Calibration and Evaluation of the STICS Intercrop Model for Two Cereal-Legume Mixtures
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The aim of this study was to calibrate and evaluate the improved STICS-Intercrop model (Vezy et al., 2020) by simulating two types of cereal-legume mixtures (winter and spring intercrops).

### Materials and Methods

- French data sets comprised of 4 years of winter wheat (*Triticum turgidum* L.) and pea (*Pisum sativum* L.) (Bedoussac, 2009; Kammoun, 2015), and 4 years of spring barley (*Hordeum vulgare* L.) and pea (Corre-Hellou, 2005) including different N levels and plant densities (Table 1).
- 3-step Approach: 1) Calibration of species and cultivar parameters with sole crop data; 2) Calibration of two intercrops parameters; 3) Evaluation for intercrop data, in order to determine the validity domain.
- Step 1 of calibration followed the order: phenology, leaf area, biomass, nitrogen uptake/fixation, and grain yield.
- The species and cultivar parameters calibrated in step 1 are used again for intercrop simulations in step 2.

### Results and Discussion

- Largest source of error was winter pea (nRMSE=40.0 %).
- All other crops had a nRMSE<17.0 %
- Simulated winter pea reached max LAI too early, possibly a result of limited observed phenology data → further research needed.

Table 1: Description of the observed field data.

<table>
<thead>
<tr>
<th></th>
<th>Winter Wheat</th>
<th>Winter Pea</th>
<th>Spring Barley</th>
<th>Spring Pea</th>
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<tbody>
<tr>
<td>Location</td>
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<td>Auzeville, France</td>
<td>Angers, France</td>
<td>Angers, France</td>
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<tr>
<td>Years</td>
<td>4</td>
<td>4</td>
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<tr>
<td>N Levels</td>
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<td>Densities</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Figure 1:** Comparison of simulated observed grain yield for sole crop winter wheat, winter pea, spring barley, and spring pea.

**Figure 2:** Comparison of simulated observed partial land equivalent ratio (LER) for intercropped winter wheat/winter pea and spring barley/spring pea.

### Conclusion

- Based on the sole crop calibration, some intercrop situations could be correctly simulated.
- Further analysis of the model's simulation of interspecific competition is necessary to better capture the large variation in observed data and to improve model accuracy.
- With these future improvements, the STICS intercrop model can be a useful tool for better understanding the biological functions of intercropping systems to and assist in optimizing their management.

### Sources