Strategic approaches to targeting technology generation: Assessing the coincidence of poverty and drought-prone crop production

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• This study prioritizes areas of high poverty, the key problem of high drought risk and the crops grown and consumed in these areas.
• We identified areas of high priority for crop improvement using global spatial data, spatial overlay methods, drought modeling and descriptive statistics.

Objectives, materials and methods
Farmers who face frequent but unpredictable drought are among the poorest in the world. The Generation Challenge Program (GCP) strives to improve crops for such farmers and regions.

Agriculture, Poverty and Drought


• Numbers of stunted children was used as measure of poverty.
• Digital crop maps in GIS formats were used.
• Farmers in these systems attempt to cope with a range of drought regimes by maintaining a diversity of cropping
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Modeling Failed Seasons (Figure 1)

• Failed season = <50 growing days or >15% stress days.
• 100 years of daily rainfall, temperature & radiation data were simulated using MarkSim.
• Potential evapo-transpiration calculated using Linacre.
• Daily water balance calculated using WATBAL.
• Model makes no reference to specific crop.

Farming Systems (Figure 2)

The farming system region was the geographical unit of analysis and based on the knowledge of experts of these regions at local, regional and global scales.

Population and stunted children by farming system

The "Avg Fail" indicator is the mean probability of a failed season in the farming system. The "Potential Drought Impact" index accounts for staple crop area and frequency of drought.

Results

Conclusions

• The coincidence of poor populations in developing countries, the production of key food staple crops on which the poor depend, and drought-prone production environments, we identified:
• 15 farming systems - where drought affects a substantial agricultural population and over 70% of stunted children in the world - should be a high priority for agricultural R&D.
• These 15 systems rely largely on just 13 crops.
• Crops appearing first time in the list are highlighted and in italics.

Table 2. Fifteen farming systems with over 2.5 million stunted children

<table>
<thead>
<tr>
<th>Farming System</th>
<th>Region</th>
<th>Failed</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>EAP</td>
<td>24</td>
<td>56</td>
<td>13</td>
</tr>
<tr>
<td>Maize</td>
<td>SSA</td>
<td>5</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>Root crop</td>
<td>SSA</td>
<td>5</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>Dry rice</td>
<td>SA</td>
<td>3</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Highland maize</td>
<td>SSA</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>Table 1. Fifteen farming systems with over 2.5 million stunted children</td>
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</table>

The spatial variability of drought frequencies within farming systems (Figure 3)

• High value and perennial systems are in well-watered areas, while pastoral systems are in drier areas.
• Farming systems with a wide range of failed seasons rely on a greater number of crops (curves closer to 45 degrees).
• High poverty, priority systems (solid lines on graph) all show moderate to severe drought risk in between the extremes.