Setting Up A Cryobank In Developing Country: Lessons To Be Learned

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Introduction

The international community has tried for decades to improve agricultural productivity and economical well being in much of the world over the past 50 years. Despite various advances recorded in these areas, food security and poverty alleviation continue to be serious issues in many developing countries. According to the most recent report on the State of Livestock in the World, there are more than one billion undernourished people (FAO, (2009)) and this figure is subject to get bigger. There is no doubt that many socioeconomical constraints are still impeding the uptake of suitable technical approaches by developing countries, but, clearly there are still rooms for focusing on ways of optimizing their agricultural outputs while preserving their natural resources base form depletion and erosion. Biotechnology, gene banks and animal cryobanks are being identified as potential alternatives to achieve the latter goals. The objectives of this paper were to underline some key elements when setting up a cryobank in developing countries while considering lessons learned from the past.

1. Animal World strategy with objectives and structure

The CBD recognized three key elements, among many others, when dealing with conservation and management of domestic animal genetic resources: 1) every country is responsible in managing its genetic resources; 2) every country must conserve its genetic resources and 3) in case where countries lack technical expertise or financial matters or both, the world community should help them save their animal genetic resources (AnGR) from threats of extinction. The Global Strategy for the management of farm animal genetic resources was initiated in 1993 and implemented. It included a well defined structure with a world focal point (FAO, Rome), regional focal points and national focal points with their national consultative committees (CCN). Manuals were prepared and distributed world wide, training of trainers and regional workshops were organized with the challenge to set up a worldwide sustainable mechanism that builds capacity and guarantees the conservation and sustainable use of AnGR. Intergovernmental Technical Working Groups on Animal Genetic Resources (ITWG-AnGR) were formed as a subsidiary body of FAO Commission of Genetic Resources for Food and Agriculture to address issues relevant to the conservation and sustainable use of AnGR. They also reviewed progress in the preparation of the State of the World Report on AnGR and endorse Strategic priorities for Action.

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One of the main results of this process was the production of the State of the World's AnGR report with 143 final country reports and 26 draft reports. Statistics reported (FAO, 2007a) indicated that Europe and the Caucasus had the largest number of local breeds in mammalian species. The same trend was also reported for avian species. These figures could be misleading due to the fact that most of livestock breeds are encountered in developing countries which are lacking means to conduct inventories and asses what they really have.

The same remark can be extended to getting support from the international community. Given that most of European and North American are capable technically and financially to conserve and manage their genetic resources, the wisdom would be to focus international efforts on technical and financial help to Africa, Near and Middle East, Southwest Pacific, Asia and Latin America and the Caribbean. The AnGR world strategy that invested time and funds to produce the world report could have benefited from the whole process by strengthening regional and national focal points in these areas of the world to upgrade their levels of animal genetic resources management and conservation. This allows building capacity of developing countries where most of the threatened breeds are actually encountered.

2. Conventional technologies

Artificial Insemination (AI) is the most widely used in developing countries. According to FAO (2007b), 100% in the Middle East reported using AI, of the 42 African that submitted reports to the State of the World Report, 74% reported using AI. This number was 55% for Southwest pacific countries and 86% for Asia. Latin America and the Caribbean used 95%. When clear breeding programmes are lacking, which is the case in most of developing countries, this should raise concerns regarding the loss of biodiversity due to inappropriate and poorly planned use of AI to inseminate locally adapted breeds.

3. Gene Banks and Cryobanks

National, regional and international research and development institutions are aware of the importance of conserving biodiversity for sustaining agricultural development, food security and protecting the environment. For millennia, the peoples in the drylands, mountainous areas and oasis used the scarce natural resources (water, soil, biodiversity,…) in a sustainable manner. Traditional farming systems, based on oasis, dryland farming systems and on communal management of natural resources, have maintained the rich biodiversity and the associated local knowledge in addition to their crucial role in sustaining the livelihoods of local communities and the other environment benefits. In recent years, the rapid population growth and modernization in developing countries have led to a massive demand of food from animal origin. To satisfy this demand, the option taken was mainly the importation of exotic breeds and the use of cross breeding of native

well adapted animals. These practices are becoming real threats to the animal biodiversity and ways of saving it are sought.

It is generally accepted that whenever possible, *In Situ* conservation should be the preferred scheme and *Ex Situ* conservation should be as an additional safeguard when breeds are at risk or have a small population size. For the past few years, a growing awareness of the importance of genetic resources management and conservation has left the impression that the answer resides in establishing a gene bank or a cryobank. Gene banks and cryobanks in developed countries are a result of a normal evolution of events. Most of the breeds are known and promoted by well defined breeding programmes and effective breeders' organizations. Gene Banks and cryobanks are assets and a back up to these programmes. In developing countries, however, the situation is totally different. Breeds are unknown having usually a common name « native ». Setting up a gene bank or a cryobank, in this case, should not be just for conservation only but rather a multifunctional entity with a political commitment and appropriate legislation. These functions should include raising awareness, building capacity, catalyst roles in conservation and sustainable use of genetic resources. Farmers, in developing countries, besides helping them save their threatened breeds via cryo banks, they need to be backed up in promoting their breeds by linking their products to market. All partners (farmers, policy makers, researchers, industry or market) should be represented in such an effort. It is from this point of view where the international community could play a key role technically and financially.

In November 2007, the Government of Tunisia, through the initiative from the Ministry of Environment and Sustainable Development, has established a National Gene Bank (NGBT) with the mandate to coordinate and promote all the activities of conservation and sustainable use of plants, animal and micro-organisms biodiversity. A gene bank with a capacity for *ex situ* conservation of 200,000 seed accessions was constructed.

The NGBT cooperates with all institutions, stakeholders and operators in a network with nine thematic groups: Cereals and food legumes; Forages; Pasture and forestry; Fruit trees; Vegetables and herbal plants; Medicinal and aromatic plants; Animal genetic resources; Fish genetic resources; and Micro-organisms genetic resources.

Even though, the NGBT is in its third year of activity some principles could be underlined:

1. Political commitment and legislation. This is a prerequisite for the sustainability of the institution like the NGBT. The legislation should state clearly the mission of the institution and its method of working. In the case of the NGBT, networking with all stakeholders is the principle adopted where nine thematic groups were formed including all operators in the field of genetic resources (research, universities, development agencies, farmers and ngo's).
2. Budget. This is a key commitment. The budget of the NGBT is 100% nationally financed.

3. Maintaining the network. All members of the network, through their groups, should be involved in the NGBT planning, programs implementation and sharing benefits in building and capacity activities.

While the momentum is kept in strengthening its network and implementing its defined activities in conserving and promoting genetic resources, the NGBT met difficulties with some international agencies which still deny collaboration through the appropriate channels and prefer dealing with individuals or outside the NGBT network and mandate.

4. Build on what has been realized and do not repeat what has been done before.

The Sicilo-Sarde sheep breed is an example. It is the only breed of milking sheep native to Tunisia and North Africa and it was at risk of extinction. In the space of just five years, scientists recorded a dramatic drop in the population of Sicilo-Sarde sheep, from 200 000 ewes in 1995 to 25 000 in 2000. In 2003, a group of Sicilo Sarde sheep farmers formed an Association in an effort to protect the breed from further decline. The team discovered that a low price for sheep milk on the market combined with the growing numbers of farmers moving from dairy sheep farming to dairy cattle farming were the main reasons behind the drop. Together with the Sicilo Sarde Breed Association and the Tunisian Livestock Development Agency (OEP), the scientists worked to bring the Sicilo-Sarde back into business. Led by a local entrepreneur, the association took various steps to improve the value of this native breed. Selling sheep milk through the association allowed the farmers to double its price in the space of just one year because they were able to negotiate the market price for milk through the association and not on individual basis as they had previously done. The association worked with researchers and policy makers to introduce new legislation benefiting dairy sheep farmers. A multidisciplinary research program tackled constraints faced by the breed in terms of nutrition, management, reproduction, health, breeding and product development (Djemali et al., 2009). As a result of this programme, milk production from Sicilo Sarde sheep doubled from 70 kg per ewe per year in 2003 to 140 kg per ewe per year in 2008. The Association also set up its own milk collecting centre and is now establishing its own cheese processing unit. Encouraged by thegrowing market for dairy sheep products, small farmers have begun to replace their dairy cattle with Sicilo-Sarde sheep (Djemali & Bedhiaf, 2009).

The National Gene bank of Tunisia has recognized the realized efforts made by the Sicilo-Sarde breed association and it is now encouraging this initiative as a part of its efforts to promote the conservation of native breeds *In Situ* as well as *Ex Situ*. This is because the strategy to reverse the decline of the native Sicilo-Sarde dairy sheep breed brings together key elements of an innovation system-entrepreneurs with enthousisasm for emerging market and a thirst for information, global and national information, brokers supply best practice knoweldege, favorable policies, support from development partners, and the willingness of all parties to work together towards a common goal.

In response to a call by developing countries for assistance in conserving animal genetic resources the USDA-ARS National Animal Germplasm Program with the Office of International Research Programs and in collaboration with ICARDA, FAO, the Gene Bank of Tunisia, the Netherlands and Canada leveraged resources to sponsor a workshop and support developing country participant travel. Consequently from April 21 to 23, 2009 a workshop was held for the express purpose of promoting and assisting in the development of gene banking activities for livestock. The primary goals of the workshop were:

• Train scientists involved in gene banking activities (cryopreservation, collection development, genetic evaluation and database requirements),
• Provide training sessions that include laboratory and software experience, and
• Form a small working group to draft a "best practices" document that can be widely distributed.

Until this workshop a common perception was that there was little capacity in developing countries to develop and execute gene banking activities for animal genetic resources. However, in a survey of participants from developing countries it became very clear that capacity exists in most of the countries to perform cryopreservation and establish gene banking activities. As Table (1) shows the majority of countries attending from Sub-Saharan Africa and North Africa not only had capacity but also had gene banking initiatives under way (Blackburn, (2009)).

All participants reported out to the entire group about their future gene banking plans. They expressed a strong desire to continue developing capacities for ex-situ for conserving animal genetic resources. In some instances countries expressed very clear plans as to which livestock populations would be targeted for collection and maintenance in the gene bank.

Table 1: Workshop Participants and Existing Cryopreservation Capacity

Region	Countries	People	Female	Countries with gene bank or cryopreservation activities
S. S. Africa	6	10	2	5 (SAfr, Kenya, Uganda, Senegal, Botswana)
West Asia North Africa	7	14	3	4 (Tunisia, Libya, Morocco, Egypt)
Central Asia	2	3	1	2 (Uzbekistan, Krygystan)
Asia	3	3	0	3 (Bangladesh, Sri Lanka, Viet Nam)
S. America	1	1	0	1 (Brazil)
Europe	2	6	1	2 (Netherlands, France)
N. America	2	3	0	2 (Canada, United States)
Intern'l Organizations	--	3	2	
Total	23	43	9	19

Conclusion

An opportunity was given to the world community to tackle AnGR conservation and management. Many think, like my self, that we could have done better by not letting advanced countries and developing countries compete for the same allocated funds. Others think that progress has been made and a plan of action is now working. Between the two positions there is a long way to go.

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