decoding, its concepts will be implemented in the BAZ genebank documentation system as well as the international crop databases managed by BAZ. The underlying paradigms were presented as follows:

- in most cases requests are the main reason for the decrease of viable seeds;
- most seed requests are not well specified;
- the principle of the "availability of germplasm for immediate delivery" has to be given up;
- the philosophy of the "one to one sample" for active and base collection has to be given up;
- a priority system for regeneration of accessions has to be established.

GENOTYPE	
GenotypeID	Integer
AccessionName	Char 84
TaxonID - > Relate taxonomy	
ProjectID - > Relate collecting project	
CollectingNumber	Char 20
CollectingDate	Char 11
CollectingSiteID -> Relate Site	Integer
OriginCountryCode	Char 3
PopulationSize	Char 5
PlantNumber	Char 9
SampleForm	Char 3
SampleStatusID	Integer
Use	Char 25
BreederID	Integer
BreedingMethodID	Integer
ChromosomeNumber	Integer
Ploidy	Integer
RegistrationCountry	Char 3
Registration	Date
DeRegistration	Date
EvaluationData	Char 1
CollectingData	Char 1

1 ∞

ACCESSION	
HolderCode	Char 15
AccessionNumber	Char 15
GenotypeID	Integer
ReceptionDate	Date
IntroductionDate	Date
AcquisitionType	Char 3
AcceptanceDate	Date
AcceptanceReason	Char 3
Responsibility	Char 3
Restrictions	Char 3
StorageStatus	Char 3
DuplicateTypeID	Char 3
RequestNumber	Integer
CoreCollection	Char 1
DonorCode	Char 15
DonorNumber	Char 15
LossDate	Date
LossReason	Char 3

Figure1. Related tables concerning genotype and accession information enabling documentation of duplicate groups without redundancy.

The last point highlights the interdependency with respect to sharing of responsibilities between different collections for duplicate groups. This issue is discussed

in more detail by W. Podyma (pp. 53-57 of this report). We will only mention some items currently being implemented in the International Database for *Beta*, the European *Avena* Database and the BAZ genebank documentation system. The problem of duplication in the genebank network has been treated in our databases by dividing passport information into two major tables (Figure 1): GENOTYPE, which describes the origin or genetic identity of a duplicate group and ACCESSION, which describes individual accessions of the 'Genotype' stored in different genebanks. The latter table (ACCESSION) also gives information about duplicate status, responsibility of genebanks for accessions of a duplicate group, assignment of accessions to a core collection, user requests and similar information specific for the duplicate accession in a certain genebank.

Different categories of duplicates have been described by Knüpffer *et al.* (1996). Accordingly, the categories have been listed in Table 1 A) below and codified using three letter codes, which are found in the descriptor 'DuplicateType' in the ACCESSION table. It will not always be possible to assign a sample to one of the biologically meaningful categories shown in Table 1 A), as the knowledge on the origin of a sample, as well as the maintenance history having a large impact on the genetic composition of an accession duplicate, can be obscure. However, if details on the samples' history are known, it can facilitate decisions on the maintenance responsibility. Once a decision has been taken it will be documented in the descriptors 'Responsibility' and 'Restrictions' (Table 1 B).

Table 1 Duplication and responsibility as a basis for a differential storage management concept

A) Duplication (Knüpffer, Frese & Jongen 1997)	
MOS	Most original sample
IDD	Identical duplication: genetically identical gene bank accessions
COD	Common duplicates: derived from the same original population
PAD	Partial duplicates: selected from the same original population
CPD	Compound duplication: one accession is a selection from the other
PRD	Duplication indicated by identical or similar passport data

B) Responsibility (modified according to Bücken & Frese 1999)					
Responsibility		**Restriction**		**Storage Status**	
PGR	Primary genetic resource	PUB	Public	ACO	Active collection
REF	Reference sample				
SDS	Safety-duplicate sample of other institutions	LOC	Locked	BAS	Base collection
PEN	Pending responsibility	TOC	Temporarily out of collection	NEW	New acquired accession
REJ	Responsibility rejected	EXE	Lost	DAT	Sample lost or withdrawn, only information available
DMS	Demonstration sample				
(PRO)	Project sample	RES	Restricted		

The accession's history might be elucidated by strictly following a documentation scheme, especially in international crop databases, which would enable to reconstruct the exchange pathway of accessions within the genebank network by documenting holders and donors with their respective identifiers and the accessions' dates of receipt. This is shown with an example from the European *Avena* Database (Figure 2). Fischer's Wirchenblatter III, an old landrace accession, is held at four institutions. In two cases it is known which genebank donated the accession to the respective holding institution. The sample held in Braunschweig (DEU001=BAZ) seems to be a common duplicate of the Gatersleben (DEU146=GAT) sample. Thus by agreement between both German genebanks the BAZ genebank rejected (REJ) the responsibility of maintaining an active

sample and transferred the sample into the base collection (BAS). In the other cases missing information has to be requested.

GenotypeID	5325				**TAXONOMY ZONE**				
Accession name	Fischers Wirchenblatter III				**Species** Sativa **Subspecies** var. Mutica				
COLLECTOR ZONE					**COLLECTING SITE**				
Institute		**Date**							
ADDRESS – Subform									
Person	D.Visser								
Collecting-Number	**Sample-status**	**Collecting-source**	**Plant-number**						
GENE BANK ZONE (subform representing the ACCESSION table linked by GenotypeID)									
Holder	**Accession**	**Reception-Date**	**Duplicate Type**	**Responsi-bility**	**Restric-tions**	**Storage Status**	**Donor**	**Accession**	**Activity**
DEU146	AVE 196		MOS				DEUNOB		
GBR005	00430		PRD						
DEU001	52285		COD	REJ	LOC	BAS	GAT	AVE0196	
CZE047	03C070529		PRD						

Figure 2. Form showing accessions of a group of probable duplicates (identical cultivar name) in different genebanks (example from EADB). Further international discussion on sharing of responsibilities has to contribute the management data still lacking in this table.

The responsibility of genebanks holding accessions belonging to a group of duplicates can be agreed on in an international discussion. Primary responsibility is taken over by a partner genebank for primary genetic resources (PGR), which may be most original samples (MOS) in the biological or geographic sense (sovereign rights over national genetic resources). Yet primary responsibility is not necessarily defined by biological or geographic criteria. It rather describes the duty of fulfilling certain standards of maintenance of and access to the germplasm, which includes holding a base and an available active sample of the accession as well as storing samples as safety-duplicates at partner genebanks.

Genebanks are of course free to store any sample they wish to store, for example if a specific sample is frequently used and quick users' access has to be guaranteed. Reference samples (REF) like demonstration samples (DMS) can be held even if this sample from the global point of view is superfluous as it belongs to a duplicate group, for which a partner genebank has accepted primary responsibility. In the case of safety-duplicates (SDS) the holding genebank has a responsibility to keep the samples in a safe store only. The responsibility does not encompass viability monitoring. Decisions on responsibility for certain duplicate accessions may be pending (PEN). If a genebank rejects (REJ) the responsibility after consultation of partners, the accession can be returned to the original donor or discarded. Several restrictions may be laid on accessions of different responsibility type. Normally accessions belonging to a genebank's primary responsibility have to be kept available and public (PUB). They belong to the active collection (ACO). Access to accessions may be restricted (RES) or even locked (LOC), especially if there is no primary responsibility of the holding genebank. In the latter case the accessions belong to the base collection (BAS), which assures their maintenance for future generations but affords much less effort for maintenance and ready access. Rationalization of collections may not primarily be aimed at discarding accessions. Duplicates should rather be moved from an active, available (ACO) to a passive (BAS) status. There is no access to the safety-duplicate collection which thus is also locked (LOC) and belongs to the base collection (BAS) of a genebank.

Accessions may be temporarily out of an active collection (TOC) for technical reasons or if important information like taxonomy is unclear.

Critical procedures in genebank work

The genebank standards (Anonymous 1994) address the following critical points in maintenance and regeneration of genetic resources:

- seed storage for base and active collections;
- triggering regeneration procedures;
- regeneration and handling of seeds (drying procedures, cleaning and seed health);
- regeneration standards;
- accession size in base collections;
- viability monitoring.

The database structure for documenting a quality management system for genebanks would have to concur with these points. Much more information about sound procedures in regeneration of accessions in seed collections is available in Sackville Hamilton and Chorlton (1997).

Seed storage for base and active collections

For documentation of seed storage procedures a SEEDSTOCK table was set up. It was designed to document data on the whole seed stock, which is subject to dynamic management processes (germination tests, amount of viable seeds). It also describes the activity of samples (active and base samples). Here we draw attention to the items 'HarvestDate' and 'StoreUpDate', which enable the period from harvest to final transfer of the processed sample to the deep-freeze store to be calculated (Anonymous 1994). During this period seeds are prone to temporary, mainly laboratory room, conditions. In addition, SEEDSTOCK can document the number of regeneration cycles since the year of collection or acquisition of a sample.

There is no detailed technical discussion on safety-duplication procedures in Genebank Standards (Anonymous 1994). It is just mentioned that the base collection for a crop genepool or any species may be spread among several institutions. Frequently safety-duplicates are handled as 'black box' in the receiving genebank. In the BAZ genebank outgoing as well as incoming safety-duplicates have been documented accession-wise in the past. The new system currently under development will provide a SAVESTORE table for both items (Figure 3). There is no seedstock management of safety-duplicates in the holding genebank (DuplicationSite). Thus this table should not be merged with the seedstock table, although several attributes are common in both tables (TGW, Germination, StorageWeight, GerminatingSeeds). In SAVESTORE they describe the seed lot sent to the partner institution.

Triggering regeneration procedures and accession size in base collections

Sackville Hamilton and Chorlton (1997) define the available seedstock in terms of the distribution unit, the test unit and the base unit. The size of these units is ideally defined accession specific, depending on breeding system, genetic heterogeneity and fecundity parameters. Regeneration has to be triggered by viability or by the seed quantity ('GerminatingSeeds' or 'Germination' in the SEEDSTOCK table) falling below a certain threshold. The latter situation of seed quantity should be avoided by storing a sufficient amount of germplasm, especially in base collections.

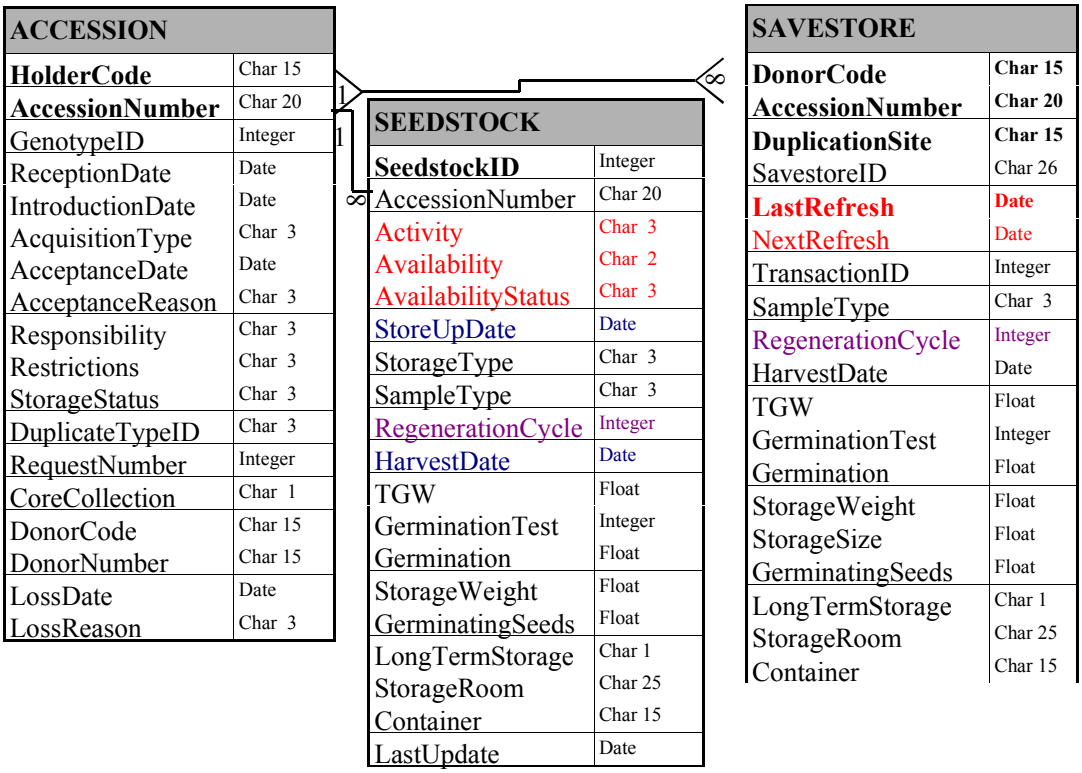

Figure3. Tables for the seedstock management of individual genebank accessions

Regeneration and handling of seeds (drying procedures, regeneration standards, cleaning and seed health)

Control of environmental conditions, storage containers, partly also the seed drying procedures are mainly determined by the facilities of a genebank and can be described in a general description at the web site.

Taxon specific methodology of seed increase is documented in the table INCREASEMETHOD (Figure 4), which is related to the taxonomy tables by the relationship table TAXON_INCREASE-METHOD and further in INCREASESTAGE.

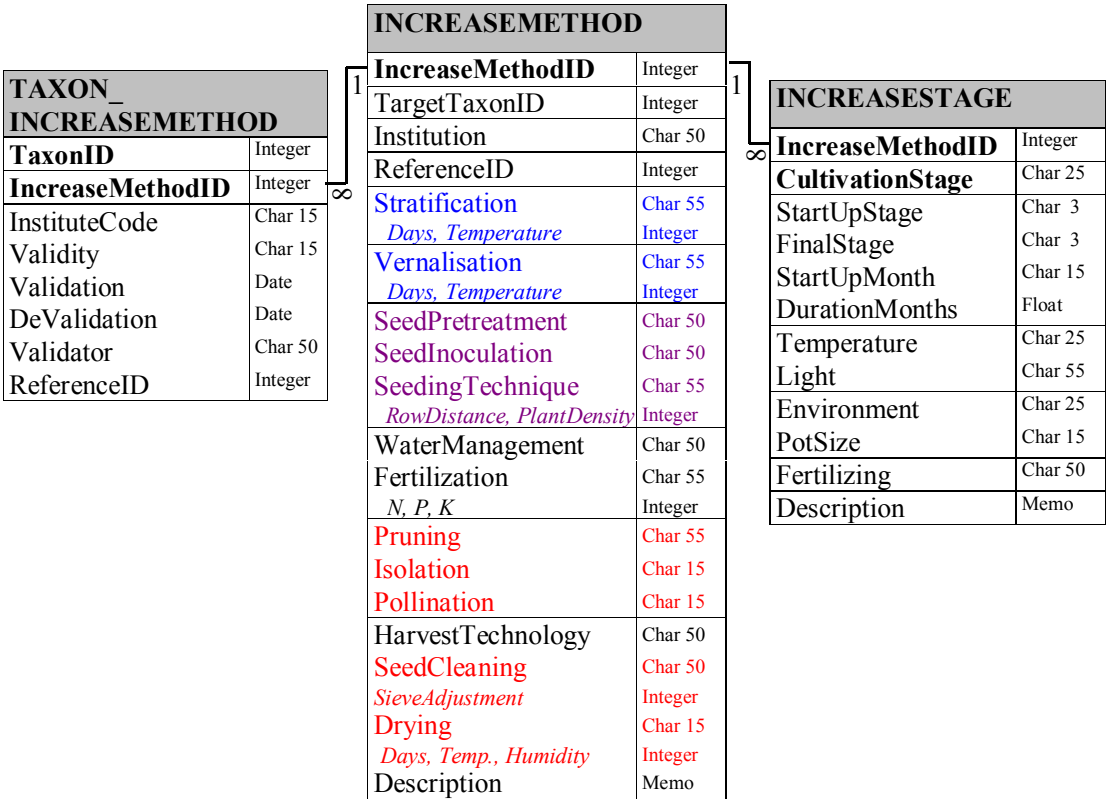

Figure 4. Related tables describing general and stage specific methodology for increasing seeds in relation to the taxonomy of an accession.

INCREASEMETHOD gives general methodology of seed treatment, management of nutrients and water, isolation, pollination, harvest technology and drying (Sackville Hamilton and Chorlton 1997). INCREASESTAGE allows a detailed description of the protocol for each stage in the vegetation cycle of a species to be entered.

Field results are documented in the table SEEDINCREASE. The relationship table INCREASE relates this to the increase method and to the respective field experiment. The EXPERIMENT table is the interface to a system of tables for evaluation and characterization data, which is not described in further detail here. There is a close relationship between the controlling of the increase procedure and characterization and evaluation of plants in the increase plots since it is applied good practice that some characterization and evaluation work is carried out during seed increase. A detailed description of the experimental environment and the protocol of agronomic measures is desirable in seed increase as well as in characterization and evaluation experiments. This results in a clear logic linking increase as well as characterization and evaluation data with the EXPERIMENT table.

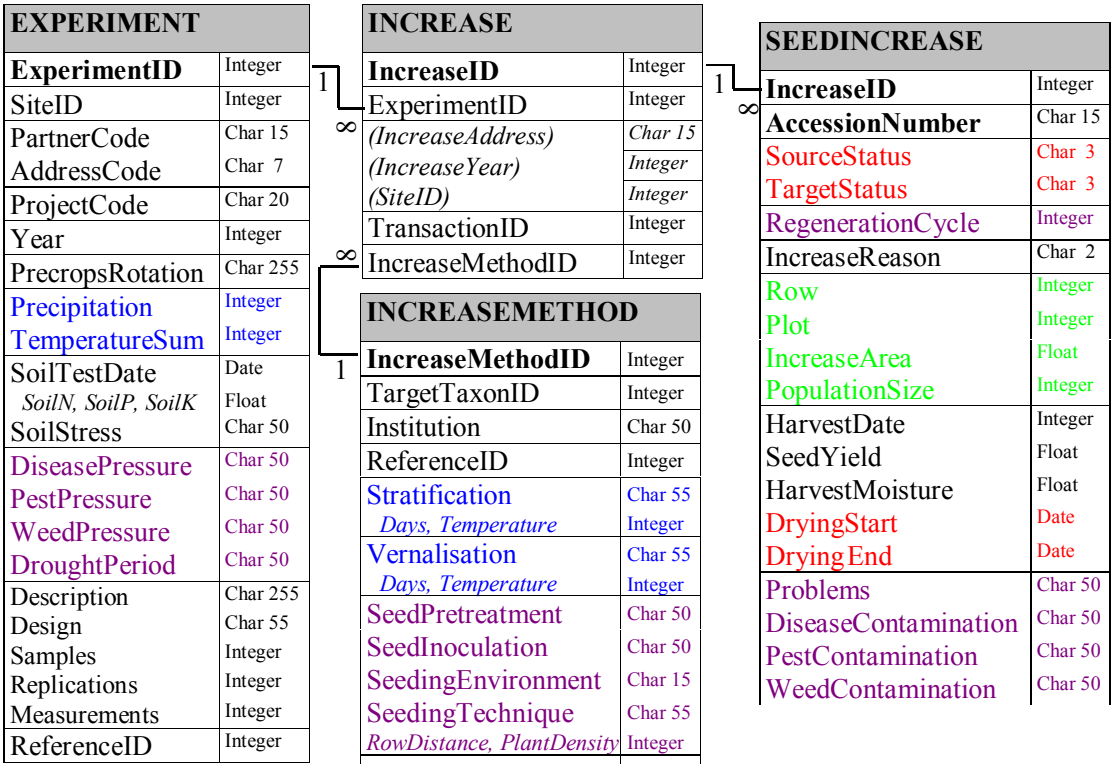

Figure 5. Related tables describing the seed increase procedures and results for each accession in an increase experiment.

Viability monitoring

Viability monitoring, mainly seed germination testing, is a further procedure related to the quality of maintenance which has to be documented. The linking of table GERMINATIONMETHOD to taxonomy by a relationship table TAXON_GERMINATION-METHOD totally parallels INCREASEMETHOD related to taxonomy by TAXON_INCREASEMETHOD. Thus it is not described here in further detail. The GERMINATION-TEST characterizes a set of accessions tested by a certain method at a certain date and a list of test results (germination percentage and germination problems like mould) in the GERMINATION table. It keeps aggregated tables from GERMINATIONSAMPLE, which holds data from each sample of a germination test. Testing 200 seeds of each accession is recommended by genebank standards. At the BAZ genebank this amount of seed is normally divided over eight replications, thus enabling the performance of germination tests to be monitored by analysis of variance procedures. The outcome of germination tests is used to update the germination percentage and number of germinating seeds in SEEDSTOCK, which both trigger database processes that flag accessions as being available or needing to be increased. Old and obsolete germination data can be stored in a table GERMINATIONHISTORY for monitoring test results, evaluating alternative germination methods and long-term germination monitoring.

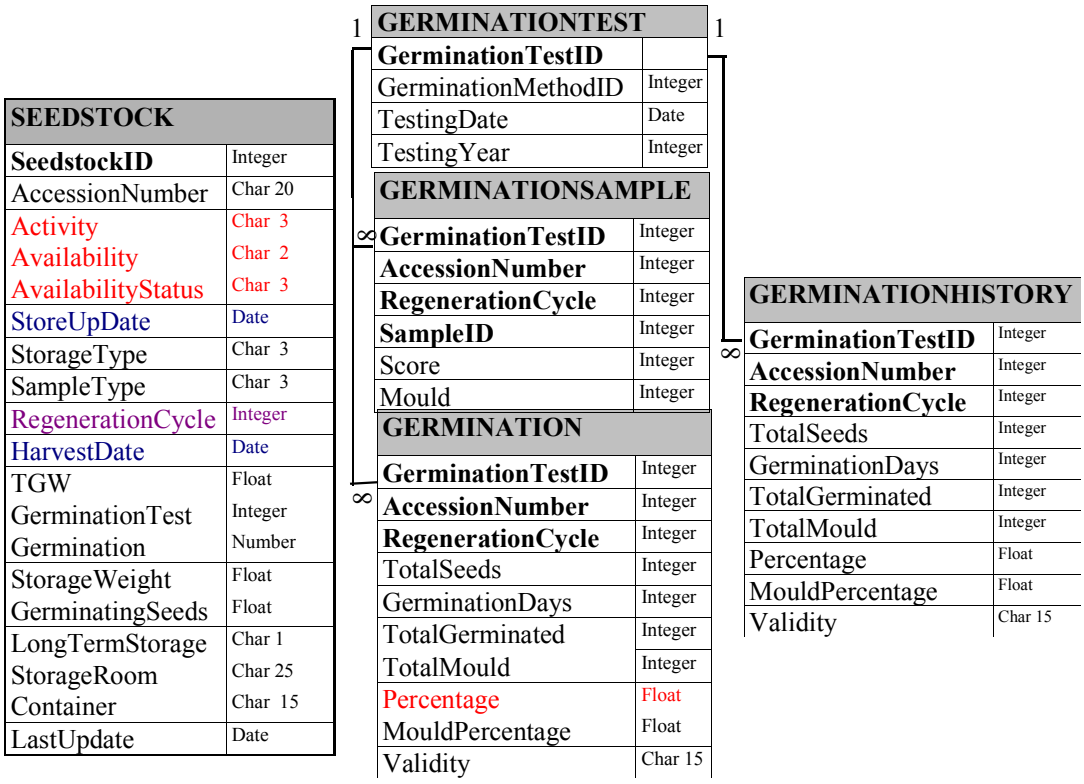

Figure 6. Related tables describing viability testing and actual, as well as, obsolete results.

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Sharing of responsibilities for plant genetic resources in Europe

Wieslaw Podyma
National Centre for Plant Genetic Resources, Plant Breeding and Acclimatization Institute, Radzikow, Blonie, Poland

Introduction

As a result of the Convention on Biodiversity (CBD), each country should feel responsible for plant genetic resources of indigenous origin. On the other hand, for gene banks to fulfil their mandatory task of "support for breeders", they have to provide a very wide set of material, not only restricted to indigenous. Genebanks and other institutes maintain in Europe a total of approximately 2 million accessions. The sheer size of collections, the workload involved in maintaining and making them readily usable by breeders, and the uncertainty about the future needs of breeding programmes make it impossible for one country to maintain and effectively exploit all potentially useful genetic resources. An important objective of Priority Activity 5 (Sustaining existing *ex situ* collections) of the Global Plan of Action adopted in Leipzig, Germany in June 1996 is to increase the efficiency of conservation activities and to reduce unnecessary duplication of efforts (FAO, 1996). In order to enhance effectiveness and efficiency of the conservation and use of plant genetic resources for food and agriculture at the regional level, European institutions may wish to formalize their cooperation further.

The present situation of plant genetic resources conservation in Europe is highly heterogeneous and complex. Specific to Europe are:

- a high level of interdependence between countries of the Region with regard to genetic resources;
- the sheer size of collections and the workload involved in maintaining and making them available to users;
- different organization of national programmes;
- restricted public funding of agricultural research which has an impact on plant genetic conservation.

In Europe there is a strong willingness to cooperate and seek opportunities for a regional approach. However, any approach should take into consideration national interests and political difficulties to make this concept realistic and lead to the establishment of a truly cooperative and integrated system for conservation and use of plant genetic resources for food and agriculture in Europe.

In the future, the priorities will only be achieved by strengthening genebank cooperation and sharing responsibilities. The ECP/GR Programme has led to a considerable level of coordination of collecting and conservation activities and has facilitated better international access to collections through documentation established systems. This implies that ECP/GR should move to play a role in formalizing the sharing of responsibilities for conservation.

The approaches to attaining this goal may vary in terms of their scope, i.e. the way in which responsibilities are shared, or the level of integration of activities. Gass and Begemann (1999) presented the following main options available to sharing responsibilities:

- decentralized European collections, on an ”accession basis”;
- centralized European collections on a ”crop-by-crop basis”;
- subregional collections.

Within ECP/GR, the "crop-by-crop" option is already applied under bilateral agreement between Germany and the Netherlands, whereby CGN-Wageningen maintains responsibility for seed-propagated potato species, while BAZ-Braunschweig takes care of the *Beta* collection. This approach leads to the creation of high quality collections and also allows a high level of expertise to be built up. However, the options available have not been developed to a multilateral approach until now. In addition to national responsibilities, some centres in Europe concentrate on a few crops e.g. lettuce and *Brassica* collections maintained at the Centre for Genetic Resources The Netherlands (Hintum and Boukema 1999). The high level of specific experience acquired by these centres makes it natural for them to become centres of excellence for the conservation of those crops.

The Nordic countries have developed a subregional option. The Nordic Gene Bank implements a regional programme for conservation and utilization of plant genetic resources under supervision of the Nordic Council of Ministers (Thörn 1999). This approach is very cost effective. However, this approach requires a high level of consensus between institutions and countries.

Recently, the accession basis option (decentralized European Collection) has been taken into consideration by several ECP/GR Working Groups.

Decentralized European collections

The new concept of "European Collections" was defined and continuously developed by the ECP/GR *Secale*, Forages, Barley, *Beta* and *Prunus ad* hoc and Working Groups (Gass *et al*. 1996, 1998; Maggioni *et al*. 1998, 1999, 2000). The European Collections were defined, by the Working Groups, as decentralized collections comprising accessions that European genebanks would agree to maintain of behalf of all member countries of ECP/GR. The task is primarily addressed to the institutions, which have long-term responsibility for conserving genetic resources, and can ensure non-restricted access to accessions.

The objectives of establishing European collections would be (Maggioni *et al*. 1998) to:

- formalize the sharing of responsibilities for the conservation of accessions in European collections;
- ensure the safe conservation of accessions;
- ensure the continued access of these accessions;
- make information on accessions available to users;
- promote an intensive exchange of germplasm;
- enhance the use of genetic resources;
- reduce the workload of each country and allow a more effective conservation;
- facilitate the establishment of a multilateral system of benefit sharing, through the sharing of germplasm and exchange of knowledge;
- comply with countries' obligations under the CBD to conserve genetic resources.

With the establishment of European Collections, appropriate consideration needs to be given to aspects such as the scope of the collections (species coverage, type of accessions and status of accessions). The scope of the collections has already been decided by most of the Working Groups. Generally the collections will contain the whole genepool of a crop, all types of material from wild to genetic stocks, and will only include the material for which distribution is not restricted.

It was suggested that database managers would initially analyse the Central Crop Databases (CCDB) and identify a list of most original accessions and they would then suggest a genebank as the primary collection for each original accession. The curators, in agreement with National Coordinators, would then accept responsibilities related to the accessions suggested by the database managers (Table 1).

The *Prunus* Working Group raised the question of whether the curators of collections should make the first step in proposing accessions for which they accept responsibility, or whether the CCDB manager should first make recommendations based on an investigation of the database and communicate these proposals to the curators who, in turn, might accept or reject these responsibilities. The approach proposed by the *Prunus* Working Group is an option that could reduce the workload of the DB managers. In this approach, the curators offer to take responsibility for a list of accessions and it is not the DB manager's task to suggest that each curator accept responsibility for a list of primary accessions (Table 1).

Table 1. Main steps leading to the establishment of a decentralized European Collection suggested by the different Working Groups (Gass et *al.* 1996, 1998; Maggioni *et al.* 1998, 1999, 2000).

Steps	***Secal*e, *Beta*, Barley, Forages Working Groups**	***Prunus* Working Group**
Step 1 Defining of status and scope	Crop-specific Working Group agrees on a common charter and the scope of a European Collection for the respective crop.	
Step 2 Designation of primary holders and acceptance of trusteeship	1. Central database manager analyzes the CCDB and identifies a list of most original accessions suitable to become part of the decentralized European Collection.	1. Curators offer accessions by sending a list to the Central Database Manager.
	2. Central database manager formally notifies the concerned genebanks of the accessions for which they are requested to take trusteeship.	2. Central database manager analyzes the offers and, after consultation with the Network Coordinating Group, notifies the participating genebanks concerned of the accessions that will be regarded as European Collection accessions.
	3. Curators, in agreement with National Coordinators or relevant national authority, formally accept the trusteeship for the total or part of the accessions suggested by the Database Manager.	
Step 3 Safety-duplication of accessions	The accessions designated as part of the European Collection are safety-duplicated as 'black box' in a genebank preferably within another ECP/GR country.	Central database manager identifies European accessions that need to be safety-duplicated on a second site and provides the list to the Working Group and the ECP/GR Secretariat for action.
Step 4 Trusteeship for other accessions	The trusteeship for accessions, which are not accepted by the initially suggested Primary Genebank, is offered to another genebank in consultation with respective ECP/GR Working Group.	Central database manager notifies each country of any genotypes originating in that country but not held there so that country can consider acquiring them.

The whole process should be initiated through the involvement of the National Coordinators in order to give more weight to this issue. Moreover, the essential role of the DB manager in any mechanism of shared responsibility should be stressed. The DB manager is in the best condition to analyze the data and identify gaps or duplications remaining after the curators have assumed responsibility for their own list of accessions. Finally, formal commitments would be taken by database managers and by curators in agreement with National Coordinators or the relevant national authority.

Following the CBD principle, that each country is responsible for the management of its own biodiversity, the primary holders of each collected accession should normally be a genebank in the country of origin of the accession. However, the primary holder must be able to guarantee storage and regeneration conditions that optimize maintenance of genetic integrity, regardless of the origin of the accession.

A number of prerequisites exist for this function:

- quick, easy and free access is required to all germplasm and related information that are shared jointly;

- high technical standards for storage, conservation, evaluation, regeneration and documentation;
- a guarantee for continuity is required and clear provisions are needed for instances in which institutions wish to withdraw from their responsibilities.

N.R. Sackville Hamilton (Maggioni *et al.* 1998) and J. Weibull (Maggioni *et al.* 1999) have prepared a protocol for designating primary holders of accessions and have defined the responsibilities of each partner (primary holders, database managers and genebanks hosting safety-duplicates).

Conclusions

Establishment of decentralized European collections depend to large extent on goodwill and on transparency of procedures. Parties adhering to this agreement would need to define clearly the role of the primary holders, the hosts of safety-duplicates, the managers of the European databases and other relevant issues. It is important to stress the need to reach the same agreement for all crops, to avoid multi-crop genebanks having to follow different mechanisms depending on the crop. In any system in which responsibility is shared, there need to be reliable partners. Agreements on sharing responsibilities should, among others, include quality standards for maintenance of material, safety-duplication arrangements and ensure continued free access to all partners. The ECP/GR Programme can successfully catalyze all the action required.

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Handling of characterization and evaluation data in crop databases

Helmut Knüpffer
Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany

Introduction

The present paper gives some background thoughts on aspects of characterization and evaluation data handling in databases of plant genetic resources. Some differences between these data and passport data that also have implications for their handling in databases will be shown. Problems related to the statistically sound processing of such data are briefly described and research tasks formulated which may be topics of a scientific technical meeting of the ECP/GR Documentation Network.

At a time when the main database problems with passport data are being solved, and most ECP/GR Crop working groups start putting emphasis on inclusion of characterization and evaluation data in these databases, it is necessary to discuss their specific inherent problems. Large databases with passport data, combined with Internet technologies, open avenues for linking separate information sets hosted at different institutions, thus making their respective evaluation data more easily and widely accessible.

Although characterization and evaluation descriptors are crop-specific, their inherent methodological problems are not crop-specific. Therefore, these questions are being addressed here to a wider audience of cereal working groups, and solutions possibly developed might then be applied for many other crops as well.

Existing approaches in handling characterization and evaluation data in databases

IPGRI descriptor lists provide definitions of the main data categories of plant genetic resources. Besides passport and management descriptors, the most important accession related descriptors categories are those of characterization and evaluation.

Characterization descriptors, according to these definitions:

- enable an easy and quick discrimination between phenotypes;
- are generally highly heritable;
- can be easily seen with the naked eye;
- and are (almost) equally expressed in all environments.

They also "may include a limited number of additional traits considered desirable by a consensus of users of the particular crop". These traits are controlled by one or a few genes. Examples are: colours and shapes of plant parts, existence or lack of particular organs (e.g. awns in cereals). Usually one observation per accession is sufficient for characterising it with regard to the particular trait.

Evaluation descriptors, in contrast, have the following characteristics:

- their expression depends on the actual environment;
- special experimental designs and techniques are needed to asses evaluation descriptors;
- their assessment may require complex biochemical or molecular characterization methods.

Examples are descriptors such as yield, agronomic performance, stress susceptibilities, biochemical traits or cytological traits. These traits are often controlled by several or

many genes. Usually several or many observations in different environments are necessary to assess evaluation traits.

The main characteristics of these data categories are summarized in Table 1.

Table 1. Data categories in the context of a PGR information system (accession-related descriptors)

Category		Stability of information	Usefulness for genebank management	Interest for external users
Passport	non crop-specific	relatively stable; changes due to: corrections and additions;	high	high
Characterization	crop-specific	relatively stable (controlled by one or few genes) growing amount with time;	high	high
Evaluation	crop-specific	environment-dependent; growing amount and complexity with time	low	high
Management	non crop-specific	frequently changing	high	low

In contrast to passport and management descriptors, which are generally non crop-specific (which led, for example, to the development of the IPGRI 'Multi-Crop Descriptor List'), characterization and evaluation descriptors are crop-specific. They constitute the main part of IPGRI's descriptor lists for various crops.

Genebanks dealing with a small number of crops usually develop a simple table structure for storing characterization and evaluation data in their documentation systems. For each crop, these tables consist of rows representing the accessions and columns representing the descriptors to be observed, usually taken from a descriptor list. In the 1970s, this approach was justified by the fact that punched cards with a fixed number of columns were the medium for data registration, and early descriptor lists (e.g. those developed in the COMECON system) even tried to fit the "minimum descriptor" to the 80 columns (Knüpffer 1983). Various national, regional and international organizations developed descriptor lists which differ, for the same crop, in the descriptors included and their methods of assessment, e.g., measurements vs. scores.

Genebanks do some of the characterization and evaluation work themselves, for example in connection with multiplication and regeneration activities. Characterization and primary evaluation are commonly considered as the duty of the genebanks. It is the secondary evaluation which requires specific knowledge, skills and equipment, that is usually done by specialized institutions. Both the observations from the genebank and the feedback of data from users'screenings constitute the wealth of data that is usually accumulating in genebanks.

A rather simple approach to dealing with growing amounts of data sets from different standardized and non-standardized experiments is that of "one table per experiment" which is being easily implemented. With the growing number of such data sets, they become rather difficult to manage, and the separate tables can only be queried jointly if one knows their exact structure, using, for example, SQL queries.

These simple, crop-specific approaches cannot be the right solution for genebanks with a large number of crops, such as that of IPK with almost 700 genera of plants (*cf.* Annex 1). Therefore, some more sophisticated approaches have been developed, e.g. by the Genebank of the Netherlands (Hintum and Hazekamp 1992) and the Genetic Resources Information Network (GRIN) of the USDA (*cf.* example in Annex 2), where a rather small number of tables is dealing with Experiments, Descriptors, Methods, and Scores, respectively.

Research tasks for characterization and evaluation data

Handling of characterization and evaluation data in genebank information systems is connected with some problems inherent to the nature of such data. The rapporteur wishes to make the plant genetic resources community aware of these problems, which hopefully may evolve into research tasks and eventually may form the topic of a scientific technical meeting of the ECP/GR Documentation Network.

Assembling characterization and evaluation data from various sources

As has been shown, characterization and evaluation data cannot be expected to arrive in genebank documentation systems in a standardized way. The existence of different descriptor lists for the same crop, and the wealth of data that has been accumulated before the publication of standardized descriptors and, later on, ignorance of the existence of descriptor lists, led to a great variation in data even on the same trait for the same crop. Definitions of the same descriptor may differ, be missing, incomplete or inaccurate. In many cases, it is not possible to transform existing characterization or evaluation data into a standardized scale without losing information. The reliability of data from different experiments may vary, due to the number of replications, accuracy of measurements, use of scores vs. measurements, field observations of disease resistance under naturally occurring infection pressure vs. greenhouse tests with artificial inoculation by well defined races or their mixtures, etc.. For many descriptors that are being investigated in the secondary evaluation activities, e.g. in research or Ph.D. studies, even no descriptor lists exist.

A solution needs to be found for genebank documentation systems to deal with this situation. It is necessary to be able to combine data from different experiments in searches. No successful attempt of aggregating such data is so far known.

An attempt to compile characterization and evaluation data of barley from different sources into a single searchable database was made in the German project EVA (Harrer 1999), and a sample output is given in Annex 3. In this exercize, IPK registered all observation data for barley from more than 50 years of multiplication activities in the genebank, and developed computer programmes for this.

It is proposed that a crop-independent database structure be developed for maintenance of characterization and evaluation data, irrespective of whether they are the result of trials following descriptor lists agreed upon or not, such as the approach followed by GRIN and CGN.

Observations made during multiplication and rejuvenation in genebanks

The accessions observed during multiplication and rejuvenation in a particular year are usually not a representative sample of the whole collection, in the sense of statistical analysis. The selection of accessions for multiplication and rejuvenation is based on the management needs of the genebank rather than assumptions of biometrical experiment planning. Multiplication plots are "overloaded" with recent new accessions, material sown for particular studies (e.g. evaluation) and material with low germination or low number of seeds are usually given priority.

The problem with this kind of data lies in a biometrically sound aggregation of such germplasm observations, where the usual experimental design requirements,, such as numbers of replications are not met. Attempts to deal biometrically with such data have been reported from the Polish genebank (Madry 1997).

It is, therefore, proposed that ECP/GR take a leading role in approaches to solving this problem, e.g. by organising a workshop of the ECP/GR Documentation Network, with the participation of biometricians and genebank documentation specialists, to handle this problem. Examples of such data should be sent in advance to biometricians for evaluating the possibilities of developing suitable algorithms.

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Annex 1. Genebank of IPK Gatersleben, Germany: composition of the collection by genus (as of July 2000). In addition to the genera listed with more than 100 accessions, 630 different genera are represented by less than 100 accessions. The total number of accessions (database count) is 88,750.

Accessions	Genus
17,234	*Triticum*
13,186	*Hordeum*
7,745	*Phaseolus*
3,596	*Lycopersicon*
3,264	*Vicia*
3,218	*Pisum*
2,945	*Glycine*
2,929	*Avena*
2,772	*Allium*
2,224	*Brassica*
2,052	*Secale*
1,681	*Linum*
1,435	*Capsicum*
1,407	*Zea*
1,241	*Aegilops*
1,071	*x Triticosecale*
997	*Lactuca*
975	*Cucumis*
861	*Lupinus*
854	*Cucurbita*
847	*Papaver*
604	*Antirrhinum*
585	*Raphanus*
496	*Lathyrus*
492	*Nicotiana*
471	*Vigna*
463	*Trifolium*
418	*Coriandrum*
400	*Beta*

Accessions	Genus
352	*Lens*
336	*Ocimum*
319	*Daucus*
310	*Cicer*
309	*Solanum*
289	*Medicago*
262	*Elymus*
254	*Citrullus*
242	*Cichorium*
242	*Helianthus*
234	*Agrostemma*
205	*Mentha*
190	*Petroselinum*
185	*Datura*
184	*Sorghum*
179	*Apium*
176	*Panicum*
172	*Callistephus*
169	*Spinacia*
161	*Setaria*
151	*Amaranthus*
145	*Anethum*
139	*Hyoscyamus*
139	*Trigonella*
111	*Foeniculum*
110	*Fagopyrum*
107	*Agropyron*
103	*Chrysanthemum*
102	*Begonia*

Annex 2. Example: GRIN observation and evaluation data. Characterization and evaluation of the barley accession CIho 15229 (Source: USDA, 2000).

Category	Descriptor	Value	Qualifier	Study
Chemical	BETAGLUCAN	4.99	ABERDEEN-GROWN	MADISON 98A
	LIPID	1.6	ABERDEEN-GROWN	BETAGLUCAN MADISON 98A
	PROTEIN	12.54	ABERDEEN-GROWN	BETAGLUCAN MADISON 98A
Disease	BSMVFREE	yes, absence of bsmv		BSMV ABERDEEN FARGO 88
	NETBLOTCH	4		FARGO 88
	SPOTBLOTCH	3		SPOT FARGO 1988
	STRIPRUSRE	susceptible		STRIPERUST BOLIVIA 92
	STRIPRUSSV	20		STRIPERUST BOLIVIA 92
Growth	HABIT	spring		ABERDEEN 93
	PLANTHT	67		AGRON ABERDEEN 86
Insect	RUSSAPHID	plant death or no recovery possible		RWA STILLWATER 90
	RWALEAFROL	leaves rolled, loosely to tightly		RWA STILLWATER 90
Morphology	ALEURONCOL	white/amber		LAB ABERDEEN 86
	AWNDECIDU	2		AGRON ABERDEEN 86
	AWNROUGH	rough (barbs over entire length of awn)		AGRON ABERDEEN 86
	AWNTYPE	awned		AGRON ABERDEEN 86
	HULL	covered		LAB ABERDEEN 86
	LEMMACOLOR	white/amber		LAB ABERDEEN 86
	LODGING	no lodging		AGRON ABERDEEN 86
	NECKBREAK	2		AGRON ABERDEEN 86
	RACHHAIR	short		LAB ABERDEEN 86
	SHATTERING	2		AGRON ABERDEEN 86
	SPIKEANGLE	erect		AGRON ABERDEEN 87
	SPIKEROW	six rowed		AGRON ABERDEEN 87
	STRAWBREAK	2		AGRON ABERDEEN 86
Phenology	DAYSANTHES	175		AGRON ABERDEEN 86
Production	KERNELPLMP	92		LAB ABERDEEN 86
	KERNELWT	44		LAB ABERDEEN 86
	TESTWEIGHT	48		LAB ABERDEEN 86
	YIELD	409		LAB ABERDEEN 86

Annex 3. Example: Output of the German Information System for Evaluation Data (EVA), (Harrer1999). Text translated from the original German.

Additional Passport Data: PGRDEU [1]
Accession Number: HOR 2566
Origin Country: ETH
Institute Code: DEU146
Institute Name: IPK, Genebank, Gatersleben
Seasonality: Spring
TGW (single values): 46.70;47.30;43.70;43.30;37.30;30.00;40.70;30.00;43.30

TGW Table:

Field	Value	Experimental Data
1960 Spring	46,7	N=752; Min=19; Max=71
1963 Spring	47,3	N=267; Min=26; Max=71
1969 Spring	43,7	N=954; Min=15; Max=72
1970 Spring	43,3	N=4895; Min=19; Max=69
1975 Spring	37,3	N=2262; Min=17; Max=67
1977 Spring	30,0	N=1518; Min=15; Max=58
1978 Spring	40,7	N=999; Min=20; Max=74
1979 Spring	30,0	N=1262; Min=12; Max=67
1989 Spring	43,3	N=151; Min=18; Max=64

Plant Height (Single values): 100;100;98;91;106;105;95;98;80;80;92

Plant Height Table:

Field	Value	Experimental Data
1960 Spring	100	N=874; Min=25; Max=145
1963 Spring	100	N=470; Min=43; Max=145
1969 Spring	98	N=967; Min=40; Max=148
1970 Spring	91	N=4991; Min=34; Max=146
1975 Spring	106	N=2303; Min=26; Max=185
1977 Spring	105	N=2001; Min=32; Max=168
1978 Spring	95	N=1623; Min=24; Max=140
1979 Spring	98	N=1640; Min=25; Max=140
1980 Spring	80	N=1835; Min=32; Max=140
1988 Spring	80	N=689; Min=36; Max=130
1989 Spring	92	N=560; Min=30; Max=130

Lodging (Single values): 1;1;1;1;9;2;7;5;7;3;2
Lodging (aggregated): Mean/Heterogeneous

Lager Table:

Field	Score	Experimental Data
1960 Spring	1	N=877; Min=1; Max=8
1963 Spring	1	N=488; Min=1; Max=7
1969 Spring	1	N=966; Min=1; Max=9
1970 Spring	1	N=4951; Min=1; Max=9
1975 Spring	9	N=2296; Min=1; Max=9
1977 Spring	2	N=1996; Min=1; Max=9
1978 Spring	7	N=1608; Min=1; Max=9
1979 Spring	5	N=1629; Min=1; Max=9
1980 Spring	7	N=1837; Min=2; Max=9
1988 Spring	3	N=698; Min=2; Max=9
1989 Spring	2	N=560; Min=1; Max=9

Yellow Rust-Field (Single values): 1;1;1;1;1;1;1;1;1;1
Yellow Rust-Field (aggregated): Resistant

Yellow Rust-Field Table:

Field	Score	Experimental Data
1963 Spring	1	N=486; Min=1; Max=8

[1] <http://www.dainet.de:8080/PGRDEU_AKZESSION/DDW?W%3DID_AKZESSION%20%20%3D%2010016672%26M%3D1%26K%3D10016672%26R%3DY%26U%3D1>

	1969 Spring	1	N=1025; Min=1; Max=6
	1970 Spring	1	N=4978; Min=1; Max=9
	1975 Spring	1	N=2322; Min=1; Max=8
	1977 Spring	1	N=2759; Min=1; Max=6
	1978 Spring	1	N=1755; Min=1; Max=9
	1979 Spring	1	N=1668; Min=1; Max=8
	1980 Spring	1	N=1838; Min=1; Max=8
	1988 Spring	1	N=722; Min=1; Max=6
	1989 Spring	1	N=566; Min=1; Max=4
Mildew-Field (Single values):	4;1;3;2;3;4;8;8;1;1;1		
Mildew-Field (aggregated):	Mean/Heterogeneous		
Mildew Field Table:	Field	Score	Experimental Data
	1960 Spring	4	N=877; Min=1; Max=9
	1963 Spring	1	N=487; Min=1; Max=8
	1969 Spring	3	N=1026; Min=1; Max=9
	1970 Spring	2	N=5002; Min=1; Max=9
	1975 Spring	3	N=2322; Min=1; Max=9
	1977 Spring	4	N=2759; Min=1; Max=9
	1978 Spring	8	N=1755; Min=1; Max=9
	1979 Spring	8	N=1668; Min=1; Max=9
	1980 Spring	1	N=1837; Min=1; Max=9
	1988 Spring	1	N=722; Min=1; Max=9
	1989 Spring	1	N=566; Min=1; Max=9
Mildew-Race (aggregated):	Resistant		
Mildew Races (Single values):	Year[2] Races[3]		C 52[4]
	1980[5]		1
	BAZ, Resistance Evaluation, Aschersleben[6]		
Dwarf Rust-Field (Single values):	4;1;1;1;9;9;8;8;8;3;1		
Dwarf Rust-Field (aggregated):	Mean/		
Dwarf Rust Field Table:	Field	Score	Experimental Data
	1960 Spring	4	N=828; Min=1; Max=9
	1963 Spring	1	N=485; Min=1; Max=8
	1969 Spring	1	N=1025; Min=1; Max=8
	1970 Spring	1	N=4972; Min=1; Max=8
	1975 Spring	9	N=2322; Min=1; Max=9
	1977 Spring	9	N=2757; Min=1; Max=9
	1978 Spring	8	N=1754; Min=1; Max=9
	1979 Spring	8	N=1668; Min=1; Max=9
	1980 Spring	8	N=1836; Min=1; Max=9
	1988 Spring	3	N=722; Min=1; Max=9
	1989 Spring	1	N=565; Min=1; Max=6

N= Source of samples tested: IPK Gatersleben, Genebank Documentation: <http://www.dainet.de:8080/BASIS/bigpgr1/all/quelle/SDF?id_quelle_O=%3D&id_quelle=1&id_quelle_C=OR>

[2] <http://www.dainet.de:8080/EVA_MEHLR/SAC?SUBACT=Retrieve+New+Terms&FL=Jahr&C=&ST=>
[3] <http://www.dainet.de:8080/EVA_MEHLR/SAC?SUBACT=Retrieve+New+Terms&FL=Mehltau+Rasse&C=&ST=>
[4] <http://www.dainet.de:8080/EVA_MEHLR/SDF?ml_rasse_O=equals&ml_rasse=C+52&ml_rasse_C=OR&FORMFL_OB=Akzessionsnummer&FORM_SO=Ascend>
[5] <http://www.dainet.de:8080/EVA_MEHLR/SDF?JAHR_O=equals&JAHR=1980&JAHR_C=OR&FORMFL_OB=Akzessionsnummer&FORM_SO=Ascend>
[6] http://www.dainet.de:8080/BASIS/bigpgr1/all/quelle/SDF?id_quelle_O=%3D&id_quelle=12&id_quelle_C=OR

Handling of evaluation data – the case of France

Annick Le Blanc
National Collection of Small Seed Cereals, GEVES – Le Magneraud, Surgères, France.

Introduction

Overview of the Evaluation Network

The present Evaluation Network was set up within the framework of a common policy for the management of genetic resources. Participants have all signed a charter, which regulates the running of the Cooperative Network for Small Seed Cereals. The main points of the organization of this Network are the:

- constitution, rationalization and maintenance of a single national collection, the description of this collection in a central database and sharing of responsibilities of seed management;
- evaluation of genotypes of diverse origin prior to their inclusion in the national collection.

Material observed by the evaluation network consists of:

- genotypes from collections of genetic resources of members of the Network;
- commercial varieties of any origin;
- breeding lines or scientific material of any origin, with the breeder's permission.

All the partners of the Evaluation Network are breeders (either public or private). Therefore, the Network is aimed at supplying creators of new varieties with parents of very diverse origins, with a view to possibly improving the national collection.

Starting point

Until now only an annual synthesis was returned to participants, as a result of the evaluations of the whole Network. This system did not allow the comparison of data from previous years and the data were not computerized.

The work undertaken this year covers the past ten years' evaluations, carried out on about thirty different sites belonging to the Network's partners. Approximately 50 genotypes are studied each year, plus control varieties. However, the Network did not plan the evaluation of material. The breeders carried out observations they estimated possible, under good conditions in a given year, and the results were passed on to the co-ordinator. Therefore, these dissimilar sets of observations need to be exploited as much as possible.

Requirements

The Network needed a more efficient, yet simple to use, computer programme, which would allow members each year to quickly display the value of a genotype for breeding, or for any other scientific use. Moreover, this display of the synthesis had to allow the Network to improve its collection of genotypes, and these to be described as fully as possible. Also, it had to help enlarge this collection to better represent the genetic diversity of the species concerned. The average score was not sufficient to judge the value of a genotype, even when accompanied by additional statistics, such as the standard deviation and the maximum and minimum scores given for a descriptor on all of the sites involved. The breeders finally opted for an intermediary system, which took into account fluctuations in the behaviour of a genotype on several sites and over several years, while at the same time being simple and quick to consult.

Handling of evaluation data

Main points

The French breeders chose to reduce the 1 to 9 scale, currently used to assess genotypes, to 5 categories. This was in order to take into account the multiple origins of the data: several assessment sites, different evaluators, different years, unplanned observation etc.

These 5 categories correspond to a regrouping of the evaluator's marks as follows: 1-2, 3-4, 5, 6-7, 8-9. In the case of sensitivity to disease, 1 signifies a very strong resistance and 9 'highly sensitive'. As for the date of heading, 1 = very late and 9 = very early. For plant height 1 = very short and 9 = very high. Reference to a control variety is necessary for these two previous characters because of the known importance of the influence of the site and the year.

The number of times a genotype receives the same mark is counted for each of the 5 categories.

This system has the advantage of showing, at a glance, the disparity or similarity of the results from different sites, while still showing, in most cases, the assessment of the intrinsic value of a genotype. The majority of the results fall into one category, or two adjacent categories.

It should be pointed out that the evaluation of characters, in dependant from cultivation conditions e.g. morphological characters, or indirect tests such as electrophoresis of glutenins or gliadins, gene composition etc, is carried out in parallel, by using a single value,. These tests are often performed by a single partner.

Obviously passport data already known by the Network are included in the basic description of each genotype assessed.

Details

All the data is processed using Excel. Formulas are used to speed up the processing.

Reception of files: The coordinating unit receives one file of results from each evaluator per year. The number of headings and columns can vary according to the number and the type of observations.

Processing and formatting the data: Data from individual files are no longer transferred to files related to the specific evaluator, but to files related to the specific descriptor. The columns correspond to the different observation sites of the given descriptor.

In the case of descriptors such as the heading date or the plant height, where dates and measures are concerned as opposed to scores, reference to a control variety is necessary. A different scale of results is used. This intermediate step involves converting the data recorded to marks from 1 to 9.

Grouping the results into categories: Before grouping the results into categories, the coordinator must ensure that maximum marks recorded on each site are above 5 (sufficient exposure to disease or stress). Failing this, the results from that particular site for that descriptor are not used.

Recording the number of scores for each category

Loading formatted data to ACCESS database: There are three tables with connected decoding tables (Figure 1):

- identification table for passport data;
- description table: morphological description and evaluation;
- gene composition table.

Decoding tables:

- descriptors;
- genes;
- origin of description.

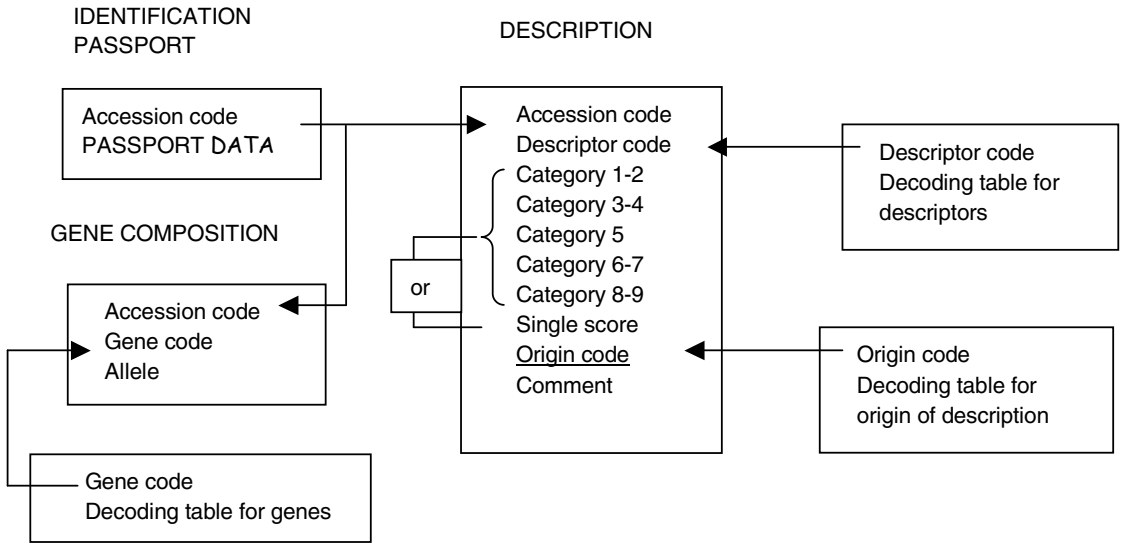

Figure 1. Access Database structure for loading passport, gene composition and description data.

In fact the system is a little more complex when the principle attributes, the electrophoretic components and the description of sites concerned etc. are integrated. However, the principle remains the same. The additional tables are like satellites linked to the identification table.

Presentation of the results

The results are presented using a programme developed under ACCESS.

The user has the possibility of displaying the description of genotypes of the wheat or barley network in three different orders:

a) alphabetically according to the name, including the control varieties;
b) alphabetically according to the name, excluding the control varieties;
c) alphabetically according to the name and the year of evaluation, but excluding the control varieties.

In all these cases, reference to the evaluation of control varieties is possible, along with the data of origin.

Keyboard controls allow access to other data such as a synthesis of agronomic data, including certain passport data i.e.:

- pedigree;
- other names or codes attributed to the given genotype;
- principal attributes: (a short summary of the essential characteristics of a genotype);
- biochemical composition (gluten composition obtained by electrophoresis on polyacrylamide gel);
- results of tests for quality (bread making or brewing);

- gene composition (mainly genes for resistance to powdery mildew).

The French Evaluation Network was conceived to allow the partners' evaluation work to enhance the collection established by them, through mutual collaboration. Apart from the fact that each member can benefit from observations of the entire Network, the programme developed to present these data also envisages that each member can propose new material for the Network's collection. Each descriptive form includes a box to be ticked by the breeder to indicate the genotypes chosen, along with an optional space to justify the choice of genotype.

A keyboard control transfers this information to the coordinating unit. The coordinator assembles the requests of each evaluator. An annual proposal for improving the Network's collection is then submitted to the Steering Committee. The Committee examines, and eventually validates, a list of genotypes to be added to the collection. The coordinator subsequently includes the material in the collection. Descriptive data are transferred to the database and measures are taken to conserve the seeds according to the rules of the Charter.

Conclusion

The system described here is not simply a means of systematically describing genetic resources, as could be imagined, in order to complete the database of a collection. It has been set up by breeders for breeders. It is exploited, with this in mind, by the network of genetic resources which is mainly made up of breeders and scientists working for breeding.

The descriptors mentioned are, on the other hand, specific to French conditions (cultivation conditions, climate, exposure to disease etc.).

Nevertheless, with a minimum of modifications, it could be used in a programme aimed at improving the description of genetic resources in general. These modifications would essentially cover the format of fields, allowing reference to the origin of data, (description methods used, context of the description etc.).

Moreover it is possible to imagine that in the near future certain area specific data, such as resistance to polygenic diseases, could be replaced by data relative to the gene composition and the given genotype.

Above all, the French experience has given breeders the possibility to consult a quickly available and easily interpreted synthesis, which displays the overall value and interest of a genotype.

Appendix I. Agenda of an *ad hoc* meeting of the ECP/GR Network Coordinating Group on Cereals

Plant Breeding and Acclimatization Institute, Radzików, Poland, 7-8 July 2000

Friday 7 July 2000

8.30 Opening and Introduction

- Welcome from the Plant Breeding and Acclimatization Institute (*Prof. E. Arseniuk*)
- Brief self-introduction of the participants
- The Cereals Network Coordinating Group (*L. Maggioni*)

Discussion

10.30 Coffee break

11.00 The Working Groups and *ad hoc* activities (*session chaired by W. Podyma*)

- *Avena* Working Group: Review of the group progress and future perspective (*M. Leggett*)
- Barley Working Group: Review of the group progress and future perspective (*H. Knüpffer*)
- Wheat Working Group: Review of the group progress and future perspective (*I. Faberová and A. Le Blanc*)

Discussion and recommendations

12.30 Lunch

14.00 The Working Groups and *ad hoc* activities (continued)

- *Secale ad hoc* Group: Review of the database progress and future perspective (*W. Podyma*)
- Maize *ad hoc* Group: Review of the database progress and future perspective (*D. Jelovac*)
- The EC 1467/94 project on maize landraces (*A. Boyat*)
- *Triticale* Database: Review of the database progress and future perspective (*G. Kleijer*)

Discussion and recommendations

- Review of other cereals and pseudo-cereals genetic resources in Europe, extent of existing expertise, potential areas of collaboration for conservation and use at a regional level. Connection between Cereals Network and Minor Crops Network (*A. Michalová*)

Discussion and recommendations

15.30 Coffee break

16.00 The Working Groups and *ad hoc* activities (continued)

- Preliminary evaluation of progress done by WGs according to criteria of Crop Working Group Process Analysis. Identifying and establishing priorities for action according to Crop Working Group Process. (*all WG Chairs to contribute to the discussion*)

Discussion and recommendations

Social dinner

Saturday 8 July 2000

9.00 Network issues for discussion (Coordinating Group members are invited to come prepared to discuss the items below, with the aim of planning a feasible medium-term strategy for the Cereals Network) (*Session chaired by G. Kleijer*)

- (9.00–9.45) Monitoring the conservation mechanisms (regeneration standards, rationalization of collections, safety duplication) and suggesting lines for action (*Introduced by C.U. Germeier*)
- (9.45–10.30) Sharing of responsibilities (*Introduced by W. Podyma*)

10.30 Coffee break

- (11.00–11.30) Coordinating future development of the databases. An alternative methods of organizing and updating of databases (*Introduced by I. Faberová and L. Maggioni*)
- (11.30-12.00) Handling of characterization and evaluation data in crop databases (*Introduced by H. Knüpffer*)
- (12.00–12.30) International cooperation. EU programmes. Links with other ECP/GR Networks. Looking at the possibility of integrating non-ECP/GR countries into the Network activities (*Introduced by L. Maggioni*)
- (12.30–12.45) Planning for a full Cereals Network Meeting in 2003
- (12.45–13.00) How the Cereals Coordinating Group will continue in its function

13.00 Lunch

Afternoon trip to Warsaw

Appendix II. List of Participants

NCG Members

Annick Le Blanc
Coll. Nationale Céréales à Paille
GEVES - Le Magneraud
Saint-Pierre d'Amilly - BP 52
17700 Surgères
France
Tel: (33) 546683093
Fax: (33) 546683024
Email: annick.leblanc@geves.fr

Iva Faberová
Genebank Department RICP
Research Institute for Crop Production
Drnovska 507
161 06 Praha 6 – Ruzyne
Czech Republic
Tel: (420-2) 33022478
Fax: (420-2) 33022286(genebank)
/33310636(institute)
Email: faberova@genbank.vurv.cz

Cristoph U. Germeier
Genebank - Fed. Centre for Breeding
Res.On Cultivated Plants (BAZ)
Bundesallee 50
38116 Braunschweig
Germany
Tel: (49-531) 596617
Fax: (49-531) 596365
Email: c.germeier@bafz.de

Drazen Jelovac
Maize Research Institute
"Zemun Polje"
Slobodana Bajica 1
11080 Zemun Polje
Yugoslavia, F.R.
Tel: (381-11) 3756704
Fax: (381-11) 3756707
Email: djelovac@mrizp.co.yu

Geert Kleijer
Service de Genetique
Station fédérale de recherches
en production végétale de Changins
Route de Duillier - BP 254
1260 Nyon 1
Switzerland
Tel: (41-22) 3634444/4722(dir)
Fax: (41-22) 3615469
Email: geert.kleijer@rac.admin.ch

Helmut Knüpffer
Institut für Pflanzengenetik und
Kulturpflanzenforschung - Genbank
Corrensstrasse 3
06466 Gatersleben
Germany
Tel: (49-39482) 5283
Fax: (49-39482) 5155
Email: knupffer@ipk-gatersleben.de

J. Mike Leggett
Cytogenetics Group
Institute of Grassland and
Environmental Research (IGER)
Plas Gogerddan
Aberystwyth, Dyfed SY23 3EB
United Kingdom
Tel: (44-1970) 823095
Fax: (44-1970 823242
Email: mike.leggett@bbsrc.ac.uk

Wieslaw Podyma
Centre for Plant Genetic Resources
IHAR
05870 Blonie, Radzikow near Warsaw
Poland
Tel: (48-22) 7252611
Fax: (48-22) 7254715/14
Email: w.podyma@ihar.edu.pl

Observers

Armand Boyat
Génétique & Amélioration des Plantes
(UFR GAP) - INRA
Domaine de Melgueil
34130 Mauguio
France
Tel: (33) 467290616/67290604
Fax: (33) 467293990
Email: boyat@ensam.inra.fr

Victor Bushtevich
Belarus RI of Arable Farming and
Fodders
Timiryazev St.1, Zhodino
Minsk Region,222160
Belarus
Tel:
Fax: (375-1775) 37066
Email: centr@belnoz.belpak.minsk.by

Dirk Enneking
Genbank
IPK - Institut für Pflanzengenetik und
Kulturpflanzenforschung
Correnstrassse 3
D-06466 Gatersleben
Germany
Tel: (49) 39482 5157
Fax: (49) 39482 5155
Email: enneking@ipk-gatersleben.de

Anna Michalová
Research Institute of Crop Production
Drnovska 507 Praha 6 - Ruzyneyne
Czech Republic
Tel: (420) 33022478
Fax: (420) 3302286
Email: michalova@genbank.vurv.cz

IPGRI*
Via delle Sette Chiese, 142
00145 Rome
Italy

Lorenzo Maggioni
Regional Office for Europe
Tel: (39-06) 51892231
Fax: (39-06) 5750309
Email: l.maggioni@cgiar.org

Unable to attend

Roland von Bothmer
Dept. Plant Breeding Research
Swedish Univ. of Agricult. Sciences
Herman Ehles v 2-4
268 31 Svalov
Sweden
Tel: (46-418) 667072
Fax: (46-418) 667081
Email: roland.von.bothmer@vf.slu.se

* New Address: Via dei Tre Denari 472/a
00057 Maccarese (Fiumicino), Rome, Italy
Tel: (9) 06 6118231, Fax: (39) 06 61979661