COMPACT SOIL--COULD IT BE PART OF THE PROBLEM?

by
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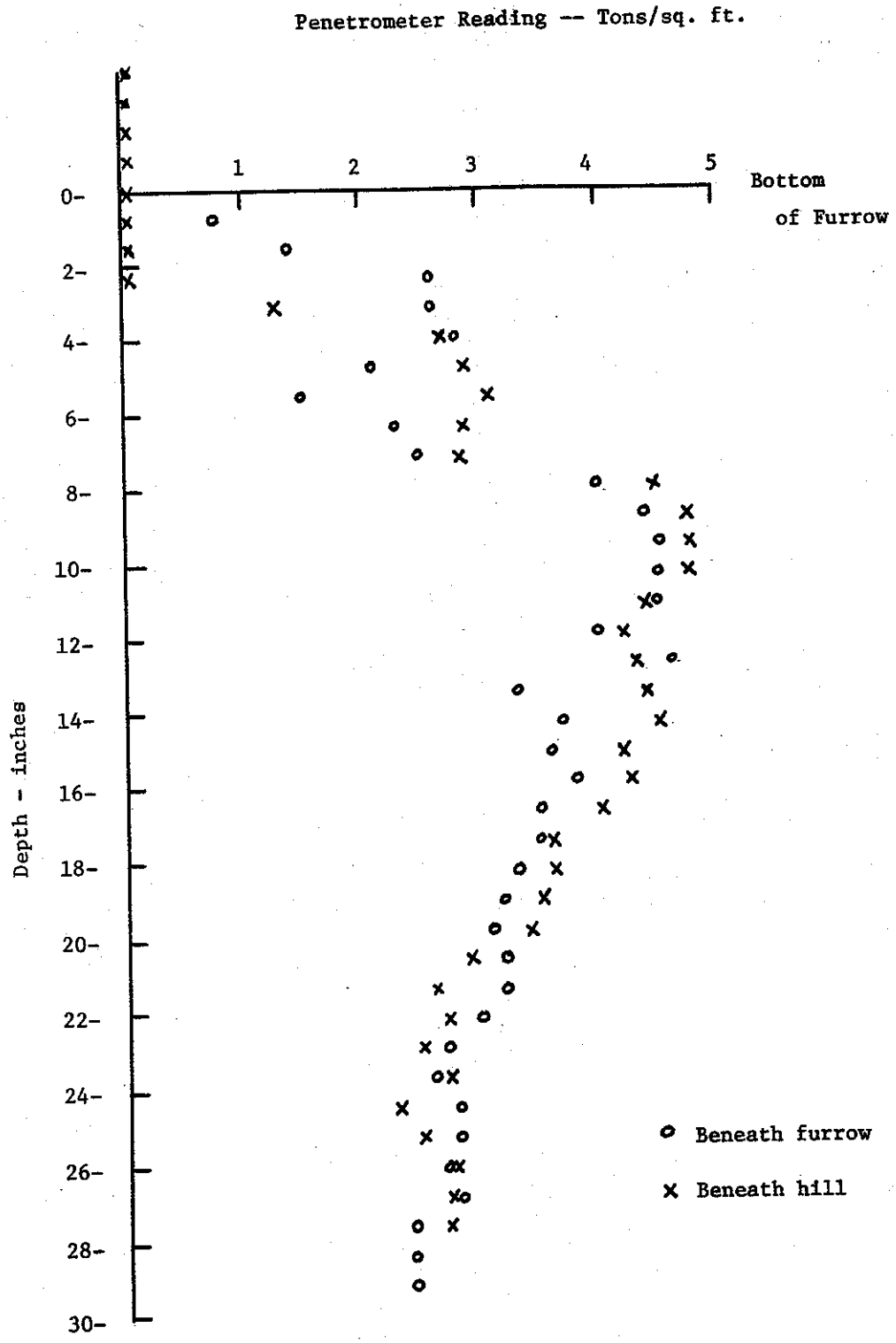
Roots grow poorly or not at all in excessively compact soil for any of three reasons: 1) mechanical resistance to penetration, 2) lack of oxygen (or, infrequently, carbon dioxide toxicity), and 3) lack of water. Soil compaction does exist in numerous soils and excessive compaction is particularly noticeable in the Shano soils, as may be seen from Figure 1, which shows penetrometer measurements at different depths in a soil profile at one location on the Othello farm. The penetrometer reading shown is the force in tons per square foot required to penetrate the soil with a pencil-sized rod. Experimental work, begun last summer to determine the effect of compaction of the Shano soil on potato growth, has shown that few roots penetrate into the compact soil which begins at a depth of from 6 to 10 inches. Water does penetrate the compact soil and there is little evidence to show that oxygen is limiting. Hence, the tentative conclusion is that mechanical resistance is the cause of poor root penetration. However, it is much too soon for drawing a final conclusion in the matter.

In the Othello experiment, soil was loosened to several different depths using a roto-tiller and two different soil amendments were used to help to keep the loosened soil open and porous. On some plots, a chemical substance (HPAN soil conditioner) was used to stabilize soil aggregates and in others, dried horse manure was mixed with the soil. In still others, nothing was added. Soil tilth was greatly improved by the treatments. Top growth was markedly better in plots with soil loosened to depths greater than normal plow depth. However, difficulties in assuring uniform and adequate irrigation over the entire growing period prevented making meaningful comparisons of final tuber yield. Except in the plot where soil was loosened to a depth of 17 inches, root growth was very good down to the compact soil where it essentially stopped. Root density thinned out somewhat in the 15 to 17 inch depths of the deepest treated plots. Problems in irrigating these plots could have been responsible for this.

The soil compaction problem is complicated because whether or not compaction beginning at 6 to 10 inches influences growth of potato plants depends upon irrigation and fertility factors as well as upon root penetration of the compacted soil. It is entirely possible that, if fertility and water conditions in the 6 to 10 inch depth of loose soil are maintained constantly at favorable levels, this much soil will be sufficient for maximum potato growth under prevailing climatic conditions. However, even though this might be true, greater soil depths certainly are desirable to increase the active root zone volume and to reduce the opportunity for stress on the plant in the event that irrigation is accidentally delayed.

It is obvious that soil compaction is associated extensively with machine traffic in fields and that reduction in this traffic would do some good in maintaining desirable soil tilth. Tillage practices, in particular use of sub-soiling machinery, will break up compacted soil. However, it is not known exactly how long the improved tilth will last and this, obviously, would vary with soil type. When the degree to which compaction affects potato growth has been established definitely and when the longivity of tillage improved structure is known, it then will be possible to assess alternative management practices in terms of relevant economic factors. One hopeful, although inconvenient, possibility for avoiding recompaction of properly tilled soil may be to develop techniques by which wheel tracks are confined to between-row positions year after year.

Studies of the compaction problem, together with water conditions as they influence potato growth, will continue on the Othello farm this coming summer.


Penetrometer Reading -- Tons/sq. ft.
1
2
3
4
5
Bottom
of Furrow
0-
2-
4-
6-
8-
10-
12-
14-
16-
18-
20-
22-
24-
26-
28-
30-
Depth - inches
Beneath furrow
Beneath hill