Effect of Subsoiling on Yield of Burley Tobacco

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Compaction of tobacco fields caused by overworking or working soils when they are too wet has become a topic of concern to burley producers in recent years. Despite the viewpoint of some producers that annual subsoiling of tobacco fields is a profitable practice, particularly on soils which percolate water slowly, the University of Kentucky College of Agriculture recommends subsoiling only for a defined compaction problem. In such cases, some field studies have shown increased yields of burley to tillage practices that penetrate and shatter the compacted layer. Questions persist, however, about the effectiveness of single shank subsoilers used annually by some burley growers. Most of the concern about their effectiveness relates to the fact that, even if the soil is compacted, their use rarely results in shattering of compacted layers between row centers on which the subsoiler is used. This results in setter rows that are not likely to be centered over subsoiler slits, thereby minimizing the tool’s effectiveness. Because of the increased concern about compaction, and because one-row subsoilers are fairly commonly used tools, we conducted an on-farm field study during 1994 to test their effectiveness in producing burley tobacco.

### Description of Study

A field test was conducted in Owen County, Kentucky, on a Nicholson silt loam, 3-6% slopes. The natural characteristics of this soil are a silt loam plow layer underlain by a silty clay loam subsoil to a depth of around 3 feet soils which percolate water slowly, the University of Kentucky College of Agriculture recommends subsoiling only for a defined compaction problem. In such cases, some field studies have shown increased yields of burley to tillage practices that penetrate and shatter the compacted layer. Questions persist, however, about the effectiveness of single shank subsoilers used annually by some burley growers. Most of the concern about their effectiveness relates to the fact that, even if the soil is compacted, their use rarely results in shattering of compacted layers between row centers on which the subsoiler is used. This results in setter rows that are not likely to be centered over subsoiler slits, thereby minimizing the tool’s effectiveness. Because of the increased

### Table 1. Distribution by depth at which the highest penetrometer readings were found*

<table>
<thead>
<tr>
<th>Soil Depth (ins)</th>
<th>Number of sites where highest penetrometer reading was highest reading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below 200 psi</td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
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<tr>
<td>21</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>2</td>
</tr>
</tbody>
</table>

* The 1-acre field was tested at 33 sites.
tobacco. It had been used for tobacco in 1992 and 1993, so that the study was conducted during the third consecutive year of tobacco. Cone penetrometer readings were made at 33 sites within the approximately 1 acre field in November 1993, and soil samples were taken and composited for fertility measurement (results: pH 7.2; P 163; K 486). The cone penetrometer can be used to define soil resistance and to measure soil compaction when readings are obtained at the proper soil moisture content. The appropriate soil moisture content for accurate use of the cone penetrometer is when the soil is barely too wet for plowing. At this moisture content, soil is at field capacity, which is too wet to work but dry enough to walk on the surface of bare soil without mud sticking to your shoes. If the soil is drier than this, penetrometer readings are more likely to reflect the effects of soil strength than compaction.

Tillage treatments tested were (1) no subsoiling, spring plow and disk (control), (2) fall subsoiled on 36 inch centers, spring plow and disk, (3) spring subsoiled on 36 inch centers, spring plow and disk, and (4) spring plow and disk, subsoiled under the setter row immediately before transplanting because of tractor wheel spacing limitations, the subsoiler slit was 8 to 12 inches to the side of the setter row rather than directly under it. Plowing was done to a depth of 10 inches with a moldboard plow, and subsoiling was done to a depth of 18 inches with a single shank subsoiler. Plots were 4 rows wide (13.33 ft) and extended for the length of the field, approximately 300 ft. Treatments were randomized in blocks and replicated 3 times. Tobacco (var. R610) was transplanted 18 inches apart in 40 inch rows. Following abnormally low rainfall during the early part of the season, amount and distribution of rainfall during the remainder of the season was excellent. Yields were estimated by weighing the cured leaf from 30 stalks (5 sticks) taken from the two center rows of each plot at two sites across the field in 2 blocks, and at one site in one block, resulting in 5 replicate yield measurements for each treatment.

### Results

Distribution of sampling sites by depth at which the highest penetrometer reading was measured at each site is shown in Table 1. Readings below 200 psi are considered to have no effect on root growth, while readings over 300 psi are considered to inhibit root growth. Depth of the highest reading found at each site was always 12 inches or greater. This was 200-300 psi at two sites and over 300 psi at one site. The highest reading found was at the 15-inch depth for 3 sites, at the 18-inch depth for 20 sites, the 21-inch depth at 2 sites, and at the 24-inch depth at 2 sites. The facts that no penetrometer readings exceeded 300 psi within the top 12 inches of soil and that 24 of the sites testing above 300 psi occurred at a depth of 18 inches or deeper suggest that such readings more likely reflect increased clay content of the subsoil than compaction caused by crop production practices.

Tobacco growth on all treatments was excellent, and yields were good, as shown in Table 2. Despite late season observations of increased plant root growth in the subsoiler slit (which was 8 to 12 inches to the side of the setter row) of the “subsoil at transplanting” treatment, there were no statistically significant differences in cured leaf yield among treatment averages. Since there was excellent rainfall amount and distribution during the last half of the growing season, it is unlikely that better root growth near the subsoiler slit would have improved yields. Such benefits would more likely occur under drought conditions during the latter part of the growing season. With the excellent late season growing conditions during 1994, however, none of the 3 subsoil treatments was better than conventionally plowing and diskin in the spring without use of a subsoiler.

These results suggest little likelihood that general use of a subsoiler on 36-inch centers on fields without a defined compaction problem will improve cured leaf yields of burley tobacco.