Productivity Evaluation of Maize Based Soil Conservation Systems on a Tropical Hillside

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Research questions

- How can we assess competition at the crop-soil-tree interface?
- Is a combination of electric resistivity tomography (ERT) and stable isotope discrimination useful in identifying causes of competition in complex cropping systems?
- How can we mitigate competition in alley cropping?

Material and Methods

- Site: Ratchaburi province, Thailand (13°28'N and 99°15'E)
- Slope gradient: ~25%
- Fertilizer @ 62-11-36 NPK
- Treatments:
  - T1: Maize sole cropping, tillage, and fertilization (farmers’ practice / control)
  - T2: Maize-chili intercropping, tillage and fertilization
  - T3: Maize-chili intercropping, minimum tillage, fertilization, and Jack bean relay cropping
  - T4: Maize-chili intercropping, minimum tillage, fertilization, Jack bean relay cropping, and Leucaena leucocephala hedgerows
  - T5: As T3 but without fertilization
  - T6: As T4 but without fertilization
- Stable isotopic discrimination
- ERT imaging
- WaNuCAS, Nutrient, Light Capture in Agroforestry Systems model

Results

Maize above ground biomass (AGB), δ¹³C, light use efficiency (LUE) and land equivalent ratio (LER)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>AGB (g m⁻²)</th>
<th>δ¹³C (%)</th>
<th>LUEₐ₉₃GS (g DM m⁻²)</th>
<th>LER</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (control)</td>
<td>1161 bc</td>
<td>-10.55 a</td>
<td>1.23 cd</td>
<td>1.00</td>
</tr>
<tr>
<td>T2</td>
<td>1365 a</td>
<td>-10.47 b</td>
<td>1.56 a</td>
<td>1.17</td>
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<tr>
<td>T3</td>
<td>1242 ab</td>
<td>-10.51 b</td>
<td>1.44 ac</td>
<td>1.03</td>
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<tr>
<td>T4</td>
<td>1250 ab</td>
<td>-10.49 b</td>
<td>1.50 ab</td>
<td>1.21</td>
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<tr>
<td>T5</td>
<td>1033 d</td>
<td>-9.28 c</td>
<td>1.13 d</td>
<td>0.88</td>
</tr>
<tr>
<td>T6</td>
<td>1076 dc</td>
<td>-9.32 c</td>
<td>1.28 bcd</td>
<td>0.94</td>
</tr>
</tbody>
</table>

Figs. with different small letters indicate significant differences between the treatments

ERT imaging and stable isotope discrimination improved our understanding of competition at the crop-soil-hedge interface

Maize AGB, LUE and LER were higher in maize-chili intercropping and hedgerows systems with fertilization than under maize sole cropping

WaNuCAS suggested small targeted additional applications of N and P fertilizer to sustain maize production

This may foster farmers’ adoption of alley cropping, contributing to a more sustainable crop production on in mountainous regions

References
