TROPICAL FORAGE GENETIC RESOURCES – WILL ANY BE LEFT FOR FUTURE GENERATIONS?

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Dedicated to J.M.Toledo whose vision was a driving force in tropical forage genetic resources.

Abstract

After very active years of pasture and forage research at major institutes, interest in tropical forage genetic resources has drastically declined. Apparently, the early phases of collecting and evaluation were much more valued than conserving and keeping the germplasm available for future generations. Accumulated data are not easily accessible and, therefore, the knowledge of tropical forage genetic resources is progressively being lost. This worldwide decrease in activity and loss of knowledge is due to declining resources. It is suggested that a global database on tropical forage genetic resources should be established and also that finances be made available to at least maintain collections at their current reduced level.

Keywords: biodiversity, evaluation, germplasm, global database, tropical forages

The High Times

In the early years of the plant genetic resources movement, forages were regarded

important in discussions concerning plant exploration, collecting and introduction because pasture researchers were well represented in important technical groups and political decision making (Pistorius, 1997).

Over several decades, a remarkable effort was made in assembling large and diverse collections. This was strongly stimulated by the Commonwealth Scientific and Industrial Research Organization (CSIRO) and the Centro Internacional de Agricultura Tropical (CIAT), also with substantial support of the International Board for Plant Genetic Resources (IBPGR), and with collaboration from national institutions in Africa, Asia and the Americas. The results stored in a few major gene banks of the tropical world, have been accounted for repeatedly (Hanson and Maass, 1999; Maass et al., 1997; Schultze-Kraft et al., 1993).

In these years, genetic resources centers (GRCs) expanded their collections, the knowledge of these collections, their facilities and staff number. Acquisition, characterization and preliminary evaluation were driven by the demand of active pasture improvement programs in many countries that also participated in the evaluation of materials through networks. Consequently, a massive knowledge base was accumulated.

Successes of cultivars releases, such as the stylo story in Australia, or *Brachiaria* and *Arachis pintoi* in tropical America, deficiencies in available germplasm adapted to particular environments, and disease and pest problems in otherwise successful cultivars all led to more systematic, gap-filling collections and continued evaluation. The enthusiasm in the early 1980s also resulted in establishing many basic principles of forage genetic resources (McIvor and Bray, 1983) and produced a “plan of action” for forage genetic resources (Davies, 1984). These heady days, however, ended unexpectedly.

The Lean Years

Scarcer resources in the 1990s led to cutting down on activities. The multidisciplinary

CIAT Tropical Pastures Program with 22 core and associated staff in 1984 evolved into the Tropical Forages Program with 10+ scientists in 1992 and, finally, into the "Multiple purpose tropical grasses and legumes project" with 4-5 scientists since 1997. A comparable reduction happened in CSIRO, where the number of scientists working in improving pastures dropped from 15 in 1985 to 3 scientists by 1999.

Gene bank operations were also seriously restricted by financial shortfalls. After severe reduction in pasture research expenditures in northern Australia, the CSIRO Australian Tropical Forage Genetic Resource Centre (ATFGRC) had to reduce its activities and management options. This has included sending samples of about 15,000 accessions of genera presently regarded as "less important" to CIAT and the International Livestock Research Institute (ILRI) for maintenance to ensure these materials remain available to international researchers. The "more important" genera will still be available through ATFGRC.

After the enthusiasm in the 1980s, when thousands of accessions were tested in multilocational trials, evaluation networks declined due to lack of external funding. Annual distribution of 2,000-3,000 seed samples each at CIAT and ILCA/ILRI from 1980 to 1994 dropped to around 500-1,000, as the demand both from networks and pasture improvement projects declined. A similar trend occurred at CSIRO.

In the meantime, leading germplasm collectors and evaluators have retired or moved to other research areas. The accumulated knowledge of many of these scientists has not been published or made available otherwise. Some information on the characteristics of individual accessions has been published in the CSIRO series 'Genetic Resources Communication'. Some passport data have been made public through the CGIAR System-wide Information Network for Genetic Resources (SINGER), the United States Department of Agriculture (USDA) Germplasm Resources Information Network (GRIN), and others through the Internet. Comprehensive databases of network evaluation results exist at many GRCs although, they are

not accessible from outside and/or the information may not be easy to interpret by new scientists.

Although passport data on forage genetic resources give some guidance as to where an accession may be adapted, there are many examples where the origin of a species or particular accession was much less important than its genotypic superiority. Thus, characterization and evaluation data are extremely important in selecting germplasm for particular environments and uses. However, future gene bank managers will not have those data at hand if efforts are not made now to document this knowledge and make it, as well as any germplasm, readily available in a user-friendly manner.

Towards Future Generations

Livestock production is and will continue to be an important component of agriculture throughout the tropics, and so providing the best-adapted forage germplasm remains a high priority. Well-adapted germplasm is also important in view of less detrimental environmental consequences that can result from improved pastures as compared with overgrazed natural pastures (Vaccaro, 1997).

The need for funding to preserve collections and for better communication and networking has been expressed repeatedly (Reid, 1993; Schultze-Kraft et al., 1993). It is high time these sentiments were put into action before both germplasm and the attached knowledge are lost. Although, current needs may partly be filled, future generations will need the resource because:

- The risk of disease wiping out existing lines points at the need for a germplasm collection to select/breed for disease and pest resistance;
- Agriculture requirements will change and so lines, which are currently adequate, may not be in the future – similarly, lines not appropriate at present could well be so;

- Many tropical forage systems need yet to be analyzed whether they can be improved by current technology;
- Crops and temperate forages are still using collections in direct selection/breeding of new cultivars, even although they have been doing so for far longer than their tropical counterparts.

We propose that the following actions should be taken immediately:

- A global database of accumulated knowledge should be established before any more is lost; this should be on both an accession basis and a utilization basis (what accessions are best for a particular use);
- Donor countries should support such an idea and put together a dedicated team to accumulate information and develop the database;
- The database and preserving of unique germplasm should be incorporated into the FAO Global Plan of Action;
- International and national centers should be encouraged to maintain support;
- The International Plant Genetic Resources Institute (IPGRI) should take an active role in tropical forages, particularly in capturing related knowledge and making it available.

In conclusion, we think that:

- It was worth to assemble these large collections because of the impact they have had and will have in cultivars development and tropical agriculture;
- The tropical forages GRCs are in “danger of extinction” because enthusiasm, interest, funding and research specialists have declined greatly in recent years;
- Germplasm will only be conserved in the long-term if it is relevant for utilization;
- The potential benefits of “forage” species for other agricultural practices and landscape

protection should not be overlooked;

- Both germplasm and knowledge must be globally available and easily accessible and understandable.

References

Davies, W.E. (1984). A plan of action for forage genetic resources. IBPGR, Rome, Italy.

Hanson, J. and Maass B.L. (1999). Tropical forage germplasm conservation. Proc. 18th Int. Grass. Cong., Winnipeg, Manitoba, Canada. **3**:31-36.

Maass, B.L., Hanson J., Robertson L.D., Kerridge P.C. and Abd El Moneim A.M. (1997). Forages. Pages 321-348 in Fuccillo, D., Sears, L. and Stapleton, P., eds. Biodiversity in Trust: Conservation and use of plant genetic resources in CGIAR centers. Cambridge University Press, Cambridge, UK.

McIvor, J.G. and Bray R.A., eds. (1983). Genetic resources of forage plants. CSIRO, Melbourne, Australia.

Pistorius, R. (1997). Scientists, plants and politics – A history of the plant genetic resources movement. IPGRI, Rome, Italy.

Reid, R. (1993). Establishing and sharing collections of a valuable global resource. Proc. 17th Int. Grass. Cong., Palmerston North, New Zealand **1**:188-194.

Schultze-Kraft, R., Williams W.M. and Keoghan J.M. (1993). Searching for new germplasm for the year 2000 and beyond. Proc. 17th Int. Grass. Cong., Palmerston North, New Zealand **1**:181-187.

Vaccaro, L. (1997). Constraints and opportunities for livestock development in mixed farming systems in tropical Latin America and the Caribbean. Outlook on Agriculture **26**:227-235.