improved varieties has not been adequately met and the most widespread cultivars remain the traditional ones.

Two biotechnology laboratories on tissue culture were established in 1998 and 1999 at ARC and the Sciences Technology and Environment Agency (STEA), respectively. They mainly produce disease-free bananas, potatoes, and orchids.

Part of the success of the agriculture in the country is due to the contribution of the plant breeding programmes of ARC and their partnership with regional/international endeavours. The supply of varieties has been expanded with the release of new varieties. However, the number of improved varieties is still very limited and they are not available for all crops important for our agricultural economy. There is an increasing demand for new varieties for different crops which has to be urgently met.

PRIORITIES AND RECOMMENDATIONS

The Government has expressed through different policy documents that conservation and utilization of plant genetic diversity is highly important to improve food security, alleviate poverty, and promote rural development. Based on the results and discussions under this Project the following priorities and recommendations have been agreed.

- Existing regulations for protecting plant diversity have to be applied and enforced properly. This may require neighbouring countries' collaboration when resources are taken from protected areas close to national borders. An awareness raising campaign on the need to preserve plant genetic resources and the benefits derived from their sustainable management could also be conducted among farmers' communities living within or near forest areas.
- Surveying and inventorying of crop intra-specific diversity and wild species of vegetables, fruits, forages and medicinal plants need to be systematically and comprehensively carried out to better cover existing diversity of PGRFA and fill in gaps in ex situ collections.
- Ex situ conservation is a central element of the national conservation and utilization strategy. Existing facilities should be upgraded to provide for long term conservation of plant genetic resources' collections. Regeneration protocols should be applied following international standards.
- Documentation and information management are liaison elements between conservation and utilization activities. Information systems currently in use do not meet the requirements for efficient PGRFA management. Strengthening of the established National Information Sharing Mechanism on PGRFA and the adoption of a crop-independent, accession-level genebank information management system would help to improve ex situ conservation and facilitate genetic improvement efforts.

Photo: R. Grossman

- To meet the growing food demand in the coming years, the agricultural sector will have to significantly evolve towards an intensification and diversification of existing cropping systems. The introduction and development of improved varieties and the availability of quality planting materials will be essential for pursuing these objectives. Therefore, adequate provisions of resources for breeding, evaluation and multiplication programmes will have to be ensured.
- Overall the National PGRFA Programme suffers from an acute shortage of trained staff in PGRFA conservation and use. This shortage extends from taxonomists to breeders, and from information technologists to socio economists. Although there are staff engaged in postgraduate programmes overseas, their number still appears too limited to meet the country's demand for expertise in PGRFA management. There is an urgent need to invest in capacity building, to increase the number of scientists involved in conservation and utilization activities and to improve their educational level.
- In March 2006, the country became a Party to the International Treaty on PGRFA, a multilateral agreement to promote PGRFA conservation, access and utilization, as well as the equitable sharing of benefits derived from their use. Opportunities disclosed by the implementation of the International Treaty on PGRFA need to be taken promptly. In this regard a task force could be established to guide the implementation of the Treaty in the country and to foster collaboration with national programmes of neighbouring countries, regional and international research centers, as well as participation in PGRFA networks.

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Photo: FAO / F. Guimaraes

CONSERVATION AND SUSTAINABLE UTILIZATION OF PLANT GENETIC RESOURCES

INTRODUCTION

Plant genetic resources are deeply rooted in our culture and economy. Their wide diversity, still present in the country, needs to be preserved and wisely managed. In fact, it represents an immense treasure for the development of our society, in particular agriculture, the principal economic sector accounting for about half of the total Gross Domestic Product and employing more than 80% of the national labour force.

As part of the component on plant genetic resources for food and agriculture (PGRFA) under the Agricultural Biodiversity Project, funded by the FAO - Netherlands Partnership Programme, the following activities have been implemented during 2006 and 2007.

Photo: R. Grossman

- *A National Information Sharing Mechanism on PGRFA* (NISM) was established in 2006. It consists of a network of five research centres from the National Agriculture and Forestry Research Institute (NAFRI) which conserve and/or use plant genetic resources. Through this Mechanism, participating institutions are given an opportunity to (a) increase understanding about the status and dynamics of PGRFA, (b) contribute to decision-making processes, (c) strengthen partnerships and (d) widen their visibility at national and international levels. The Mechanism relies on a database, built by participating institutions, addressing *in situ* and *ex situ* conservation, as well as utilization of PGRFA, and a web portal. (see Figure 1 and http://www.pgrfa.org/gpa/lao).

- *A National Plant Breeding and Biotechnology Capacity Assessment* was carried out in 2007. Results from this assessment were analyzed and discussed by a composite team from national agricultural research institutions. Collected data together with the final report are published in a dedicated website within the framework of the Global Partnership Initiative for Plant Breeding Capacity Building (GIPB) (see http://waicent.fao.org/test/agricult/agp/agpc/Nordat/).

- *A Country Report on the State of Plant Genetic Resources for Food and Agriculture*, based on the information available under the NISM and through the National Plant Breeding and Biotechnology Capacity Assessment, was prepared in 2007. It will be submitted to the FAO Commission on Genetic Resources for Food and Agriculture as the Lao PDR contribution to the preparation of the *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture*.

Findings, as well as priorities and recommendations, which resulted from these participatory processes are hereunder summarized.

CONSERVATION

Since the early 1990s, the changing socio-economic situation has increasingly put pressure on plant genetic resources, in some cases leading to a severe loss of their diversity. For this reason, most vulnerable areas at risk of genetic erosion have been demarcated and protected by forest law and regulations. However, law enforcement in most of the protected areas has not been as effective as expected. Therefore some improvements in this regard urgently need to be considered. This particularly applies to the *in situ* conservation of wild species from the forest and wetland ecosystems, including wild vegetables and fruits, which play an important role for rural people in terms of food security, both quantitatively and nutritionally. It is also urgent to make provisions for the preservation of the indigenous knowledge associated with the culinary and medicinal use of wild species, a knowledge that is being lost due to urbanization and lifestyle changes of younger generations. Likewise, it is necessary to assist the on-farm management of traditional landraces, which bear adaptive traits essential for crop improvement programmes, and complement it with an adequate *ex situ* conservation strategy of these resources.

During the past 12 years NAFRI's Naphok Agricultural Research Center (ARC) and Haddokkeo Horticulture Research Centre (HRC), in collaboration with international organizations, have carried out systematic PGRFA surveys and collecting missions targeting mainly rice, whose primary centre of origin includes our country, and vegetable crops. Additional sporadic surveys have been conducted for maize, cassava, sweet potato and sugarcane, as well as species for non-wood forest products and medicinal plants. Surveyed materials have also been collected and conserved ex situ in medium term storage facilities set up in our country. These account for about 15,000 traditional cultivars/landraces and wild accessions, rice being the biggest collection with more than 13,000 samples conserved at ARC, followed by the vegetable collection, which consists more than 2,130 landraces held at HRC. The rice collection represents one of the largest collections of glutinous rice, worldwide. During the past years despite serious measures taken by the genebank for the proper management of this collection, some losses due to electrical power failure had occurred. In order to reduce risks of further losses of materials of this unique rice collection, the entire collection was duplicated and put in long-term storage at the International Rice Research Institute (IRRI), as per an agreement signed by the Ministry of Agriculture and Forestry and this institute.

Figure 1. The portal of the National Information Sharing Mechanism on PGRFA (http://www.pgrfa.org/gpa/lao/laowelcomeil.html).

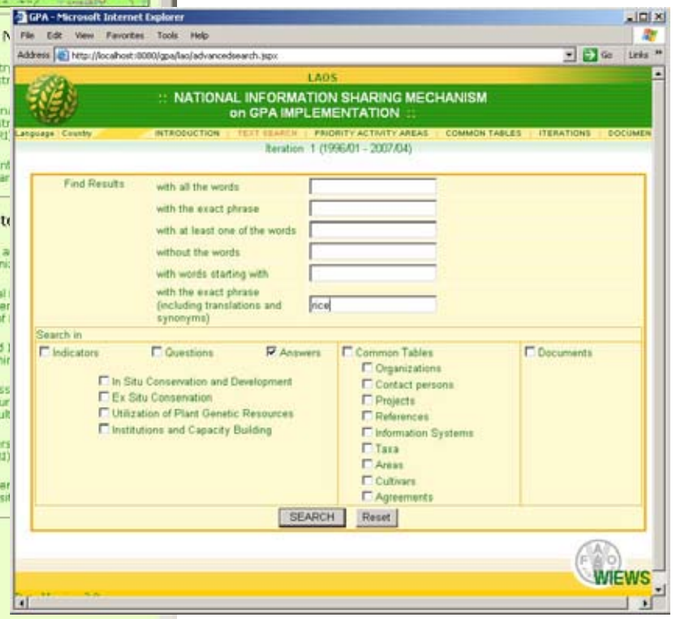

Figure 2. Searching for "rice" in the NISM database through its Google-like text-search window.

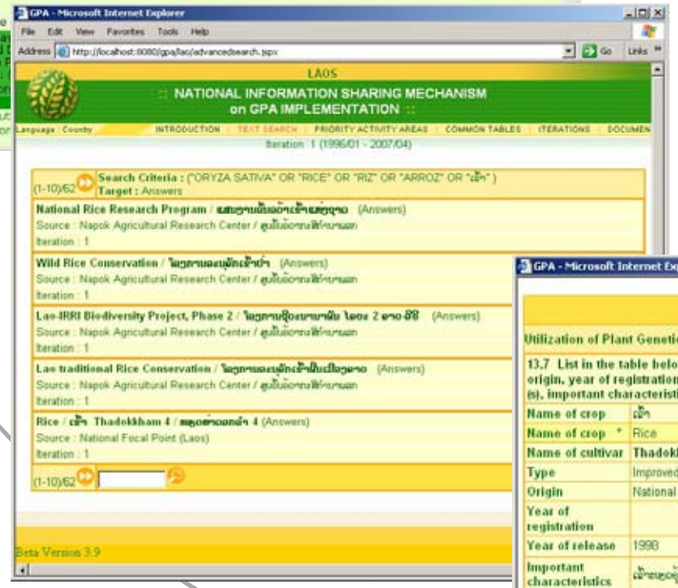

Figure 3. Results from the search for "rice" in the NISM database: 62 hits are found.

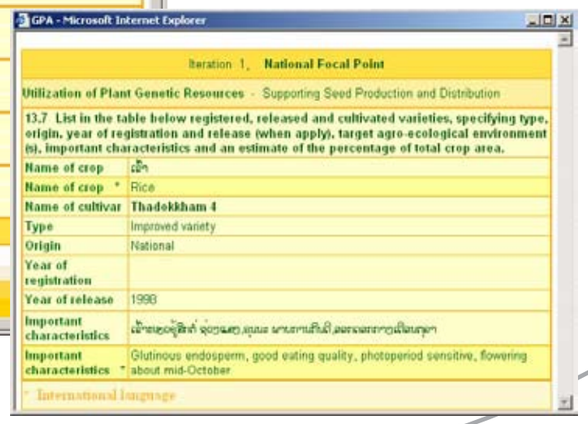

Figure 4. "Thadokkam 4", one of the results of the search, is displayed.

UTILIZATION

The national policy for PGRFA aims to establish sustainable food security systems and to alleviate poverty in the rural sector, while protecting the diversity of plant genetic resources. Rice is the most important agricultural product of the country. With the significant contribution of national and international germplasm, substantial progress has been made in increasing the productivity of rice during the past decade. However, to meet the internal demand in 2010, rice production should increase up to 3.2 million tonnes, almost 1.0 million tonnes more than currently produced. Crop improvement is therefore a high priority of the rice industry. Traditional breeding can still play a major role in rice improvement. The genebank's rice collection is an important source of traits for stabilizing yield under low input management where modern varieties do not achieve high yields. Recent genetic evaluation programmes with landraces have shown positive results on drought adaptation and high yielding in aromatic rice. The country has also benefited from collaborative efforts with international programmes. The introduction of genetic material from breeding programmes of IRRI, Thailand-IRRI and the Australian Center for International Agricultural Research (ACIAR) has contributed to significant increases in rice yield over the last 10 years.

Both *in situ* and *ex situ* conservation policies of plant genetic resources in the country have made important achievements in the past twelve years. However an integrated strategy for PGRFA conservation and management has not yet been fully developed and implemented. Insufficient human and financial resources are among the main constraints that prevent the National Programme from adequately dealing with the increasing needs of communities that depend on these resources.

Corn varieties with high and low waxy endosperm have been identified following evaluation trials of the collection at ARC. The existing corn improvement programme aims to improve yield and agronomic characters of non-waxy varieties for use in animal feed. Currently, a selection programme is being implemented by ARC for non-waxy germplasm. ARC is receiving a corn population (F_1) from the International Maize and Wheat Improvement Center (CIMMYT) and a cassava population (F_2) from the International Center for Tropical Agriculture (CIAT) for the development of new corn and cassava varieties. ARC also implemented a soybean breeding programme in which several crosses were made with locally available material and introductions. The vegetable seed development programme at the HRC mainly concentrates on leafy vegetables as well as eggplant, chilli, tomato and others. The pure line selection programmes for wet and dry season vegetables are highly successful. Descriptors from the Asian Vegetable Development Research Center (AVDRC) are usually applied for the selection of materials.

As a result of the emphasis placed on PGRFA utilization, the number of scientists from NAFRI involved in plant breeding activities almost doubled in the last decade. Their educational level also showed a significant improvement (Table 1). However, this overall capacity appears insufficient for a country with diverse agro-ecological conditions, high indigenous crop genetic diversity and an agricultural sector so important for the economy and livelihoods. There is an urgent need to invest in capacity building, to increase the number of scientists involved in plant breeding activities and to improve their educational level.

Table 1. Number of scientists involved in plant breeding activities at NAFRI during 1995-2007.

	1995	2000	2007
BSc	3	4	4
MSc	5	7	9
PhD	-	1	2
Total	8	12	15

Since 1995, mostly rice benefited from some genetic improvement activities although the amount of resources devoted to plant breeding has been in general too limited. Investments in other highly important crops such as vegetables have been insufficient. Consequently, farmers' demand for