POTATO ROOT DEVELOPMENT

by
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Studies on root growth and tuber development as they are related to water, soil fertility and soil compaction have continued on the WSU Othello farm. This past summer we had an experiment where soil fertility was continuously varied from zero to about 700 lbs/acre along the rows in one direction and where water application was varied in the other direction. Additionally, a duplicate set of plots was chiseled with a 14 inch chisel set to cut to a depth of about 20 inches but which actually penetrated the hard zone of this soil only a short distance. Irrigation was accomplished with trickle irrigation hose which is a plastic hose about 5/8 in. diameter with small holes feeding into an attached smaller hose (1/15 of the cross sectional area of the larger one) and from which water is applied to the soil from small holes spaced at intervals of about 18 in. Filtered water was used in the trickle system but growth of a bacterial slime in the pipes plugged emitter holes so that irrigation was not wholly successful. Despite problems encountered some observations of considerable interest have been made.

Root distributions have been determined in wet and dry plots which show that relatively few roots penetrate into the hard layer found at about plow depth in the Shano soil at Othello. When both water and fertility conditions were favorable so that vigorous plants were produced a few roots were able to penetrate into the hard zone, but the contribution of water and nutrients by soil below the plow depth was small. The reason for the hardness of the soil (penetrometer measurements below were 2 or 3 times as great as those above, as shown in the report last year) is not apparent. The bulk density of the soil above and below does not differ greatly (1.51 above and 1.53 g/cm^3 below) but there appears to be a thin layer of soil which is oriented by passage of the plow blades. We refer to this as a "scoured" layer. Few roots penetrate this scoured layer but rather spread out in a net on the soil surface immediately above. Additionally, there is evidence of similar but irregular "scoured" layers in the hilled soil where roots have spread out into a network along such layers. These layers are to be studied more intensively this winter using a scanning electron microscope to determine their nature and to give some insight into why roots penetrate them so poorly.

In addition to observing root development we have also observed water flow in the soil profile. Time-lapse motion pictures showing the advance of the wetting-front demonstrate that downward water movement is little affected by the compacted soil below the plow depth. However, upward flow is slowed at the scoured soil interface. The exact contribution to plant growth of upward flow into the rooting zone between irrigations is difficult to determine with available data. However, observations to date suggest that most of the water used by potato plants in the Othello experiments comes from soil in the rooting depth which is essentially the plowed depth. Should this observation be substantiated in further work it will mean that irrigation amounts should be computed on the basis of the water capacity of the plowed depth only and that heavier applications should be avoided so as to eliminate loss of soluble nutrients below the rooting zone.

We made some automatic field measurements of tuber weight changes with an electronic load cell and of tuber diameter changes with a linear transducer. These were made late in the season and we didn't attempt to correlate them with water conditions. However, we expect to apply these techniques in water plant growth studies this summer.