Introduction

Our goal is to enhance the ecological dynamics within the soil, plant and human systems, by adapting age-old traditions of husbandry and selective seed-saving to evolve resilient community seed systems in the face of unprecedented climate change and globalization.

Introduction

For the past 8,000 farmers have selected landrace seed, generation by generation, developing the wheats that nourished earlier peoples. However recently, genetic management has shifted to the hands of industrial breeders, but with hidden costs. Modern wheat has evolved through a genetic bottleneck of breeding for uniformity and high yield, designed for ease of harvest with goliath combines, dwarfed to not lodge under agrochemicals, and dependent on chemical protectants to survive. In contrast, landrace wheats evolved in low-input fields, are genetically diverse, better adapted to organic systems, are the robust survivors of human systems, by adapting age-old traditions of husbandry and community members in exchanging knowledge, skills, breads and seeds. Each year seeds from the most robust, intelligent and disease-resistant plants were selected. Elite seeds were given to partnering farmers to multiply, select and bulk. We planted mixtures of plants with similar dates to maturity, and spacing trials. Each year new material collected from Europe was screened. A Grain Conference-Festival was held each summer to involve local bakers, educators and farmer community members in exchanging knowledge, skills, breads and seeds.

Methods

Ecological Crop Improvement

Ninety-six populations of landrace winter wheats were procured in Europe and from the USDA genebank. Genepools were screened and selected under organic management in 2008-9. Fifteen elite landraces and genepools were selected in the fall of 2009 in 4’ x 50’ plots x 3 replications, and selected over a three year period. Seeding rates were evaluated. Clover was planted to suppress weeds. Plants were scored for robustness, architecture, lodging, disease resistances, tillers per plant and seeds per tiller, protein and minerals, and more. Each year seeds from the most robust, intelligent and disease-resistant plants were selected for complex linked traits and replanted. Elite seeds were given to partnering farmers to multiply, select and bulk. We planted mixtures of plants with similar dates to maturity, and spacing trials. Each year new material collected from Europe was screened. A Grain Conference-Festival was held each summer to involve local bakers, educators and farmer community members in exchanging knowledge, skills, breads and seeds.

Landrace Wheat Breeding Trials at the University of Massachusetts

<table>
<thead>
<tr>
<th>Landrace</th>
<th>Date of Selection</th>
<th>Protein %</th>
<th>Wheat Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Einkorn</td>
<td>1888</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>Emmer</td>
<td>1888</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>Fusarium resistance is a key breeding criteria. Tested by agrinostics.com</td>
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Increasing Genetic Diversity

Increasing genetic diversity of wheat through the use of landrace populations and composite-cross genepools in combination with introgressing traits from modern wheat as appropriate, can be an effective strategy to increase yield in organic fields. Stable yields under low-input conditions tend to favor the polygenetic traits of landraces over modern pedigree varieties. Genetically diverse populations allow for adaptation through self-regulating, evolutionary systems that echo natural interactions that evolved landrace wheats, providing adaptable traits. Although farmers are the original breeders, this traditional knowledge has been almost forgotten in developed countries. Farmer-to-farmer circles, research and extension support are needed to advance on-farm selective seed-saving and breeding expertise. Increasing the diversity of wheat can not only 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 urbanization pressures.

Discussion

Landrace Terroir

Landrace wheats tend to have less gluten toxicity, richer flavor and higher nutrition. As farmers rediscover the power of selective seed-saving, new local organic-adapted landraces can emerge for artisan markets that celebrate ‘terroir’ - history of the grain, taste-of-the-land, and farmer-in-their-community.

Next Steps

The project is sustaining itself beyond SARE funding through sale of seeds, flour and artisan breads. Lead farmer seed-savers are exchanging locally-adapted landraces. The Heritage Grain Conservancy community seedbanks continuing on-farm seed-saving for evolutionary in-situ conservation of wheat landraces. We welcome cooperation – the work is vast.