

THE EFFECT OF SUBSOILING ON POTATO PRODUCTION
IN THE COLUMBIA BASIN

by

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Since discovery of restrictive layers in soils of the Columbia Basin some years ago we have conducted a number of experiments to determine the effect of these layers on potato plant growth and yield. We have shown that such layers materially restrict the rooting zone and slow the downward movement and return flow of water. Water retention above such layers has been increased over what it would be without such restrictive layers. This compensates somewhat for reduction in the rooting zone. Because of the reduction in deep percolation, losses in soluble fertilizers is similarly reduced. Observations of potato growth over a period of years have suggested that root restrictions may not affect yields, providing that management of water and fertilizer is optimum. To determine with greater certainty if a restricted rooting zone does affect potato production we have undertaken several experiments during the past three years involving the use of deep tillage to increase the depth of roots.

The first of four experiments conducted involved loosening and mixing soil to a depth of up to 2 ft. using a rototiller and incorporating soil additives to maintain the soil tilth thus created. Fifteen to 20% increases in root systems were achieved, but no significant increase in potato yield or quality of Russet Burbank potatoes resulted. However, some increases were achieved with an experimental potato variety. The second experiment involved deep chiseling on the WSU Othello farm. Soil was loosened for a short distance below the plow pan with a double chisel points. However, the root system increase was small and inconsistent. And, yields were so highly variable that the small differences observed were not significant.

The third experiment was conducted in 1978 on the Bob Holloway farm south of Ephrata. Plots 40 ft. by 4 rows, running across a circle were established on a field, without the typical plow pan interface, but otherwise similar in soil hardness and rooting restrictions. Chiseling was carried out in various combinations according to the following plan:

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| Two implements (single shanks,
86 cm apart) | (1) Chisel points alone.
(2) Chisels with 30 cm sweep
attachments |
| Three positions | (1) Pre-plant under the center
of the potato row (row).
(2) Post-plant centered between
the potato rows (furrow).
(3) Both of the above in
combination. |
| Two depths | (1) Shallow (30-40 cm).
(2) Deep (40-60 cm). |

In general, the differences in potato yield between the treatments were not statistically significant. The percentage of U.S. No. 1 grade potatoes was statistically lower for furrow tillage compared to row, or row and furrow, subsoiling. Also, tuber specific gravities for the row tillage position were statistically lower than those from the other tillage locations. However, none of these effects have very much practical significance since the differences obtained were small. Some differences in yield were observed between different parts of the circle where the depth to the underlying gravelly coarse sand was different. Where the depth was shallow, small increases were achieved, but the economic value remains questionable.

The fourth experiment involved an irrigation variable. Here closely spaced sprinklers placed along a supply line provided a high rate of water application at the center with decreasing rates on either side of the line. Fertility was maintained high on all plots except for nitrogen, which was varied. However, the residual nitrogen from the previous alfalfa crop was sufficiently high that nitrogen was not really limiting as originally planned. On half of the plots at various irrigation levels soil was loosened with sweep chisels down to 10 to 15 cm (4 to 6 inches) below the plow pan. As expected, data showed generally a significant increase in yield and quality of potato tubers with increasing irrigation, but with a slight reduction occurring at the highest irrigation rate. Deep tillage achieved significant improvements in yield only at very low irrigation rates. It produced no significant effects at intermediate rates (approximately optimum) and had a depressing effect at high irrigation levels. Deep chiseling did not appreciably influence the percentage of U. S. No. 1 potatoes over the entire range of irrigation.

Data presented in these studies suggest that subsoiling, on at least some Columbia Basin soils, is not likely to improve potato yield or quality under typical high levels of irrigation and fertilizer management. But, these data should not be extrapolated to all Columbia Basin soils. Nonetheless, they do indicate that it is not safe to assume, without confirming data, that increasing the rooting zone through subsoil tillage practices will automatically lead to increased yield. The situation would be entirely different on non-irrigated land. However, where irrigation is practiced and it is possible to maintain favorable water and fertility conditions, the size of the root system may not be a limiting factor.

