On-farm Conservation of local durum and barley varieties in the Northern Ziz valley

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Summary. In situ conservation of local Durum wheat and barley populations in the Northern Ziz valley of Morocco is conceivable through several complementary actions as the improvement of production techniques, based on availability and quality of seed, storage conditions of the production, agricultural practices adapted to local condition, improvement of the local populations through the participatory approach, implementation of local product processing units and local laws of seed production, trade and norms.

Key words: Local, Durum wheat, Barley, In situ conservation, Participatory, Ziz valley

Introduction

Genetic resources conservation methods are relatively developed in gene banks (ex situ conservation) (Bommer, 1991). Recently, more attention has been given to the need of in situ conservation techniques (Altieri and Merrick, 1987; Cohen et al., 1991; Cooper et al., 1992; FAO, 1989; Keystone Centre, 1991; Montecinos and Altieri, 1991). Oldfield and Alcorn described in situ conservation as the conservation of evolution and adaptation processes of crops in their environment. Brush and Merg (1998) noted that the objective of the in situ conservation is not to preserve a given number of alleles or genotypes but to maintain an agricultural system that generates diversity in a similar way that of traditional systems. However, Lande and Barrowclough (1990) recall that a prerequisite for such process is the existence of genetic variability. On farm conservation of genetic resources is considered to be the “management of genetic diversity of locally improved populations in their own traditional agricultural systems of different crops”. The key trait of on farm conservation is the traditional knowledge of local agricultural practices (Engels and Woods, 1999).

In the North Ziz valley of Morocco (Rich and Imilchil), local barley and durum wheat are cultivated in an extensive production system in which the farmers produce their own seeds from one season to the next. Traits such as shape, colour, grain size, plant height, yield and taste are kept as to satisfy the farmer and the consumer. Consequently, in the long term, farmers tend to modify the genetic composition of the plant populations in accordance to their needs and these populations would acquire specific traits of adaptation to the local conditions (drought tolerance, resistance or tolerance to diseases, cold and salt). Loss of the mentioned variability implies the loss of certain evolution traits. In case of the modification of growth conditions, the population would be lost.

This work was carried out within the frame of the project entitled “Strengthening the scientific basis of in situ conservation of agricultural biodiversity: Moroccan Component, IPGRI/INRA/IAV”. Three components were concerned: Barley and durum wheat as self pollinated species, Alfalfa, a cross pollinating crop and Faba bean as intermediary pollinating crop. Three sites were chosen depending on the agro-ecological classification: Taounate, Azilal
and Rich (Sadiki et al., 2002), with the contribution of development agencies, local NGO’s and farmers of the mentioned areas.

Four main investigation themes were taken into account to support farmers and local communities in the on-farm conservation process:

- What is the extent and distribution of genetic diversity maintained by farmers in time and space?
- What are the procedures in the on-farm conservation of genetic diversity?
- Who is in charge of genetic conservation in the farm (men, women, young, elders, ethnical groups)?
- What factors are affecting farmer decision to maintain local populations (market, social and environment factors)?

These issues were addressed to identify a strategy of in-situ conservation. The present document summarizes preliminary results for barley and durum wheat in the north Ziz valley. An approach of in-situ conservation is also presented.

**Methodology approach**

**a. Description of the high Ziz valley**

The high Ziz valley is located upstream of the Ziz river, north side of the Central High Atlas mountains, covering about 24,000 hectares. The altitude varies from 1400m (Rich) to 2200 m (Imilchil). Cropped land is mainly at the sides of water streams, with generally medium fertility. The weather is of mountain type characterized by cold winter and an average of 40 days frost risk per year. High temperatures are about 22°C at Imilchil and over 30°C at Rich. Rainfall varies from 150mm at Rich to 500mm at Imilchil. Acreage of 2300 ha to 3700 ha is annually cropped to durum wheat and barley in irrigated small plots (anonymous, 1997).

**b. Surveys and sample collection**

Fields of barley and durum wheat populations were surveyed at maturity. The objective was to detect the maximum number of alleles, including those at low frequencies in a given population. The sample size was determined in a way to permit a high probability of sampling a copy of each allele among the rare ones (Marshall and Brown, 1975; Lawrence and al., 1995).

**c. Characterization of cultivated populations**

Characterization was based on two main types of trials: on-farm trials and tests under controlled conditions or in experiment stations. Measured traits consisted of criteria used by farmers and other agronomic, morphological and molecular characters. Traits used by farmers are criteria of differentiation or appreciation of local varieties originating from investigations related to local seed and knowledge.

**d. Seed production survey**

The investigation was carried out to draw information on the following aspects:
• farm structure: family composition, land, herds and beats resources;
• technical practices;
• Farmer knowledge in terms of production, selection and seed storage through analysis of ancient and recent practices;-Analysis of seed movement through the identification of providers and circuits.

e. **Field days and training for technicians and extension agents**

Field days were organized for farmers and consisted of introduction to seed definition, production techniques, fertilizing, seed processing and storage of the production. Training courses for local technicians and extension agents were held and covered topics such as local varieties, genetic resources conservation, organization, management and collecting of data related to local level.

**Results**

**a. Land use and agricultural systems**

**Crops**

Cereals cover about 50% of the cropped land each year in the Ziz valley (Table1). At Imilchil, durum wheat is the main crop followed by barley and bread wheat. However, barley is of lower importance in the Rich area. Alfalfa is the main forage crop in the area. Other crops, mainly potatoes and onions are also present (Anonymous, 1977).

Continuous cereal cropping is very common, mainly in the Imilchil area, and this led to disease problems. Seed and soil transmitted diseases (Fusarium, smuts and bunts) cause damage during emergence and yield is reduced. Farmers tend to increase seed rate to overcome the problem.

Table 1: Cropping pattern in Ziz north valley (Birouk, 2003; Saidi, 2003)

<table>
<thead>
<tr>
<th>Crops</th>
<th>% contribution to the arable land in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rich</td>
</tr>
<tr>
<td>Cereals</td>
<td>59</td>
</tr>
<tr>
<td>Lucerne</td>
<td>25</td>
</tr>
<tr>
<td>Vegetables</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

**Production systems**

In the whole area, farmers practice a small scale subsistence cropping system (Table2), sustained by other activities outside the farm. 35% of farmers have an income from activities other than farming (Nassif, 1999).
Table 2: Proportion of different farm sizes (Nassif, 2002; Birouk et al., 2003)

<table>
<thead>
<tr>
<th>Farm size in ha</th>
<th>Proportion in %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rich</td>
</tr>
<tr>
<td>0.07 - 0.99</td>
<td>51</td>
</tr>
<tr>
<td>1 - 2</td>
<td>34</td>
</tr>
<tr>
<td>&gt; 2</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

b. Quantification of barley and durum wheat population diversity

Naming system of local varieties

A local variety designates an entity associated to concepts, perception and practices of farmers. It is defined as a unit of large diversity, selected on the basis of criteria that maintain its identity. It is designated by a name or a description that corresponds to an identifiable plant type. This is true for durum wheat but not always for barley. In fact, for the latter, the generic naming relates to the area or territory of use.

Cropped varieties

Durum wheat. Local durum wheat is used from three variety populations or farmer diversity units (FDU). The oldest one is named 'Irks', meaning slender spike (4 rows) in local terminology. This type is known for its large adaptation in the Imilchil area. It is characterized by a white coloured small head, small size kernels and a plant height of 80-145 cm. It is also known for its resistance to yellow rust, a good level of resistance or tolerance to Fusarium and resistant to cold injury. This variety is mainly used to make bread known as 'tahtocht', baked beneath ashes and has the capability or storing humidity which makes the bread able to keep a longer period of storage. However, this variety is not of good baking quality (Table 3).

Tableau 3: Level of discriminating characters of local varieties of durum wheat cropped in the Ziz north valley (Saidi, 2003)

<table>
<thead>
<tr>
<th>Caractère</th>
<th>Irks</th>
<th>Aberioum</th>
<th>Irdene de Tialaline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought tolerance</td>
<td>+++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Cold resistance</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lodging resistance</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Yellow rust resistance</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Fusarium tolerance</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Straw production</td>
<td>+</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Straw quality</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Baking quality</td>
<td>+</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Specific weight of 10 litres</td>
<td>15 kg</td>
<td>16 kg</td>
<td>16 kg</td>
</tr>
<tr>
<td>Yield (q/ha)</td>
<td>20</td>
<td>26</td>
<td>30</td>
</tr>
</tbody>
</table>

The variety name 'Abrioun' or 'Ifr ou morgh' means locust's wing, because of the black awns that resemble the nervures of the insect's wing. This variety, originating from Aghbala region, has a white small spike, a plump and white grain. It is of good baking quality. Data show that tentative of introduction of this variety in the area date back to the 50's, years during which cold
winters prevailed and did not permit its adaptation to the area. During the 70’s, the variety Abrioun could be used with success. Farmers would use seed from Aghbala and carry it for 5 or 6 years before renewal when it degenerates and loses its baking quality.

The variety known in Tialaline region of Rich is named 'Irdene N'talaline', durum of Tialaline. This variety comes into two forms: 'Tabarant' (black awns) and 'Toumlilt' (white awns). The awn colour is the trait that is used to distinguish the two forms, though they are originating from the same population that is known and largely used in the area for its large grain and baking quality (Taghouti et al., 2002), adding to that the high yield in grain and straw.

Barley. Barley covers 27% of the cropped area at Imilchil but is almost absent in the Rich area. Mainly local six row type varieties are used, characterized by long awns, white small kernels. Protein content is between 11% and 15% and germination at harvest about 95%. Plant height is between 90 and 110cm. Days to flowering is from 120 to 150 days, the longest cycle in the barley populations of Morocco. Seed is provided from the farm regardless of the production level (Saidi, 2003; 2004). Each farmer uses his own seed and the barley population cropped under the same conditions for several years becomes specific to that farmer, thus assimilated to a FDU. Some farmers would keep seed stocks for a minimum of 6 years and are considered as diversity holders.

c. Seed source and seed movement

Three classes of farmers were identified in terms of barley and durum seed availability. The first group would continuously keep seed from the production of all their fields. The second group uses its own seed except in successive years of drought. The third group uses seeds produced by the former two groups except in good years where they use their own seed.

Seed movement depends on the level of production in a given year and type of farmers. In good years all farmers use their own seed, no seed movement is taking place. In average years, 40% of farmers buy seed from neighbours or at the market place, this last source is preferred by the 35% of farmers. In low production years, small and medium farm holders are obliged to get seed from other sources than their own. In the other hand, depreciation of seed (disease, weed seed) is one reason to acquire seed from other sources (Saidi, 2003; 2004).

Storage facilities are precarious. Survey data show that storage in bags is very common practice (58% of surveyed farms) and some 15% use wooden cases. These techniques do not allow adequate seed treatment.

d. In situ conservation approaches

In situ conservation of local populations is possible through four main actions:

• Improvement of production and storage techniques

Seed transmitted diseases, storage insects and maintenance of storage facilities were discussed with farmers on several training sessions. A guide in Arabic language was edited for large diffusion.

The effect of seed treatment was noted on the good emergence and crop stand. Seed transmitted diseases (Fusarium, smuts and bunts) were absent from plots where seed was treated with appropriate chemicals. Availability of equipment for this purpose contributed to the success of the operation. Additional sets of seed treatment equipment were provided for a larger number use of the technique.
Some farmers proceeded to the cleaning of seed and the application of pesticides to storage facilities. This permitted the control of storage pests, consequently, this improved the period of storage.

Improvement of local populations on farm and by farmers was adopted. This was done by rearrangement of local population composition using lower number of performing lines. Seed of these lines will be increased in large amounts and will be dispatched to farmers. This procedure will allow yield increase using material already adopted by farmers and, at the same time, keep a good level of diversity. This strategy is being integrated to the National Breeding Program.

**Production and use improvement**

Implementation of local processing units (semolina, whole bread making...) will contribute to production improvement. Attribution of a product label will permit a more efficient selling process.

**Organizational approach**

The success of such project relies on the creation of farmer organizations and cooperatives in order to reduce the cost of inputs.

**Legislation approach**

A local seed legislation setting (organization, norms, repartition) and trade of local products, including quality norms, must accompany the realization of the mentioned actions. This will permit integration of in situ conservation in the agricultural development of the country.

Références bibliographiques


