Modelling crop-weed canopies as a tool to optimise crop diversification in agroecological cropping systems

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Modelling crop-weed canopies as a tool to optimise crop diversification in agroecological cropping systems

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Aim Evaluate crop diversification and promote agroecological weed management
Method Mechanistic modelling to synthesize knowledge and simulate plant-plant interactions in agroecosystems

Key modelling points
- Emergence = f(ecological needs, season)
- Plant-plant competition for resources
- Soil legacy for future crops

A tool to investigate & promote diversification
- Prototypes
- Virtual experiments
- Participatory workshops

Crop traits to regulate weed harmffulness
- Investigate traits
- Investigate practices
- Occupy space before other plants
- Escape shading by neighbours

Diversifying crops allows to reduce herbicide use intensity

<table>
<thead>
<tr>
<th>System</th>
<th>Crop diversity</th>
<th>Cover crop (%)</th>
<th>Plough</th>
<th>Mechanical weeding</th>
<th>Herbicides (TFI)</th>
<th>Yield (1000 MJ/ha)</th>
<th>Weed loss</th>
<th>Bee-food offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>4 Species &amp; varieties / 12 years</td>
<td>100%</td>
<td>8%</td>
<td>Yes</td>
<td>No</td>
<td>1.6</td>
<td>63</td>
<td>50.9</td>
</tr>
<tr>
<td>IWM simplified</td>
<td>18</td>
<td>77%</td>
<td>39%</td>
<td>No</td>
<td>No</td>
<td>1.7</td>
<td>51</td>
<td>58.4</td>
</tr>
<tr>
<td>IWM medium</td>
<td>10</td>
<td>63%</td>
<td>8%</td>
<td>Yes</td>
<td>No</td>
<td>0.8</td>
<td>54</td>
<td>55.3</td>
</tr>
<tr>
<td>IWM complete</td>
<td>8</td>
<td>55%</td>
<td>0%</td>
<td>Yes</td>
<td>Yes</td>
<td>0.7</td>
<td>67</td>
<td>40.9</td>
</tr>
<tr>
<td>IWM ~ 0 herbicide</td>
<td>12</td>
<td>63%</td>
<td>16%</td>
<td>Yes</td>
<td>Yes</td>
<td>0.1</td>
<td>69</td>
<td>50.5</td>
</tr>
</tbody>
</table>

Systems with the highest crop diversification = highest yield and lowest herbicide use
Diversifying crops is not enough to promote weed-based biodiversity (e.g. bee food)
Diversifying crops is not enough to control weeds and ensure crop production

What next...
- Participatory workshops
- Easier use by farmers & advisors

Ergonomic tools