**Soil Compaction Varies by Long-Term Application of Barley Straw in Paddy Field**

Ki-Yuol Jung*, Eul-Soo Yun, Chang-Young Park, Young-Dae Choi, Jae-Bok Hwang and Seong-Ho Jeon  
Coarse Cereal Crop Research Division, NICS, RDA, Milyang, 627-803, Republic of Korea

**Introduction**

- Cropping system and organic matter affect crop productivity and soil chemical-physical properties.  
- In Korea, most rice and barley straw are utilizing as feeds and mat to livestock by removing them from the fields.  
- Crop residue management practices are key factor in improving soil fertility for agricultural production.  
- The depth to the hardpan was limited up to only about 17.6 cm, hardness of compaction layers index was 21.1 mm and thickness of plow pan were distributed from 5 to 17 cm.  
- Crop residue management practices need of soil management practices beneficial not only for crop production, but also for sustainable agricultural and the environment.

**Methods**

- Soil Properties  
  - Soil series: Pyeongtaeg (mixed mesic, Typic Haplaquepts)  
  - Fine silty loam (somewhat poorly drained fine silty)  
- Cropping systems and straw treatment for 20 years since 1990  
  - Rice : with rice straw  
  - Rice-barley(Removal) : with rice straw, without barley straw  
  - Rice-barley(Incorporation) : with rice and barley straw

**Results**

Fig. 1. Penetration resistance classified the shapes of cone index for analysis the effect of crop residue management.

![Fig. 1. Penetration resistance classified the shapes of cone index for analysis the effect of crop residue management.](image)

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>Max PR (MPa)</th>
<th>Depth to Max PR (cm)</th>
<th>Depth to 2 MPa (cm)</th>
<th>Thickness 2 MPa (cm)</th>
<th>Compaction layer type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice mono</td>
<td>2.21±0.19</td>
<td>34±0.61</td>
<td>15±1.67</td>
<td>21±1.09</td>
<td>Clear</td>
</tr>
<tr>
<td>Rice-Barley</td>
<td>2.0±0.27</td>
<td>25±1.57</td>
<td>19±2.39</td>
<td>11±1.80</td>
<td>Gradual</td>
</tr>
<tr>
<td>Rice-Barley</td>
<td>1.90±0.23</td>
<td>29±1.97</td>
<td>23±1.41</td>
<td>10±3.22</td>
<td>Gradual</td>
</tr>
</tbody>
</table>

**Conclusions**

- Rice-barley double cropping system is much more effective to increase soil organic carbon than mono-rice cultivation in paddy field.  
- Rice-barley double cropping system with barley straw incorporation showed the least maximum CI, the deepest layer to 2 MPa and 2 MPa-thickness compare to the rice-barley system without barley straw and mono-rice cultivation.  
- Rice-barley double cropping system could be a good management practice to increase soil organic carbon storage and to enhance soil physical properties in paddy field.