**Agricultural Management Effects on Properties of Semi-Arid Sandy Soils**

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**INTRODUCTION**

Although no-tillage farming systems have been shown to reduce soil erosion and modify soil chemical, biological, and physical properties in many areas of the US, little information is available for semi-arid sandy soils of the Southern High Plains. The objective of this study was to test the hypothesis that long-term no-tillage management will provide more favorable soil chemical, biological, and physical properties for ecosystem functioning than conventionally-tilled systems on sandy soils in west Texas.

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**METHODS**

Two sites were located in Terry County, West Texas, USA on Amarillo Isosy fine sand (fine-loamy, mixed, superactive, thermic Aridic Paleudults). Site 1 included conventionally-tilled dryland cotton (Dryland Cotton Conv), no-till irrigated and dryland cotton/ wheat (Irrigated Cotton NT and Dryland Cotton NT, respectively), conservation reserve grassland (Conservation Grassland), and native rangeland. Site 2 included conventionally-tilled irrigated cotton, no-till irrigated cotton/wheat, and conservation reserve grassland.

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**RESULTS AND DISCUSSION**

The soil enymes studied participate in key reactions of soil biogeochemical cycling that affect soil functioning. Specificity of glucosidase is key to cellulose degradation (C cycling), β-glucosaminidase is key to chitin degradation (C and N cycling), and arylsulfatase is key to soil organic matter mineralization (C cycling).

**Management Effect on Enzyme Activities**

All enzymes activities studied showed significant decreases with depth (P<0.01). The enzyme activities at the surface 0-5 cm of the native rangeland, conservation grassland and no-till management systems were significantly greater (P<0.01) than those of the conventionally-tilled dryland cotton. The activity of β-glucosidase and arylsulfatase in the irrigated cotton/wheat system was greater than those found in the conservation grassland. These results demonstrate the degradation of soil properties that control soil chemical processes when conventional tillage is used with continuous cotton monoculture for these semi-arid soils.

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**CONCLUSIONS**

Penetration resistance showed a significant difference for depth class (P<0.01). The 0-5 cm and 5-10 cm depths had significantly lower penetration resistance than the lower depths. All individual test management systems had significant differences with depth class (P<0.001). The native rangeland had the lowest resistance throughout all the depths. The conventionally tillage dryland cotton system showed a dramatic increase in penetration resistance through the 10 to 20 cm range. The other systems were comparable to each other by showing gradual increase in resistance through 20 cm and leveling off to the bottom depth.

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**REFERENCES**


**Soil Properties Comparison**

<table>
<thead>
<tr>
<th>Depth Class (cm)</th>
<th>Native Rangeland</th>
<th>Irrigated Cotton NT</th>
<th>Dryland Cotton NT</th>
<th>Conservation Grassland</th>
<th>Dryland Cotton Conv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 cm</td>
<td>0.8</td>
<td>1.0</td>
<td>1.0</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>5-10 cm</td>
<td>0.6</td>
<td>1.0</td>
<td>1.0</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>10-15 cm</td>
<td>0.4</td>
<td>1.0</td>
<td>1.0</td>
<td>1.2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Total Organic Carbon and Particulate Organic Matter**

Due to relatively high variability in organic carbon mass measurements, only the surface 0 – 5 cm of the irrigated cotton/no-till system had higher organic carbon mass than the other soil layers for comparisons by depth within management systems (P<0.05). No difference in organic carbon mass with depth was found in any other system tested. In comparisons by depth among management systems, the native range had significantly higher organic carbon mass than all other systems at each depth (P<0.05). Particulate organic matter (POM) increased with depth. Generally, the surface 0 – 5 cm had statistically greater POM (P<0.001) than all other depths. The native rangeland and the irrigated no-till/cotton/wheat system had greater surface 0 – 5 cm POM than the dryland cotton system. The other systems had similar soil surface 0 – 5 cm POM.

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