Michael P. Malone and the International Leadership Award
Norman E. Borlaug

Born and raised on a subsistence farm

Iowa

B.S. Forestry ’38; M.S. & Ph.D. Plant Pathology ’41 & ’42

Minnesota

Rockefeller Foundation; wheat breeding achieves self-sufficiency

Mexico
Norman E. Borlaug

High yielding semi-dwarf wheats avert mass starvation in Pakistan & India

Pakistan & India

Model for International Agricultural Research

World

>4,000 trainees from 120 countries

Mexico

Nobel Peace Prize 1970

Norway
Cereal Diseases

Stem rust
Fusarium head blight
Spot blotch
Leaf rust
Net blotch
Powdery mildew
Stripe rust
Barley Yellow Dwarf Viruses
Bacterial leaf streak
Disease Resistance: Pre-breeding

- Evaluate unadapted germplasm for resistance to diseases
- Characterize & map genes for resistance
- Make selections having resistance trait

<table>
<thead>
<tr>
<th>Year</th>
<th>Generation</th>
<th>No. (locations)</th>
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<tbody>
<tr>
<td>1</td>
<td>Crossing/F&lt;sub&gt;1&lt;/sub&gt;</td>
<td>300</td>
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<tr>
<td></td>
<td>F&lt;sub&gt;2&lt;/sub&gt; (300 x 1000)</td>
<td>300,000</td>
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<tr>
<td>2</td>
<td>F&lt;sub&gt;3&lt;/sub&gt; Winter Nursery</td>
<td>20,000</td>
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<tr>
<td></td>
<td>F&lt;sub&gt;4&lt;/sub&gt; Headrows</td>
<td>20,000 (2)</td>
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<tr>
<td>3</td>
<td>F&lt;sub&gt;5&lt;/sub&gt; Scab</td>
<td>500 (2)</td>
</tr>
<tr>
<td>4</td>
<td>Winter Nursery</td>
<td>1,000</td>
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<tr>
<td></td>
<td>Prelim. yield trial</td>
<td>500 (2–3)</td>
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<td>5–6</td>
<td>Adv. yield trial</td>
<td>200 (8–10)</td>
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<td>7–9</td>
<td>MN Variety trial</td>
<td>10 (15)</td>
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Genetic Diversity
The Key to Food Security

- Wheat
- Banana
- Apple
- Maize
- Potato
- Rice
Fertile Crescent: Birthplace of Wheat, Barley & Oat

Germplasm is vital to every breeding program!

Diversity of wheat spikes

Collecting in Turkey

Vavilov genebank in Russia
Stem Rust: Wheat Destroyer

- Can *completely destroy* crops over a *wide area* in just a *few weeks*
- Annual loss: 6.2 mMT ($1.12 billion)
- African isolate virulent on >90% of wheat varieties
Countries of Origin for Scholars/Trainees Hosted

- Australia
- Brazil*
- China
- Colombia*
- Czech Republic
- Egypt
- Ethiopia
- Finland*
- Gambia
- Georgia*
- Germany
- Hungary
- India
- Iran
- Iraq
- Israel

- Italy
- Kenya
- Kyrgyzstan
- Lebanon
- Malaysia
- Norway
- Pakistan
- Peru
- Russia*
- Slovenia
- South Africa
- Sweden
- Tajikistan
- Turkey
- Ukraine*
- Uruguay

32 countries

*Minnesota Agricultural Student Training (MAST)

Visiting professorships:
- Czech Republic
- Scotland
- Israel
- England

Graduate student internships:
- Pablo Olivera: Israel
- Ben Alsop: Australia
- Matthew Haas: Germany
- Shuyi Huang: Israel
Crop Wild Relatives Short Course: April 2016
Universities: Minnesota & Tel Aviv
For the Future

- Keep innovating with fresh ideas/technologies
- Engage new students and the public
- Keep telling the success stories
- Never give up!

Borlaug among his wheat plants in Sonora, Mexico