'Israel – Palestine Seed Conservancy'

Project 4196 – Year 1 Annual Report, 2008

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in cooperation with
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1. Goals

Our goal is to foster regional cooperation for the conservation of agro-biodiversity and indigenous knowledge of wild and cultivated food plants – focusing on landrace wheat, with market-based initiatives for genetic conservation to benefit small-scale farmers. Biodiversity is not contained by political boundaries, thus it provides an ecological bridge for regional cooperation for landrace seed conservation.

2. Objectives

A. Conduct **conference and workshops** to bring together regional researchers and farmers for the conservation, sustainable management and use of landrace wheat genetic resources.
B. **Collect, conserve and document** the indigenous wheat varieties and traditional knowledge of their cultivation and uses.
C. Establish a model **in-situ conservation farm** to maintain, select and process landrace populations, with trainings, on-farm field days and pilot **market initiatives** to increase income and nutrition for small-scale farmers.

3. Introduction and Problem

The landrace[1] wheats of the southern Fertile Crescent are critically threatened due to replacement by modern cultivars, with 90% of local wheat demand filled from imported, subsidized modern wheats. Modern wheat is bred for genetic uniformity and yield in high input industrial farming systems. The narrow genetic base of modern cultivars has resulted in vulnerability to disease and a loss of characteristics sought by organic and low-input farmers, such as adaptability to rainfed systems and tolerance to typical fluctuating extremes of drought and heat in the southern Fertile Crescent. The lands of Israel, Palestine and Jordan, in the southern arch of the Fertile Crescent, are the center of origin for landrace wheats that have evolved exceptional disease resistances and genetic diversity, with important varieties dating back to biblical times. Due to broad-scale replacement by modern cultivars, the very landrace wheats that have evolved these desirable traits are threatened – *some on the verge of extinction.* A team of Palestinian and Israeli seed curators and organic and low-input farmers have come together to pool resources for regional genetic conservation of shared agro-biodiversity.

[1] A 'landrace' refers to a population that has evolved over generations of natural and human selection to be well adapted to local conditions. Landrace populations represent the genetic variability and diversity range found in their centers of origin. Wide genepools of landraces evolved survival mechanisms to produce stable yields in low-input fields, and harbor broad genetic diversity and buffering capacity.

4. Methodology for Conservation

a. Conduct a conference and workshops to bring together regional researchers and farmers for the conservation, sustainable management and use of landrace wheat genetic resources.

4.1 Mechanisms for Cooperation

A. Team Planning (March, 2007 – November, 2007):

Biodiversity and Environmental Research Center (BERC):

'The collaboration with the Israeli group started with a kick-off meeting in Jerusalem in March, 2007 (Appendix 6.1). In the meeting we discussed how best to implement the joint project to achieve its set goals. During the first stage period our efforts were focused on the collection of landrace wheat germplasm cultivated in the West Bank and documenting the traditional knowledge of their cultivation and uses.'

Israel Gene Bank (IGB) and Heritage Wheat Conservancy (HWC)

Our cooperation was initiated with a planning meeting in March, 2007 at the American Colony Hotel in Jerusalem. The complementary roles of each partner were discussed. All agreed on the critical genetic erosion of our shared landraces. Since Israel today has minimal cultivation of landrace wheats, except in isolated pockets in the Galilee and the Negev, Israel's initial contribution was agreed to be the repatriation repository of landrace wheats collected early last century, and currently stored in the USDA gene bank, with local collection as feasible. Following the meeting, IGB and HWC conducted collection missions and multiplied landraces that were collected and repatriated. In addition, landraces were collected in West Bank villages of Wadi Fukin and Tekoa near Jerusalem, in the Galilee and the Negev. Rare landraces from Ethiopian-Jewish markets in Jerusalem were collected that include: purple wheat and emmer. Einkorn was found to be grown by Druze in the Golan.

Joint collection protocols were developed to document cultural practices and indigenous knowledge. Coordination of joint collection protocols was the first step in cooperation.

Evaluation

All cooperators agreed that parameters to evaluate will be based on IPGRI descriptors that include: disease resistances (fusarium head blight, leaf rust), height, days to maturity, soil itrogen, rainfall, yield (grain weight per plant, 1000 kernel weight), baking quality (flour protein and flavor), and traditional and commercial uses.

B. Conference with Seed Exchange - Nov. 29, 2007 (Conference proceeding appendix 6.2)

A conference and germplasm exchange was conducted at IGB to bring together regional scientists, agriculture extension and traditional farmers to develop a team-based workplan to collect, conserve and improve threatened Mideast landraces, establish core collections at

IGB and BERC and an in-situ conservation farm, and to develop a database and an on-line '*Guide for the Conservation of Landrace Wheat in the Southern Fertile Crescent*'.

In the first half of the day, a public conference was held for all partners, international observers and farmers. Presentation were given by: Dr. Rivka Hadas, IGB, Dr. Abdullah Jaradat; ARS-USDA, Dr. Munquez Shtayah; BERC, Dr Hussein Migdadi and Dr. Adnan Yassin; NCARE, Jordan, Dr. Dominique Declaux and Yuna Chiffaleau; INRA Genebank, France and Eli Rogosa; HWC and IPSC coordinator, Israel. The in-situ conservation farmer-partners: Chaym and Petra Feldman, Havah ve'Adam Farm and Palestinian farmers Nazee Shalabi, Mas'ha (near Kfar Kassem), Ahmad Awad, Budrus (near Modiin-Ilit), Abd-el-Fatach Burnat Bil'in generously contributed landrace wheat seed from their villages.

HWC displayed wheat sheaves of the ancient varieties found at Masada: Hourani and Jaljuli, and other representative indigenous varieties. The presentations were simultaneously translated for the Palestinian farmers by Chaym Feldman and summarized in Arabic by Dr. Munquez Shtaya. The Havah farmers served a delicious organic buffet of baladi traditional cuisine. Artisan emmer bread was baked by baker Yiftah Baraket.

Following the public event, a closed team planning meeting was conducted. A report on the first phase was presented. The urgency of collection was agreed by all. Outcomes of the team meeting include:

1. Collection missions by all partners
2. Trials to evaluate our landraces
3. Development of a regional on-line database of the results of the trials
4. Establishment of an in-situ conservation farm and a community seedbank, with pilot market strategies for conservation to benefit traditional farmers.

At the conference, IGB distributed the following samples contributed by the farmers and grown from the USDA collection to all partners for co-evaluation:

1. Horani (USDA PI234382)
2. Jaljuli (USDA PI2231585-5)
3. Nursit (USDA PI 12818)
4. Tekoa, 2007
5. 'Debea', Wadi-Fukin, 2007
6. 'Fesha', Bilin
7. 'Souri', Bilin

(Photographs appendix 6.4)

BERC sent IGB thirty landraces samples of an average of 22 grams each for co-evaluation by all partners. The Jordan Genebank/NCARE participants contributed rare Hourani seeds that were distributed to IGB, the Havah and the Wadi Fukin farmers to multiply.

Highlights, photo-documentation and proceedings of our ground-breaking conference are posted on: **growseed.org/wheat.html**

The evening before the conference, IGB hosted a 'welcome dinner' at a restaurant in Jerusalem. After the conference HWC hosted a delicious dinner prepared by Chef Moshe Basson, Israel's renowned expert on ancient Israeli foods. Informal discussions continued all evening. The following day, researchers from France visited the Wadi Fukim traditional fields and interviewed the in-situ conservation farmers with Eli.

International Cooperation for In-Situ Conservation

Eli Rogosa was invited by the INRA French Genebank participants to their genebank and to conduct field research with their in-situ conservation farmer-partners. She also conducted field research with the Greek genebank at their in-situ conservation project <aegilops.gr>, and will be hosted by the Hungarian Cereal Genebank for collaborative in-situ conservation this coming winter with funding from the USDA.

C. Community Seed-Saving Trainings

A community seed-saving initiative has been organized by HWC and Havah ve'Adam. At the first workshop about 100 Arab and Jewish farmers and gardeners participated. Lead seed-savers presented workshops. Dr. Tova Dickstin of Neot Kedumin conducted a workshop on ancient Israeli traditional food and farming practices with a walking tour of edible wild plants. Eli conducted a hands-on training in seed-saving technical methods. Indigenous (baladi) and heirloom seeds were exchanged. The group plans to develop 'training kits' with rare indigenous seed and instructional materials that will be sold to support in-situ conservation activities.

4.2 Implementation

Collect and conserve the indigenous wheat varieties and traditional knowledge of their uses, that will establish partnering biodiversity in-situ conservation farms and seedbanks.

Rationale

Maintenance of landrace wheat in ex-situ genebanks is essential for long-term preservation, however it freezes the evolutionary process of landrace populations. On-farm conservation allows for the dynamic co-evolution of indigenous varieties with local pests, predators and pathogen complexes and to climate changes. Due to decline in utilization of landraces, remaining populations today suffer from a narrowing of their genetic base and geneflows Maintenance of landrace genepools through in-situ conservation is best accomplished under the typical conditions of traditional fields where they evolved. Just as wild crops are genetic resources that cannot be contained in ex-situ facilities, ecological relationships such

as gene flows between populations, natural adaptation to the environment and farmer selection are intrinsic components of a landrace crop's total evolutionary system

A. Collection and Documentation of Traditional Practices

BERC collected samples of landrace wheat (30 accessions) that were planted and evaluated at their farm in Till, Nablus. These seeds were exchanged with IGB in January, 2008, multiplied and evaluated at IGB and the Havah.

HWC conducted extensive collection and documentation missions in the Galil, the Negev and in Palestinian villages in the central West Bank. HWC interviewed the traditional farmers and documented their cultivation practices. Every traditional farmer that was visited planted mixtures of landrace populations that formed a resilient polyculture. It would be necessary to collect hundreds of seedheads to obtain a full representative sample of the biodiversity in a single field. The traditional farmers' methods of crop selection enhanced the landrace wheats biodiversity. Wild wheats were found growing in the wheat field edges in the Galilee, contributing over millennia a 3-5% geneflow of wild resilience into the ancient landraces! The farmers' criteria for selection of complex traits include: flavor, health, maturation and large seeds. It was reported by BERC that often the elder grandmother was brought to the field to select the grain for replanting next season.

Repatriation: IGB and the Havah regenerated 30 USDA seed samples that were collected in Israel from 1913 to late 1940s. These seed were stored in the USDA genebank, since there was no state of Israel at the period during their collection.

B. Multiplication and Trials

Trials were conducted at the Israel Genebank and at BERC, Til-Nablus with landrace varieties[2] under typical rainfed irrigation and fertilization management, planted in replicated blocks, each plant spaced 12 cm apart each. The Havah Farm planted in the typical traditional manner, and is maintaining a small seedbank of its harvest for replanting in fall, 2008. IGB harvested between 500 to 3,500 additional seeds from each sample, recorded yield data and photo-documented each sample. BERC and IGB evaluated the samples using the guidelines of IPGRI descriptors. The results of the evaluation trials are presented in the attached charts for data of the trial results. (See trail data on appendix 6.3)

C. In-Situ Conservation

In order to maintain agrobiodiversity within the dynamic farming systems where landrace wheats evolved, two partnering in-situ conservation farms were established at the Havah and at Wadi Fukin near Bethlehem. The lead farmers visited each others' farms, exchanged seeds and discussed their mutual challenges to maintain landrace varieties in face of the cheaper imported wheats that flood the market. The Wadi Fukin farmers supply organic

baladi vegetables to Israelis in the adjacent town of Tsur Hadassah. HWC met with the key participants in the local market initiative. All were excited to work together to conserve baladi vegetables and wheats through a market initiative. All the farmers agree that the foundation of conservation is to maintain their local varieties in their communities, and to develop public awareness and most importantly - local market demand. All farmers interviewed lack technical and financial support and struggle to conserve their landraces.

5. Discussion and Recommendations

'The main challenges of on-farm conservation of wheat landraces in the Fertile Crescent are non-biological, but involve a complex of ethno-anthropological processes, including legal, economic and social factors, superimposed on ecological and genetic processes.' A. A. Jaradat, [3]

Discussion

Importance of Conserving Threatened Landrace Wheats

Modern wheats have been bred so successfully for high input agrochemical systems that they have lost key characteristics important for low input, organic production and for adaptability.[4] Modern wheat cultivars are bred in conventional fields with synthetic chemicals and controlled irrigation. Economies of scale enable industrial-bred wheat to be produced cheaply and yield well in favorable conditions, but they are not adapted to the low-input conditions of traditional farmers' fields. Genetic uniformity lacks adaptability to unprecedented climate change. Modern uniform wheats are a disaster waiting to happen in the face of unpredictable climate extremes, whereas ancient wheats have evolved in the natural climate extremes of the southern Fertile Crescent and bear urgently needed traits for survival in adverse field conditions. Breeding for organic systems and for climate change is grounded in the genetic variation of the landraces' natural adaptations and mutations. A comprehensive knowledge of the genotypic inventory of a landrace population combined with the performance of genotypes under typical stresses will provide vital information for the conservation and improvement of landraces, and for utilization in breeding programs.

The Ecological Function of Traditional Wheat Polycultures

Traditional farmers do not grow one pedigree variety, but grow mixed landrace populations with highly diverse genepools, allowing nature and farmers to work together to evolve the best locally-adapted variety. Current research[5] confirms that wheat varietal mixtures tend to yield higher and better resist diseases and pest pressures. Biodiversity is the farmer's best security against disease, fluctuating markets and climate change.

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[3] A. A. Jaradat. Biodiversity and Sustainable Agriculture in the Fertile Crescent, Princeton University Press, 1999
[4] Wolfe, Martin, Composite Crossing to Enhance Genetic Variability, <cost860.dk> SUSVAR 2004
[5] Effect of Intercropping and Cultivar Mixtures on Organic Wheat Production Jacqueline Claire Pridham, Martin Entz, University of Manitoba,<organicagcentre.ca/ResearchDatabase/res_mixtures_wheat.asp>

Protecting Farmers Rights and Role in Wheat Conservation

Seed-saving and adaptive selection has been the right and responsibility of farmers and gardeners since the emergence of agriculture. Farmers are the original wheat breeders, inspecting their wheat plants day by day, tasting grain in the field, selecting plants for the traits best-adapted to their farm conditions. However in today's southern Fertile Crescent, in Israel and the West Bank, 90% of the wheat is imported from US mega-farms, the local seed system is fragmented and critically threatened.

Activity Summary – Year One Outputs:

a. Structures and relationships for long-term cooperation between researchers and traditional farmers in Israel and Palestine, with international cooperation of in-situ wheat conservation initiatives through the French, Greek and Hungarian genebanks.[6]

b. Parallel landrace wheat collections in BERC and IGB, with a database of trial results, and documentation of the traditional cultivation practice of wheat polyculture, and traditional baking methods.

c. Two cooperating in-situ conservation farms of the Havah in Modin and Wadi Fukin in the West Bank, with partnering farmers who visit each others' farmers and exchange seed and knowledge, facing shared challenged together.

d. A community seed-saving program with workshops and seed exchanges has been conducted by the Heritage Wheat Conservancy. Increase Israeli public awareness, as documented by attendance at the Havah seed-saving workshops that involved over 100 farmers and gardeners with planned follow-up for educational materials that include a color poster of landrace wheat and a seed-saving kit. Link: growseed.org/ancient.pdf

e. A project webpage: growseed.org/wheat.html

Anticipated Activities - Year Two

a. A conference with a field day is planned to bring together partners to exchange knowledge and seed, and to present their year two activities, and to highlight the work of the participating farmers.

b. Trials in Israel and Palestine will continue to multiply their landrace wheat collection, and compare the drought tolerance and disease resistance as related to yield and flour protein, to build our understanding of the traits that contribute to productivity in low-input environments.

c. In-situ conservation farmers will continue to collect and grow landrace wheats. We plan

[6] INTERNATIONAL COOPERATORS: Dr. Dominique Declaux - INRA France, Dr. Kostas Koutas <aegilops.gr> - Greece, Dr. Geza Kovacs, Director, Hungarian Cereal Genebank

to expand to involve other traditional farmers. We will develop an on-line 'Guide to Landrace Wheats in the Southern Fertile Crescent' and a supporting 'Seed-Saving Kit' containing indigenous seed and instructional materials to disseminate the program and generate funds for in-situ conservation.

d. Baking Trials and Product Development: The genetic capacity of a wheat landrace to accumulate protein is a primary factor for end-use, for the flour markets and for contributing genes for nutritional value to modern wheat. A baked crispy flatbread and other products using landrace wheat, emmer and einkorn will be developed as a market-based initiative for genetic conservation.

Recommendations

We are in a race against time. The landraces are decreasing season by season, as globalized wheat systems overshadow our fragile community seed systems. Israel and Palestine's wheats are on the verge of extinction.

a. We recommend that an interdisciplinary team coordinate the program; expanding to address sustainable economic development and artisan baker-markets. There needs to be multi-sectoral coordination to support ex-situ and in-situ conservation with the development of market initiatives that foster genetic conservation, through value-added niche market products that benefit the traditional farmers. We are not alone in our efforts, and would benefit by involving the international wheat conservation community, who has reached out to us.

b. We recommend that the on-line 'Guide to Wheat Landraces in the Fertile Crescent' have a supporting 'seed conservation kit' containing landrace seed and instructional materials in Arabic, Hebrew and English. The on-line guide will be downloadable for free. The 'kit' with practical seed-saving instructions will be designed for farmers and gardeners to foster a community seed-saving network. Small amounts of seed will be provided in the kits that have been evaluated to be highest yielding, most drought hardy, healthiest or have superior baking quality and flavor.

c. We recommend to increase the technical support for and involvement of farmers, and implement pilot market initiatives to increase nutrition and income of farmers and their families. This will be achieved by conducting field workshops with seed exchanges that involve women farmer-bakers. Farmers today need farmer-to-farmer support systems and technical extension support to enhance the conservation and improvement of landraces. Women, who do much of the practical work of seed-saving in traditional farms, are a neglected population and often do not participate in field days. The involvement of the women will strengthen the seed conservation success.

Conserving and increasing the diversity of foodcrop varieties not only can improve the livelihoods of farmers and gardeners at the local level, but is a key link for robust local food and farming systems for a planet facing unprecedented climate change and population pressures. If the traditional farmers thrive, the landraces will thrive.