Buckwheat research to diversify cropping systems – activities in Switzerland

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Introduction

Buckwheat (Fagopyrum esculentum):
- has the potential of diversifying the landscape and widening crop rotations
- is an excellent bee crop
- produces seeds that are interesting regarding the increasing demand for gluten free and healthy food
- has been replaced by arable crops with stable yield and a standardized agronomic management
- is difficult to breed due to self-incompatibility and strong dependence to environmental conditions

Objectives:
- Description of 20 buckwheat accessions in terms of agronomically interesting traits and seed quality
- Description of the inter- and intra-specific variability of quality traits
- Identification of suitable accessions for cultivation in Switzerland and implementation of a breeding program

Conclusions

- Buckwheat is mostly handled as populations. Our analysis of the phenotype and the seed quality suggest focusing on individual plants that show the desired phenotype/seed quality for buckwheat breeding. This would require further studies on heritability of certain traits and new breeding strategies.
- Russian accessions showed interesting agronomical traits but are sensitive to extreme weather conditions.
- Exploring the use of greenhouses for buckwheat breeding and research reveals difficulties regarding pollination and phenotype. However, seed quality seems to remain characteristic of accessions.

Phenotypic analysis

- Four small-plot trials with 12 accessions in four repetitions in the years 2014 and 2015; one trial under organic farming conditions
- Measured traits: soil cover, plant length at different growth stages, development of flower and maturity, grain yield and thousand kernel weight (TKW)

<table>
<thead>
<tr>
<th>Accession</th>
<th>Soil cover 21 d.a.s. (%)</th>
<th>Start flowering (d.a.s.)</th>
<th>Plant height at fullflower (cm)</th>
<th>Plant height at fullhull (cm)</th>
<th>Yield at 87 % DM (kg/ha)</th>
<th>TKW (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mehl</td>
<td>30.0</td>
<td>30.0</td>
<td>190.0</td>
<td>190.0</td>
<td>1200.0</td>
<td>28.1</td>
</tr>
<tr>
<td>Billy</td>
<td>35.2</td>
<td>35.2</td>
<td>200.0</td>
<td>200.0</td>
<td>1300.0</td>
<td>28.1</td>
</tr>
<tr>
<td>Darja</td>
<td>30.0</td>
<td>30.0</td>
<td>190.0</td>
<td>190.0</td>
<td>1200.0</td>
<td>28.1</td>
</tr>
</tbody>
</table>

Seed quality

- 20 accessions grown in the field in two consecutive years; subset of six accessions grown in the greenhouse.
- Whole (hulled) seeds of 20 individual plants per accession were milled and content of starch, total soluble protein and polyphenol compounds as well as the antioxidant activity were measured

Outlook

- Degustation trial (flour and whole grain) of the six most promising accessions.
- Testing the most promising accessions for dehulling with existing equipment.
- Genetic analysis: genotyping-by-sequencing approach on population level to genetically describe the accessions and associate the phenotypic data to its genetics.

Partners

World Food Systems Center