Breeding for the future

Merja Veteläinen
Director, Plant Breeding
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Contents

• Scope of plant breeding

• Major challenges

• Plant breeding progress

• Future outlook
Plant breeding – long term product development activity

**DEFINE GOALS**

**STUDY**
- TRAITS
- INHERITANCE

**PLAN**
- BREEDING PROJECT
- TARGET AREA

**ACT**
- CREATE VARIATION
- SELECT
- TEST

Product: Variety

10-15 years
Plant breeding in the food system
Future global challenges

1. Population growth and need for more and nutritive food

2. Climate change and decrease of arable land
   → Crop certainty needed
   → Higher yields needed from less land
   → Maintenance of soil fertility

3. Maintenance of clean environment
   → Improved nutrient use efficiency and resistance to pests and diseases needed
Local climate change challenges in the North

• Seasonal changes in temperature and moisture conditions
  • Increasing precipitation late season or/and at ripening
• Weather extremes e.g. rainstorms, drought
• Variation in over-wintering conditions
• New pests and diseases

Plant breeding progress
Increased yield – case early maturing Finnish oats

<table>
<thead>
<tr>
<th>Variety</th>
<th>Year</th>
</tr>
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<tbody>
<tr>
<td>Veli</td>
<td>1981</td>
</tr>
<tr>
<td>Aarre</td>
<td>1995</td>
</tr>
<tr>
<td>Fiia</td>
<td>2002</td>
</tr>
<tr>
<td>Akseli</td>
<td>2009</td>
</tr>
<tr>
<td>Niklas</td>
<td>2014</td>
</tr>
</tbody>
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Improved crop security with better straw and stem stiffness

Spring barley “Kaarle”

Spring turnip rape: new and old variety
Improved winter hardiness and pest resistance

Tall fescue trial with non-hardy and hardy genotypes

Screening winter wheat for snow mold
Improved end-users quality
Future outlook
Challenges and goals

• Crop diversity

• Sufficiency of **genetic variation** for traits needed to tackle the new challenges

• **Time and accuracy** required to select superior varieties

• Identifying testing environments for the **future climate**
Future crops – Nordic considerations

- Adaptation to local conditions, local food and feed systems
- Protein self-sufficiency
- Crop diversity: Economic and farming sustainability
- Financial resources of local plant breeding companies
Genetic variation is the raw material for plant breeding also in the future

... when available can be utilized through crossing

... when NOT available could be created with NBTs
Big data and intelligent data management enable the development of varieties for future conditions

Genotype

Phenotype

Environment

Modelling and Data Mining

Information systems

Decision support tools

New climate resilient varieties
Conclusions

• Plant breeding can provide solutions for the future food systems

• Plant breeding needs to be accelerated in order to provide solutions for the needs of a growing population in time

• Speedup requires availability, know-how and investments on new breeding technologies