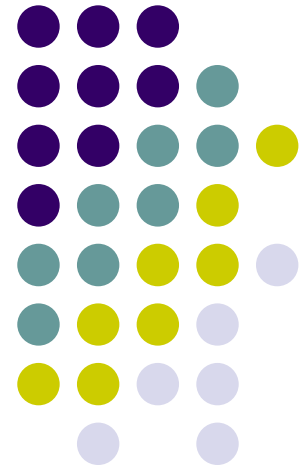


# Methodologies for *in situ* - on farm conservation



*Biologist Diana Batâr Rusu*

# Triple dynamics of *in situ* -on farm conservation



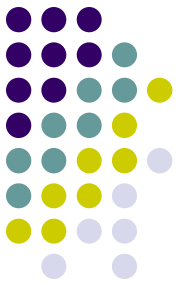
- Environmental factors:
  - Climatic, edaphic, biotic
  - Global changes (demographic, land-use)
- Economic factors
- Social factors.

# What is *on farm* conservation of plant genetic resources?



- *In situ - on farm conservation* means the conservation of genetic diversity of traditional crops in the surroundings where they have developed their distinctive properties in traditional farming systems. (by the *Convention on Biological Diversity, 1992*)
- *On farm conservation* involve the maintenance of genetic diversity in the locations where it is encountered *in situ*.
- *On farm conservation* is the sustainable management of genetic diversity of locally developed crop varieties (landraces) by farmers within traditional agricultural, horticultural or agri - silvicultural systems. (Maxted, 1997)
- *On farm conservation* involves the maintenance of traditional crop varieties (generally know as "landraces") or cropping systems by farmers within traditional agricultural systems. (Altieri and Merrick, 1987, Oldfield and Alcorn, 1987, Brush, 1991)
- The conservation of cultivated forms, actual varieties, old cultivars and landraces in the production process is included in *on farm conservation*, which is a dynamic conservation form, because it's referring to a continuity of evolution process.
- Several authors (Maxted, 1997, Damania, 1996, Engels, 1995) list the conservation of plant genetic diversity in home gardens separately. (A community of gardens may need to be included, as the intraspecific diversity within an individual garden is often limited, whereas the variation among gardens is often substantial).

# What are *on farm* conservation strategies?



*In situ - on farm* conservation strategies involve a range of complex to simple activities, depending on:

- the species concerned and their characteristics
- distribution
- genetic variation
- the habitats
- economic importance
- the degree of threat
- the resources available.

# *On farm* conservation activities

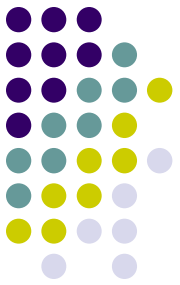


There are 2 distinct conservation activities that are currently both referred to *on farm* conservation:

- if the focus is the conservation of genetic diversity within a particular farming system (*on farm conservation*)
- if the focus is the conservation of the traditional farming system, irrespective of what happens to the genetic diversity of landraces material within the farming system (*on farm management*).

These two variants of *on farm* conservation are obviously interrelated and may in certain cases be seen as one, but in other instances this may not be possible. (For example, the introduction of a certain percentage of high-yielding varieties to a traditional farming system may sustain the farming system at that location, but could lead to gene replacement or displacement and therefore genetic erosion of the original landrace material).

# Matters of *on farm* conservation



For a number of reasons, developing a generalized methodology for *on farm* conservation is more problematic, because:

- firstly, there have been, until recently, relatively few attempts to scientifically study *on farm* - conservation. (Brush, 1999, Jarvis, 2000)
- secondly, the farmers ultimately undertake the conservation, not the scientists. (Maxted, 1997)

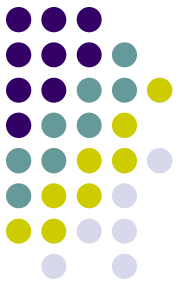
The formulation of a general methodology is more difficult for *on farm* - conservation, because it is a entire process of plant genetic conservation, there are a number of activities that are involved, from selection of a target crop through to its utilisation.

# How we actually do *on farm* conservation?



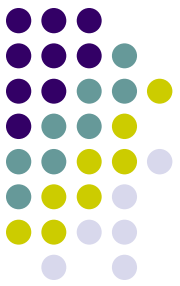
- Farmers have been practicing *on farm* conservation for as long as agriculture has existed, as a necessary part of crop production.
- For them, the most effective management practices have been those that combined highest yields with the greatest food security.
- Usually, these practices are based on within- and among species diversity, surviving in areas that are not served by modern high - input agriculture.

# The role of farmers

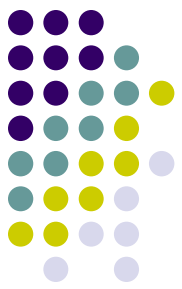


- Farmers are aware of the importance of landraces and the need for based agricultural biodiversity, but their principal goal is economic, agricultural security for them and their family, not the conservation of genetic diversity.
- They are directly responsible with selection of seeds for seeding in the following years.
- The farmers is actively undertaking the conservation, because they makes decisions in a complex socio - economic and cultural environment.
- Thus, landraces continue to evolve, influenced by natural selection as well as by selection pressures imposed by the farmers, and providing opportunities for continuous crop adaptation and improvement.

# How the farmers make selection of seeds?



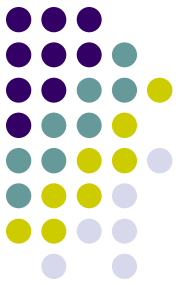
- Each season the farmers keep a proportion of harvested seed for resowing in the following year. The farmer selects from current crop a sample on the basis of phenotypic characteristics to act as seed for the following year, in other words the farmer makes a conscious decision about which sample to retain for seed.
- The factors that influence the choice of seed sample include:
  - yield
  - quality
  - disease
  - pest resistance.
- The farmers selections of seed for planting in the following year are likely to be directed toward favour characteristics that enhance the crop's production in the local environment where the farmer lives or even for different field within the farm or production for different markets. (Jarvis, 2000) - for example a farmer may have different landraces for home consumption or for market sale.
- Thus, the landrace will have been selected by the local farmers and/or nature to be highly adapted to the local environment, to contain geographically specific and utilisation potential.



## The role of woman in biodiversity administration

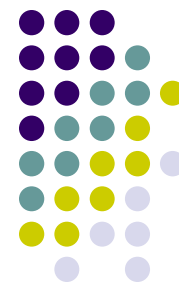
- Involving woman in biodiversity administration (maintaining, multiplication and selection of plant genetic resources) is a reality in Romania.
- In rural areas, the women are responsible by keeping of genetic resources for covering their needs. Majority of them cultivate legumes and a part of cereals for family consumption or other intentions (sale, barter).
- The directly and essential relation between women and plant genetic resources result from their identity, their roles and responsibilities created by society in household, in communities and ecosystems.
- The women represent an important percentage of the working hand in agriculture, because they utilize landraces for their families good and of communities in which live.
- All strategies for protecting biodiversity must consider the role of woman in community as administrator, consumer and protector of biodiversity.

# Protecting the use of landraces



- fragmentation of farm holdings
- stimulation of the farmers to ensure sustainable conservation of the landraces within the agricultural system
- improving the conditions in which the traditional farmers can maintain genetic diversity in landraces within the traditional production systems
- advising the farmers on which landraces to sow or which seed to keep for seeding the following year
- monitoring farming practices to avert threatened of farming system or significant changes in genetic diversity
- identifying any possible factors that may lead to the abandonment of landraces, constraints to the continued use of landraces.
- increasing cultivation of marginal land, where landraces tend to have an competitive advantage over modern varieties and intensive agriculture
- economic isolation
- cultural values and preferences for diversity and organic agriculture

## Promoting *on farm* conservation



For promoting the conservation of landraces in a farming system, it's important to encourage farmers to continue to select and manage local crop populations, and one method for reaching this goal is to increase the value of local and diverse crop populations to farmers who might otherwise stop growing them.

# A methodology for *in situ* - *on farm* conservation of plant genetic resources



## Objectives

- to set *on farm* conservation within the context of plant genetic resources conservation as a whole
- to introduce a possible generalised model for the conservation of genetic diversity *on farm*
- to promote debates around the science of *on farm* conservation.

The conservation of plant diversity is of critical importance, because of:

- the direct benefits to humanity that can arise from its exploitation in improved agricultural and horticultural crops
- the potential for development of new products
- the fundamental role played by plants in the functioning of all natural ecosystems.

# A generally model for a modern *on farm* conservation (proposed by Nigel Maxted, 1997)

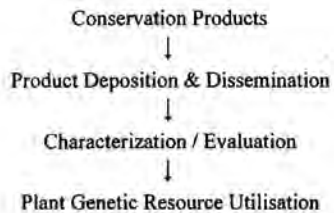
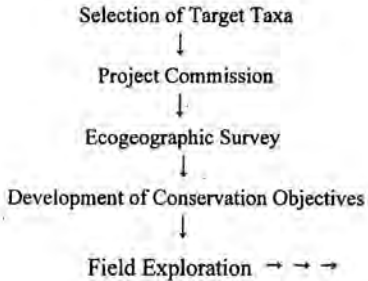
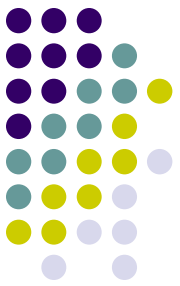


Figure 1. Proposed model of on-farm plant genetic conservation.

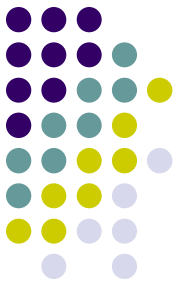
- On farm* conservation is divided into three phases:
- project planning and establishment
  - project management and monitoring
  - *on farm* utilisation of diversity.

# 1. Project planning and establishment



- selection of sites, communities and farmers where the conservation activities could most effectively be implemented
- ensuring of the maximum possible range of genetic diversity of the target crops managed by farmers within their farming systems
- achieving of information on the amount and structure of genetic variation, breeding system, eco - geographic distribution of the target species
- it's important to understand farmer needs (which may vary considerably among communities) and how it impacts their management of genetic diversity
- identifying regions where both collecting for *ex situ* conservation and *on farm* conservation activities could usefully be initiated and where target crops are diverse and abundant. It must be combined in these areas some tasks:
  - ✓ a high levels of genetic diversity
  - ✓ interest the user community in the specific genetic diversity
  - ✓ lack of previous conservation activities
  - ✓ threat of genetic erosion
- it's necessary to identify local people (farmers) which have a tradition of active experimentation and manipulation of genetic diversity, to interact with most of them in a small community. Rural communities are not homogeneous and the selection of farmers depend on a number of factors, the relative importance of which will vary from place to place. Some of these factors include:
  - ✓ genetic diversity
  - ✓ age
  - ✓ gender
  - ✓ wealth
  - ✓ social status
  - ✓ ethnicity

## 2. *On farm* management and monitoring

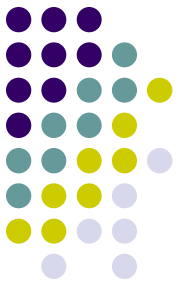


The actual content of an *on farm* management plan can vary depending on the location, target crops, local community, staff that are involved, resource availability but is important to include some tasks:

- a statement of the *on farm* project in the context of an conservation strategy
- the results of the eco - geographic survey and diversity survey, including a list of specific potential sites
- specific target crops
- genetic description of the landraces present at the target sites (mapping of landraces distribution and density within the site, details of farmers management practice, relationship with other crops in the cultivation system, genetic diversity)
- the results of the preliminary socio - economic survey of the potential sites, including a list of possible partners (farmers)
- a preliminary assessment of the potential threats (genetic erosion) and potential causes of it
- training and research
- a strategy for monitoring both the potential cause of genetic erosion and the effects of some interventions on genetic diversity
- a strategy for use of conserved genetic diversity.

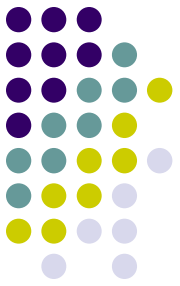
It's important that management and monitoring of these resources *on farm* in the framework of traditional farming systems to develop with the participating of local communities (that allow the maintenance and evolution of traditional landraces) and to answer of the following questions:



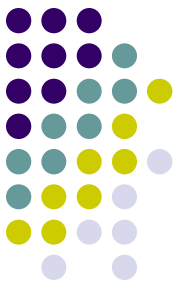


- Where samples will be taken? (which villages, which agro ecological areas)?
- How many samples will be taken?
- How samples will be taken?
- When the samples will be taken (at sowing, at harvest, after selection or a combination of these)?
- How frequently will be taken the samples (every year)?
- What characters will be assessed?
- How will the data be analyzed?
- What are the farmers practices (seed selection strategy, area sown, cultivation practice, disease and pest control)?

### 3. *On farm* utilization of diversity



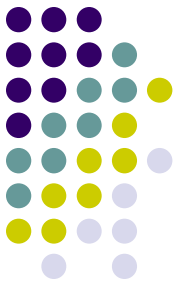
- There is a linkage between genetic conservation and utilization.
- Conservation of genetic resources must facilitate their use, either immediately or in the future.
- Utilization of genetic material conserved *on farm* may be classified as:
  - ✓ traditional
  - ✓ general
  - ✓ professional.
- The direct users of the germplasm conserved *on farm* will be the farmers who have traditionally developed, managed and exchanged landraces.
- The storage of material from *on farm* sites in an *ex situ* facility will mean that it will be more easily available to other users. It also means that it would be possible to reintroduce it to the community which originally developed it and donated it, but should it be lost *on farm* for whatever reason.
- The goal should be conservation that contributes to the quality of life of the local people.



The major future needs for a sustainable *on farm* conservation

- raising awareness of the benefits of growing locally adapted landraces
- facilitating interested farmers access to planting material of landraces
- improving those characters and qualities of landraces seen by farmers and consumers as inadequate
- increasing access to markets or creating new preferential markets for landraces
- promoting agro - ecotourism
- access to local landraces and establishment of farmer's networks to promote seed exchange
- introducing indirect (enhance local services, build better roads) or direct (monetary rewards) subsidies for the cultivation of local landraces.

# References



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- *In situ* conservation of crop genetic resources through maintenance of traditional farming systems (Altieri M. A., Merrick L. C., 1987)
- A guide to effective management of germplasm collections (Engels, Visser, 2003)
- Genetic diversity and conservation in traditional farming systems (Brush, 1986)