

Urgent Needs for Genetic Resources Remain Unfulfilled Decades After Clarion Call

By

Nagib M. A. Nassar and Márcio de Miranda Santos

The historical “Genetic Resources Movement” led by such plant pioneers as J. Harlan, O. Frankel, J. Hawkes, J. Creech and M. Swaminathan in the late 1960’s established the basis for the development of today’s global plant genetic resources (PGR) programs and subsequently led to the creation of the International Board of Plant Genetic Resources in 1974*. Initially sponsored by the U.N. Food and Agriculture Organization (FAO) and today known as the International Plant Genetic Resources Institute (IPGRI). IPGRI operates as an autonomous center under the Consultative Group of International Agricultural Research (CGIAR) with a mandate to collect and conserve the world’s genetic resource base.

To recollect the fundamental thinking of that time, it is instructive to review the subjects covered in “Genetic Resources in Plants: Their Exploration and Conservation” the seminal handbook published by the International Biological Program in 1970. In addition to the widely read Preface by Sir Otto Frankel, that landmark study contained, among others chapters on “Evolution of Cultivated Plants” by J. R. Harlan: “Centers of Diversity” by D. Zohary: and “Tactics of Plant Exploration” by E. Bennett, as well as others dealing with specific crops and their evaluation and utilization.

Pioneers Establish Framework

It was hoped that this initial work by the world’s most expert plant genetic resources scientists would provide the framework for establishing the strategies and programs necessary to:

1. Map the variation and diversity of major cultivated crops while taking into account the ecological changes that occurred since N.I. Vavilov developed the concept of centers of origins. Much was added to this knowledge base in the 1950’s and 1960’s when the concepts of secondary diversity, microcenters and noncenters in other crops were introduced. It was anticipated that subsequent activities would further enrich our knowledge about both how to apply these concepts to other crops and how genetic diversity is distributed on the five continents.

2. Preserve genetic resources of the major staple crops used largely consumed by developing countries and establish comprehensive conservation and use strategies that would embrace the full range of genetic materials in a given gene pool, particularly those related to landraces and wild relatives of the priority-crop species.

3. Make Preserved plant germplasm available to scientists worldwide to support their research efforts.

*DIVERSITY published an exclusive four-part series entitled “Genetic Resources: The Founding Years.” By Sir Otto Frankel. See No. 7, 1985, pages 26-29; No. 8, 1986, pages 30-34; No. 9, 1986, pages 30-33; and No. 11, 1987, pages 25-27.

Nagib M.A. Nassar is a plant genetic resources specialist and professor at the University of Brasilia, Brazil. Márcio de Miranda Santos, chair of the IPGRI board of Trustees, is a scientist with the Brazilian Corporation of Agricultural Research (EMBRAPA).

Yet – despite the adoption of FAO Global Plan of Action for Genetic Resources in 1966: the ongoing work being carried out by IPGRI and other CGIAR centers: and the various conservation activities undertaken by other relevant institutions at regional and national levels – **today we find gene centers disappearing before our eyes.**

Ancient plant races continue to be substituted by massive importations of new seed, and landraces are increasingly abandoned in favor of the modern varieties. Sufficient and crucial information is still not available to scientists on many important crops. This includes a lack of even simple, basic information on the origin of a large number of crops (such as sesame, pigeon peas, cassava, cotton, and sweet potato). While many crops originated in Vavilovian centers, many others originated elsewhere in areas that are still to be determined! Agriculture sometimes emerged in a center and then dispersed. Sometimes it evolved over vast areas, which cannot be accurately called a center.

For example, critical information is still lacking on the geographic distribution of major pulse crops, and few of their wild relatives are being conserved in a world collection. In the case of cassava, out of the 98 wild species. Little more than 20 are being conserved in the respective international collection responsible for its maintenance. Further, **its putative ancestor has become extinct over the past decade (Nassar, 1999).** More disconcerting is the fact that the **microcenters and habitats of cassava’s**

A Proposal for Remediation

These observations have compelled us to propose some avenues that might be followed by the various national and international programs whose mission is to secure the conservation and promote the manipulation of plant genetic resources:

1. High Priority for Genetic Conservation and Manipulation: The economic and environmental pressures that affect these areas have led to the extinction of many wild relatives – in some cases, their putative ancestors (Nassar, 1999). Keeping the ancestors of staple food crops found in developing countries alive is a vital matter for all of the peoples of this world. Such actions not only contribute to conserving irreplaceable sources of food, but they also serve to conserve independent sources of culture and thereby counteract some of the social and economic residue as a result of the colonial era of Western domination. In addition, such initiatives would provide those in developing countries, where most of the world's genetic resources originated, the great satisfaction of learning about their ancestors and their contributions.

2. A Specialized Research Model Based on Diverse Partnerships: The IPGRI mandate covers the entire plant genetic resources domain, with priority given to economic and neglected food crops as well as forest and medicinal plants. The majority of these activities are conducted in developing countries. This important mission requires the development and continual strengthening of a model of research designed specifically for this work. Diverse forms of partnerships-the very heart of the IPGRI modus operandi-must be pursued.

Gene centers are disappearing before our very eyes

Our proposal calls for an additional component that would involve collaborative efforts led by IPGRI and key universities located in centers of diversity of the main food crop. In our view, IPGRI should place a greater emphasis on the promotion of PGR graduate courses, held at targeted key universities in the developing world that would follow clearly defined strategies. The model would also require the placement of IPGRI scientists at the sponsoring universities, which would presumably offer the type of facilities that could provide a stimulating academic environment. The Agricultural Research Service of the U.S Department of Agriculture has followed this model with great success.

Ideally, scientific profiles of the professionals involved with this strategy would include expertise in plant population genetics; sources of plant genetic variation: evolution and domestication of cultivated species: and ethnobotany. **In addition, professionals would need to be world authorities on crop-plant breeding.**

Priority should be placed on filling information gaps on the origin and genetic distribution of the main food crops and their wild relatives, as well as on methods to promote their conservation and utilization in breeding activities. It should be remembered that it was the work of one such scientist- J. Harlan- that led to the redefinitions of Vavilov's theory on centers of diversity and centers of origin, and introduced new concepts such as noncenters, secondary centers and microcenters.

Emphasis should also be placed on promoting curatorship-related activities for the main food crops and their wild relatives, as a way to: assess both the current status of the conservation and use of these materials and the areas of high concentration of diversity; establish collecting priorities; and develop information systems to make information accessible to users. It is our opinion that while great emphasis was placed on collecting activities in the past, very little priority has been given to follow-up activities. Yet, it has been shown that follow-up of operations is essential for the adequate development of information relevant to improved conservation and use of accessions maintained in ex situ facilities.

3. Postgraduate Networks Based at Diversity Centers: Postgraduate courses should be sponsored by IPGRI and **implemented in centers of diversity**. The courses should function as a network that is led and coordinated by IPGRI. Every course should take responsibility for research on the genetic resources **of the crops compatible with the centers of diversity** located in the area. For example, wheat genetic resources would be studied through a network constituted of postgraduate courses given in Izmir, Turkey; Adis Ababa, Ethiopia; Tehran, Iran; and Baghdad, Iraq; while a network formed by the postgraduate courses of Vicosa, Brazil; Catie, Costa Rica; and Chapingo, Mexico would study cassava.

The establishment of such networks would avoid repetition of study by several institutions, thereby saving money and time.(Nassar,1976, 1978a, 1978b, 1978c, 1978d, 1978e, 1978f, 1978g). If the above-mentioned networks had been operating at the time, the huge budget that was wasted on this needless effort could have been applied to other research and the duplication avoided. IPGRI could and should play an important role in coordinating and articulating the activities of these networks by granting scholarships to postgraduate students; placing IPGRI scientists at those postgraduate courses; and making every network the responsibility of particular IPGRI staff member.

Conclusion

After more than a quarter of a century of concerted work by organizations with global mandates to conserve genetic resources, **gene centers continue to disappear at an**

alarming rate; ancient plant races continue to be substituted by a growing number of importation's of new seed and landraces increasingly abandoned in favor of modern varieties; and crucial information on many important crops is still unavailable to scientists. We suggest a proposal for remediation based on: (1) Placing high priority on conserving crop genetic resources threatened by extinction; (2) Adopting an efficient model of research based on and located in centers of diversity of the main food groups; and (3) Creating postgraduate courses in crop networks based in centers of diversity.

We offer these proposals to those organizations and individuals who can effect changes in the current global systems responsible for conserving genetic resources for future generations and urge them to find expeditious ways to incorporate these initiatives into their respective programs. While the hour is late, better late than never.

References

Frankel, O.H. and Bennett E., 1970. Genetic Resources in Plants: Their Exploration and Conservation. IBP Handbook n°11, Blackwell, Oxford.

Harlan J. 1975. Crops and Man. ASA, Madison

Nassar, N.M.A. 1978a. Conservation of the Genetic Resources of Cassava: Determination of wild Species Localities with Emphasis on Probable Origin. Econ. Bot. 32:311-320.

Nassar N.M.A 1978b. Microcenters of Cassava Diversity in Central Brazil. Turrialba28: 345:347

Nassar N.M.A 1978c. The need for germplasm conservation in wild cassava. Ind. J. Genet.& Plant Breed.39:465-470.

Nassar N.M.A 1978d. Wild Manihot species of Central Brazil for cassava Breeding. Can. J. Plant Sci58:257-261.

Nassar N.M.A 1978e. Hydrocyanic acid content in some wild Manihot species. Can.J.Pl.Sci.58:577-578.

Nassar N.M.A 1978f. Some Further species of Manihot with potential value to cassava breeding. Can.J.Pl.Sci.58:915-916.

Nassar N.M.A 1978g. Genetic resources of cassava: Chromosome behavior in some wild Manihot species native to Central Brazil. (Ind. J. Genet.& Plant Breed) 38:135-137.

Nassar N.M.A 1979 a. Three Brazilian Manihot species with tolerance to stress conditions. Can. J. Plant. Sci553-555.

Nassar N.M.A 1979b. A Study of the collection and maintenance of the germplasm of wild cassava, Manihot spp. Turrialba29:221-224.

Nassar N.M.A 1999. Conserving cassava genetic resources: Has Manihotoides pausiflora, a cassava relative, become extinct? Diversity 15 (2):20.

Nassar N.M.A and C. P. Costa 1976. Tuber formation and protein content in some wild cassava (mandioca) species native to Central Brazil. Experientia (Basel) 37:1304-1305.

For more information contact: Nagib Nassar. Professor of the University of Brasilia, Brazil. Cx. P. 04477. Cep:70919-Brazilia-Brazil. Tel:061-272-2187. Fax: 061-349-3253.

[Home](#)

[Photo Gallery](#)

[Articles](#)

[Contact](#)