Impacts of Climate Change on Plant Health

Ralf Lopian
Senior Advisor
Ministry of Agriculture and Forestry of Finland

12.11.2017
“There is no peace without tackling food security and eliminating hunger and there will be no food without tackling climate change.”

José Graziano da Silva, 2017
“By 2050 the world’s population will reach 9.1 billion, 34 percent higher than today. Nearly all of this population increase will occur in developing countries.”

“In order to feed this larger, more urban and richer population, food production (net of food used for biofuels) must increase by 70 percent.”

FAO, 2009

“For the major crops (wheat, rice, and maize) in tropical and temperate regions, climate change without adaptation will negatively impact production …..”

IPCC, 2014
However, many yield projections do not consider biotic factors such as climate change-induced pest, diseases and weed impacts.
The disease tetrahedron – illustrating the interactions between pathogens, hosts, environment and human

Source: A. Breukers, 2010
# Impacts of Temperature Increase on Plant Health

<table>
<thead>
<tr>
<th>Pests</th>
<th>Hosts</th>
<th>Environment</th>
<th>Humans</th>
</tr>
</thead>
<tbody>
<tr>
<td>improved winter survival</td>
<td>induced stress in/decreases susceptibility</td>
<td>change in effectiveness of nat. predators</td>
<td>extension of production period (+/-)</td>
</tr>
<tr>
<td>increased fertility</td>
<td>breakdown of resistance mechanisms</td>
<td>Imbalance of development synchrony</td>
<td>increased pesticide applications (+-)</td>
</tr>
<tr>
<td>accelerated population development</td>
<td>increased lignification of plant(+)</td>
<td>change of ecosystem may affect distribution &amp; new pest introductions</td>
<td>shifts in plant breeding (+/-)</td>
</tr>
<tr>
<td>raised virulence</td>
<td></td>
<td></td>
<td>shifting crop production ranges</td>
</tr>
<tr>
<td>better dispersal opportunities</td>
<td></td>
<td></td>
<td>increased trade of host commodities</td>
</tr>
<tr>
<td>reduced dormancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>increased growth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enlarged geographical range</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15.11.2017
## Impacts of Precipitation Increase on Plant Health

<table>
<thead>
<tr>
<th><strong>Pests</strong></th>
<th><strong>Hosts</strong></th>
<th><strong>Environment</strong></th>
<th><strong>Humans</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>fungal and bacterial pathogens</td>
<td>increased foliage surface wetness increases foliar pathogens</td>
<td>change of ecosystem may affect distribution &amp; new pest introductions</td>
<td>increasing or changing pesticide applications (+-)</td>
</tr>
<tr>
<td>increased infectivity</td>
<td>susceptibility of plant affected by humidity</td>
<td></td>
<td>changing pest control practises</td>
</tr>
<tr>
<td>competitive edge for certain weeds</td>
<td>changes in plant architecture and structure</td>
<td></td>
<td>shifting crop production ranges</td>
</tr>
<tr>
<td>increased spread of pathogens</td>
<td></td>
<td></td>
<td>increased trade of host commodities</td>
</tr>
<tr>
<td>increased growth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enlarged geographical range</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15.11.2017
Impacts of other Climate Change Factors on Plant Health

- Increased CO$_2$ or O$_3$ may affect plant architecture, plant physiology and structure leading to greater susceptibility
  - however increased photosynthesis rate may slow down pathogen invasion
- Changes in wind pattern will affect distribution of pests
- Extreme weather conditions (e.g. hurricanes, tornadoes) act as long distance dispersal vehicles for pests
- Extreme weather conditions and their effects (e.g. storm damage) will weaken plants and make them more susceptible to pests.
Major Challenges in Plant Health

- World-wide shifts in host distribution and cultivation will increase risks for pest distribution
- Shifting trading patterns will increase risks for pest distribution
- Emergence of “new” pests
- Pests extending their geographical range will cause extension of pest distribution
- Pest surveillance and diagnostics need to be improved
- Strengthening of Pest Risk Analysis capacity is indispensable
- Enhancing plant health research and international collaboration will be crucial
THE INTERNATIONAL YEAR OF PLANT HEALTH in 2020

An Effort to Raise the Public and Political Awareness of Plant Health to help governments and the international community to address these challenges for plant health
Thank You!