Access to the plants in the fields

A short analysis of factors influencing access to PGR conserved *in situ* (including in-nature and on-farm)

Introduction

Climate is changing and the world population is growing. This causes obvious challenges in terms of securing our future food security. To assure sufficient food can be produced in a sustainable way, farmers, agronomists and plant breeders need to contribute. In this context Plant Genetic Resources (PGR) play an important role.

PGR need to be accessible to be used. One could think that nothing is more accessible as a plant growing in the field, which is to a certain extent true. The plant is certainly more visible, touchable, aromatic and collectable then plants stored as seeds in a genebank in aluminium bags frozen in big freezers at -20°C behind the walls of research institutes. But if it comes to access in terms of availability for use in research or breeding by professional users all over the world, this is different. This user first needs to know that the plant exists, then (s)he needs to be able to assess the value of this plant for his/her research or breeding programme. If all this is known this user needs to get access to physical material of the plant (seeds or cuttings) with permission of the owner or custodian of the material. Usually all this is unclear for plants growing in the field: their existence, value, ownership and conditions for use.

In well-organised genebanks, providing access to PGR is part of the core business. The material is presented in various on-line databases, and can be requested and received under well-defined conditions. Healthy seed is readily waiting to be shipped with the required phytosanitary statements and other paperwork.

In this short analysis we will explore how the *in situ* community (including in-nature and on-farm) can benefit from the experience of the *ex situ* community, and how the *in situ* community could make use of the existing infrastructure of the *ex situ* community to improve access to the diversity conserved *in situ*?

The *ex situ* ideal

The *ex situ* view on PGR conservation and use is relatively simple. The genetic diversity of the crop that is to be conserved is sampled, the diversity in terms of genetic diversity (allelic richness and other measures) is optimised and the value of the conserved material (current and future use-value) is anticipated. Once it is clear what material should be in the collection, the optimal conservation technique is selected (in terms of reliability and costs), and the material is collected on the basis of material acquisition agreements and prepared for storage. Once conserved, passport, phenotypic and genetic information about the material is collected and made available, and users can request the material on-line. Material is distributed to the requestors after signing a material transfer agreement. Meanwhile, the health status of the material is monitored allowing also the provision of phytosanitary certificates regarding the distributed material.

Obviously not all *ex situ* genebanks are organised that way, actually many of them aren't. However, many of the larger genebanks such as those in the international network of the CGIAR, and some important national genebanks are well-organised. As a result, users such as crop scientists, plant breeders or non-governmental organizations (NGOs) can get quite good access to a wide variety of PGR from *ex situ* genebanks. Data about material in *ex situ* collections can be found in databases such as GENESYS, that presents (mainly) passport data of about four million accessions maintained in genebanks worldwide. Phenotypic and genetic data are more difficult to access. However, a recent initiative to

identify genebank accessions with digital object identifiers (DOI's), supported by the International Treaty on PGRFA, can be expected to improve access to this kind of information as well.

The *in situ* situation

The situation in the *in situ* community is less straightforward. First of all, the *in situ* community is less coherent, as it is composed of a very wide spectrum of semi-independent actors involved with an even wider spectrum of approaches and convictions. It includes large nature conservation organisations managing nature reserves that may harbour populations of wild species that are relatives to our cultivated crops. But the community also includes small local or regional NGO's bringing together enthusiasts who are growing old varieties of a certain crop in their home-garden and are exchanging seed and experiences. And not only the nature of the material conserved, and the conservation methods vary, also the actors involved often have quite different perspectives on the world, genetic diversity and the value thereof. Where the actors in the *ex situ* community generally have a scientific institutional background, and share an eco-modernistic worldview, the actors in the *in situ* community form a very diverse mixture including actors such as wealthy conservative land owners, environmentalists that believe we should all grow our own food, and small seed companies catering for hobby farmers.

As a result of this diversity in species, methods and actors, it is difficult to describe the specificities of the *in situ* community or the difficulties regarding access to the conserved PGR. However, it can be observed that access to the PGR conserved *in situ* and its subsequent use is very low, and that this is caused by the following factors:

- first of all, there is the lack of information about the diversity conserved: 'what is conserved where?',
- secondly the relative value of each population is rarely clear,
- thirdly, if a user would like to have access to material, it is not clear whether this material is available for utilisation, and if so, how to get access, where to go to, and who to approach, and
- finally, in case the appropriate person has been identified, often the conditions under which the material can be obtained and used are not clear to the potential user nor to the manager/owner/custodian.

These four elements will be discussed below.

Access to information about in situ conserved material

The fact that information about the diversity conserved *in situ* is difficult to find doesn't mean it doesn't exist or have value. A first distinction should be made, as often when discussing *in situ* matters, between the crop wild relatives (CWR) occurring in nature and the diversity grown on farms (on-farm) and by hobby growers (in-garden). In the rest of the paper latter two terms (on-farm and in-garden) are collected referred to as on-farm.

Regarding crop wild relatives, often information about the flora in a country is available in publications or databases with a local, regional or national scope and much of the digitally available information is compiled in the database of the Global Biodiversity Information Facility (GBIF). However, the information is scattered and very rarely presented in a context that serves the potential user of the PGR.

Regarding the diversity on-farms, the information is completely scattered. Sometimes lists of varieties conserved by a NGO can be found in published or grey literature or on the internet, and obviously there will be lists of materials on individual computers possibly shared amongst members of organisations. However, for an outsider, a potential user, it is very difficult to even get an impression of the diversity conserved and potentially available for use.

Determining the value of in situ conserved material

Also, when discussing the value for use of *in situ* conserved diversity, a distinction between the crop wild relatives and the on-farm diversity should be made.

Regarding CWR, generally very little is known about their use-value. For the economically more important crops some knowledge is available about the 'relatedness' of the wild species with the crop species with implications for the ease of use in a plant breeding programme (referred to as the 'crop genepool' or 'taxon group' concepts). On the other hand, it is generally known that it is more difficult and costly to successfully breed with CWRs than with on-farm genetic resources and far more difficult than with elite material. The more related, the easier the crossing which may give the possibility of transfer of genes to the cultivated species. If less related, gene transfer may be difficult and the use of the CWR may require intermediate crossing parents, *in vitro* embryo rescue, and other expensive and time-consuming procedures. Not to mention the unwanted linkage drag that needs to be dealt with. Even more important is the question which species, populations or plants are the most likely to contain the traits, genes and alleles that are of value for the cultivated species. Mostly, such information is missing, only in rare cases the necessary data have been collected to determine the use-value of crop wild relatives or the occurrence of traits in populations in relation to their geographic distribution.

Regarding the value of diversity grown on-farm and with which there is no crossing barrier, generally much more is known since it often concerns landraces and old varieties that have been used and studied in the past (the well-studied varieties will often also be available in *ex situ* collections). However, this information is rarely properly documented nor made available. Often it is scattered in national languages over documents and web sites.

Communication with the responsible authorities

In the rare cases where a potential user can make a choice regarding the *in situ* / on-farm material to obtain, getting in touch with the ones responsible for the management of the PGR is the next hurdle to take. For the CWR growing in-nature the user needs to find out the organisation or person managing the area that harbours the desired population, which is not easy but is generally feasible. For diversity occurring on-farm, this step may be quite straightforward as the document or website containing information about the PGR may generally be produced by the organisation managing it, or this organisation will be mentioned in the information. Nevertheless, it should be noted that such organisations may not answer requests for information and/or access and may even refuse to provide information or access outside the circle of their own members.

Conditions for access and use in Europe

The final step in getting access to *in situ* conserved PGR is complicated since it not only involves agreement from the responsible authority (landowner, farmer, etc.), but also involves legal rules regarding 'access and benefit sharing', phytosanitary issues and potentially other obstacles (such as ownership/property matters etc.).

The first step in defining the conditions for use is the willingness to cooperate in making the PGR available to a user. If the responsible authority agrees, it will depend on the nature of the biological material how difficult it will be to make the material available. Access to crop seeds is relatively easy as in most cases seeds will be held in stock and samples can be made available or sold to the interested user. If it concerns wild relatives occurring in-nature, or cuttings of trees or shrubs either in-nature or on-farm, more elaborate agreements will have to be made to arrange the collecting and transfer of the biological material.

In addition to agreement by the responsible authority and logistic issues, also national laws and regulations have to be taken into account. Specific expertise in this field is required since the rules and their interpretation can be complex and may vary from country to country. As all European countries are

party of the Convention on Biological Diversity (CBD) and most of the Nagoya Protocol Protocol; as well as to the International Treaty on plant genetic resources for food and agriculture (ITPGRFA), many of the rules have been defined in that context and have been, or are about to be, implemented into national law. Every party of the CBD and to the ITPGRFA is supposed to have a National Focal Point (NFP) and a Competent National Authority on Access and Benefit Sharing (CNA-ABS) which can inform the user on the national policy and corresponding rules concerning exchange of PGR. In this context also, the access and benefit sharing clearing house (ABSCH) website can be checked in which for many countries the laws and regulations concerning PGR exchange are supposed to be present. In addition, there can be phytosanitary requirements, that are also defined on EU level and implemented in national legislation under responsibility of national authorities. These laws and regulations are especially relevant when PGR is transferred over national borders (regional borders in some countries). However, under the Nagoya Protocol, they can also be relevant if subsequent use of the PGR requires proper documentation of the source of the PGR used (such as in commercial plant breeding). In addition, plant species may be legally protected in a country under nature protection laws (CITES, Endangered Species Acts and other), which can mean that such plants may not be collected.

Improving access to the plants in the fields

Most of the difficulties regarding access to *in situ* conserved diversity are related to access to information. What material is conserved where, what is the use-value, under which conditions is it available and what should one do to get the material. Part of the answers to these questions often exists, but are not sufficiently accessible. Making these components better accessible, by digitising and translating them and connecting them via websites will increase access to *in situ* diversity substantially. It will also make clear which components are still lacking or are very weak, and thus need to be developed further.

Access to PGR, both *in situ* and *ex situ*, depends apart from the factors discussed, primarily on the existence of the PGR. In platitudes: ‘what is not there cannot be made accessible’ and ‘once lost is lost for ever’. Therefore, systematic, complementary conservation should be the first and main concern. Given the already significant loss of biodiversity due to various factors, including climate change, the effective and efficient organization of *in situ* conservation activities for CWR should be given a high priority, considering the dependence on the ecosystems in which they occur and the vulnerability of such systems to rapid changes.

Access to PGR can be considered of highest importance to farmers, plant breeders and crop scientists in order to assure sufficient and sustainable food production now and in the future. Therefore, all steps feasible should be taken to improve (the conservation and) the access of PGR and their wide utilisation wherever they occur.