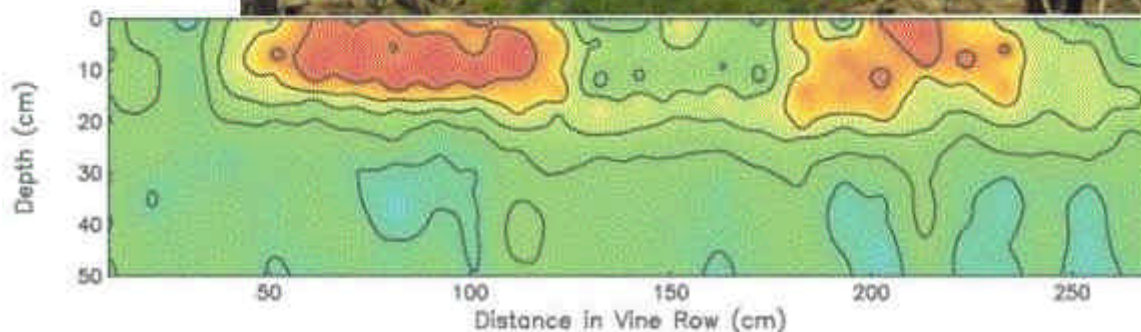




# Soil Compaction in Western Oregon Vineyards:



Tractor tire compaction is a common feature in western Oregon vineyards. Tractor tire "ruts" seen running between the vine rows are the visible signs of compaction (see photo). The colored diagram is a cross-sectional representation of soil compaction with depth, measured across the vineyard row. The nature and genesis of soil compaction is discussed in this report. Although compaction is a ubiquitous feature in Oregon vineyards it does not seem to be a production problem at common vine densities planted in our region. We are currently exploring the relationship between compaction and rooting density. This information will be available at this site in the near future.

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# Soil Compaction in Western Oregon Vineyards:

## Soil Compaction Survey Conducted in the Spring of 1999

### Compaction Survey

We measured soil compaction (soil penetration resistance) at two western Oregon vineyards in the spring of 1999. Two dominant soil types were represented: Jory, a dark reddish-brown deep silty clay loam; and a Willakenzie, a shallower silt loam to silty clay loam.

The effect of vineyard production age (number of machinery passes) on soil compaction was evaluated at these two vineyards.

### Genesis of Soil Compaction

Soil compaction (increase in penetration resistance) is the natural result of multiple passes of heavy equipment down the vineyard rows. The use of farm equipment with narrow tires exacerbates the problem as the weight of the vehicle is spread over a very small area. Using wider set of tires on heavy vehicles can, in part, alleviate this problem.

### Factors Effecting Compaction

Soil moisture and texture also figure importantly into the compaction question. Soils are most susceptible to compaction when they are at field moisture conditions or wetter. These conditions occur in winter into the spring months. One would want to avoid making multiple passes, as much as, possible when the soil is wetter than field capacity.

### Does Compaction Effect Vineyard Production?

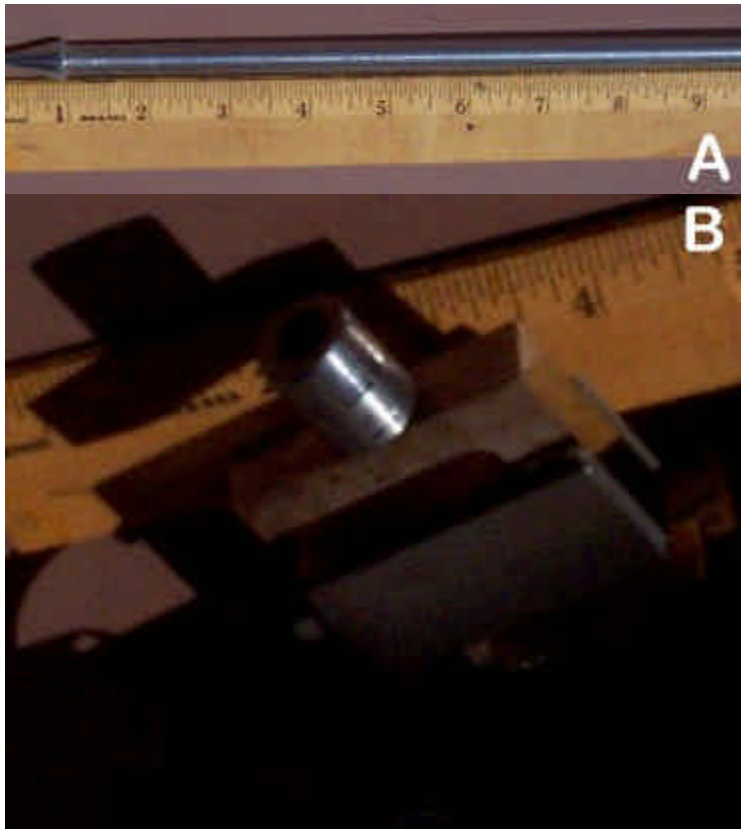
In a compacted state, the soil grains are pushed closer together and the soil pore space is reduced. The soil becomes stronger as reflected in the penetrometer resistance values. Roots have to work harder (require additional photosynthate) to penetrate and move through compacted soil. The movement of air and water is also restricted in compact zones. These zones could potentially become anaerobic (waterlogged), thus altering the biological communities in the compacted zones. The reduction in pore space and pore

connectivity is the critical matter. Soil compaction could also lead to a lowering of the rate of water infiltration into the soil and could contribute to erosion.

The overall effect of compaction is to reduce the volume of soil that a vine can explore. Compaction may be expected to be more of a problem in dense vineyard planting where tire paths are close to the vines.

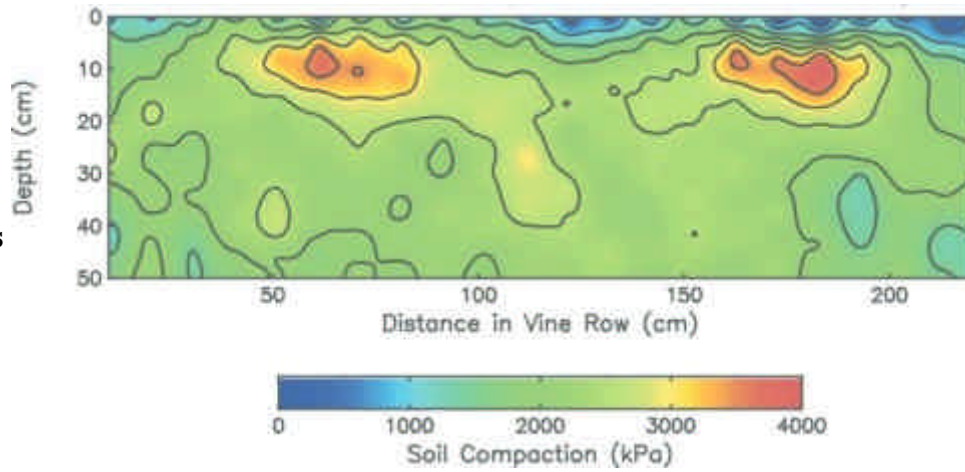
### **Measurement of Soil Compaction**

Compaction (soil penetration resistance) measurements were made at 4" intervals between the vine rows. Readings are made by slowly pushing a 7/16" stainless steel rod into the ground. The end of the rod has a pointed cone attached (A). The other end of the rod is connected to a electronic strain gauge (B) . The electrical output of the gauge is measured and stored in an "onboard" microprocessor. The instrument records compaction values at 1" intervals as the rod is pushed into the soil to a depth of 20". A typical transect between vine rows takes about 1 hour to measure and consists of more than 900 compaction readings (C). The compaction data is input into a graphics software package which allows us to produce color "topographic" maps of the compaction data.



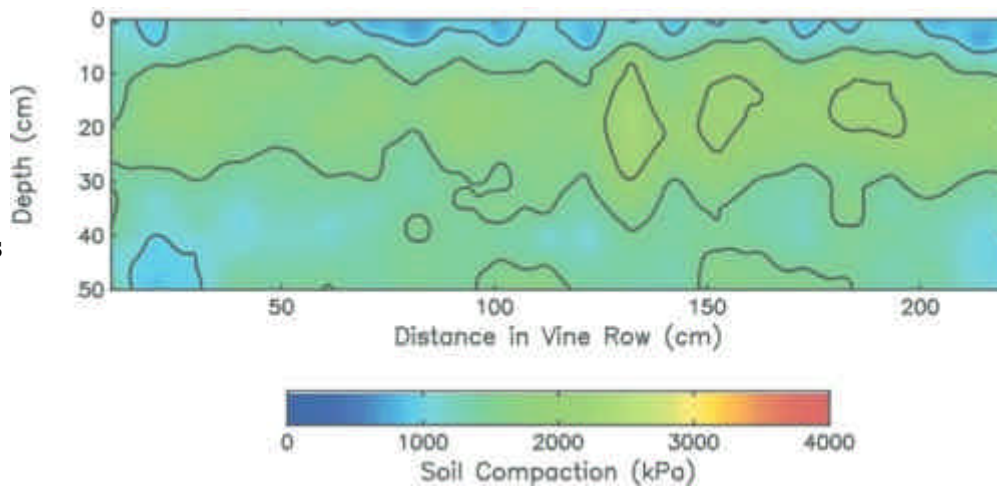
This map shows the effect of seven years of vineyard management of a Willakenzie soil with a silt loam texture. Prior to planting, the soil was ripped to a depth of 3'. The maps show two compacted zones (orange-red) centered in the vine row about 1.2 m (4') apart. They extend from roughly 2 - 5" in soil depth at this site. The distance between symmetric compaction zones is approximately the separation distance of the tractor tires. Penetrometer resistance (compaction) values range from 1000 to 3,500 kPa (140 - 490 psi). The critical penetration resistance where roots should begin to experience difficulty growing is believed to be 2,000 kPa. The critical value depends on moisture content at measurement time and texture. Roots should experience difficulty growing into the hardened compacted regions compared to the surrounding soil which is not effected by the traffic pan.

7 years

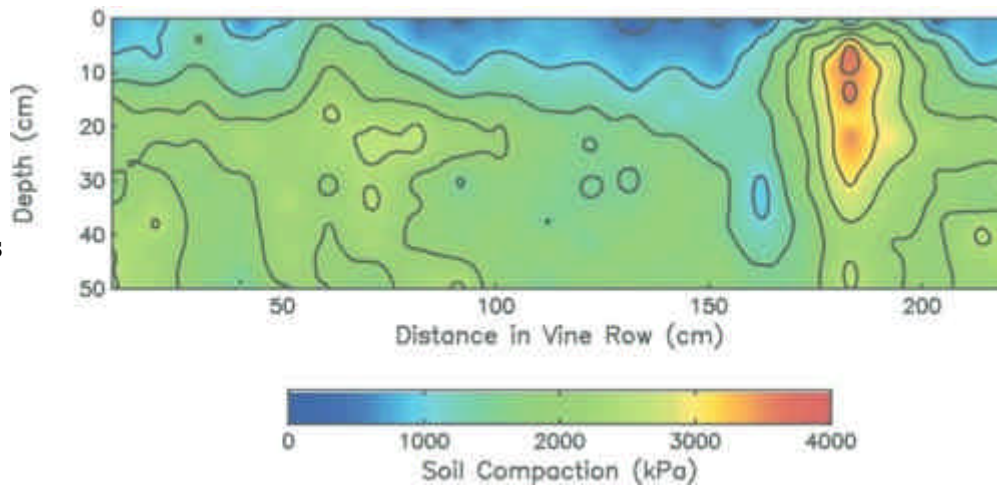


Compaction maps for 0, 2, and 5 years of vineyard management combined with the previous map suggest that compaction is a progressive phenomena.

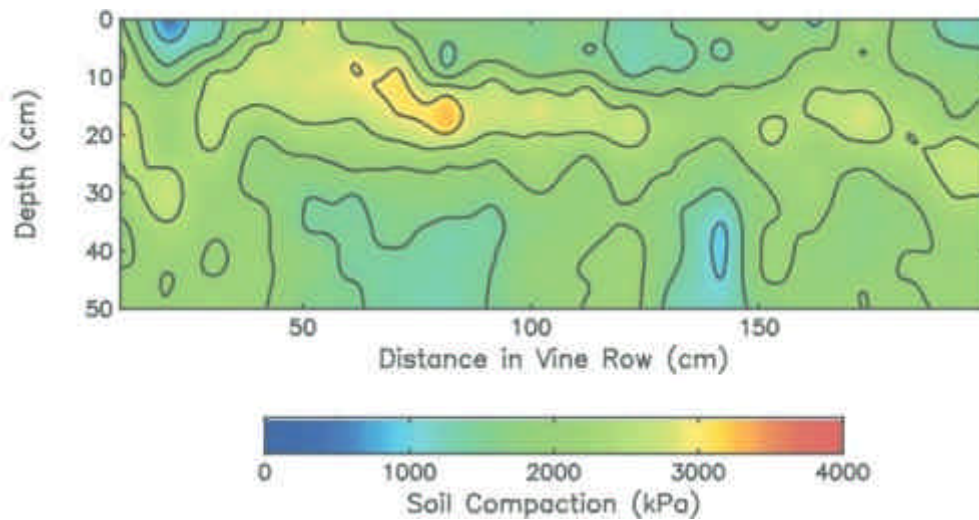
0 Years



2 Years

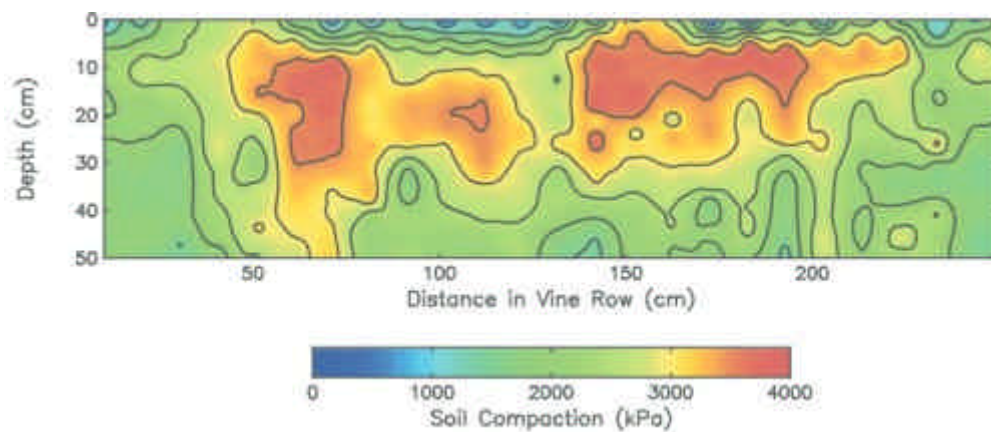


5 Years

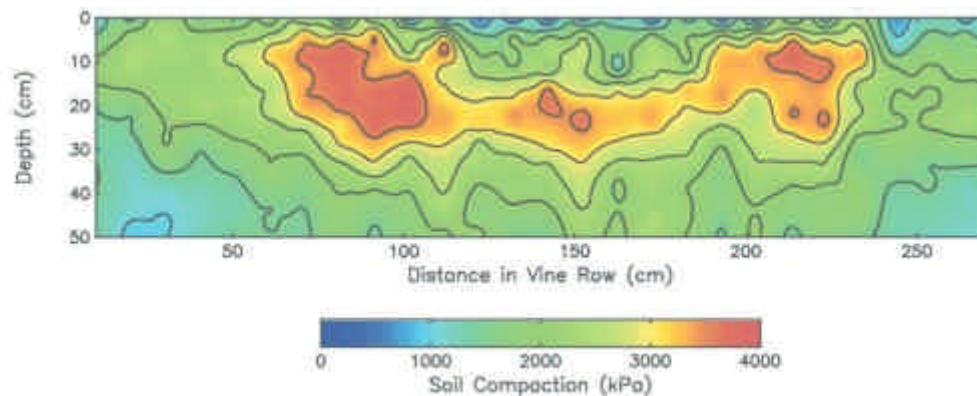


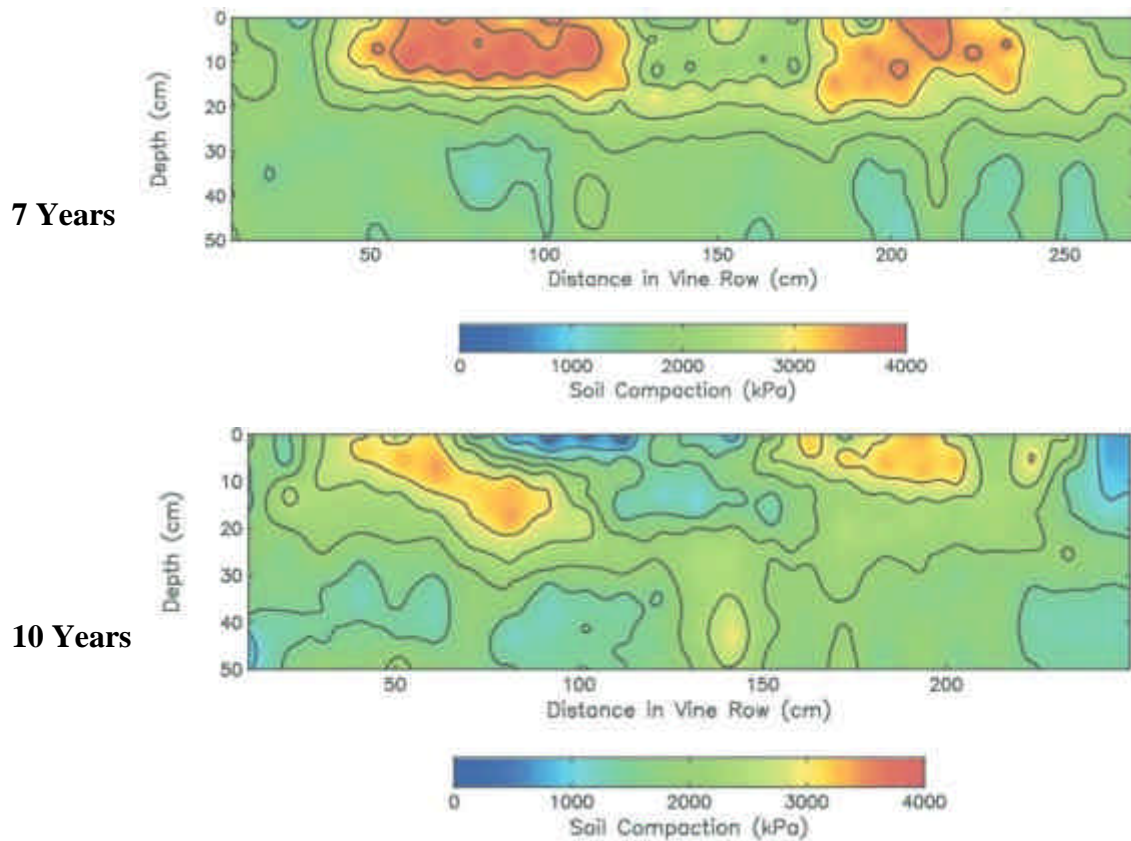
Compaction maps measured on Jory "like" (silty clay loam) soil in the Willamette Valley appear to be a little more compacted than the Willakenzie soil. The compaction also appears to extend a little deeper into the soil at the Jory site.

3 Years



5 Years





The site which has been under viticultural practices for 10 years does not seem to be as compact as the vineyard sites sampled with 3, 5, and 7 years, respectively. This may be due to minor variations in the soil type and moisture conditions at the time of sampling.

## Conclusions

Compaction is a ubiquitous feature in western Oregon vineyards.

Roots should experience stress growing into the compacted regions.

However, at vineyard spacings of 1,500 plants per acre or less, the volume of soil compacted is small relative to the total soil volume. As a result compaction is probably not an immediate concern for grape grower.

The effect of wheel traffic compaction can be ameliorated by shallow tillage (5 - 6"). This would best be done post-harvest or just prior to bloom. In both cases soil disturbance is minimized if the soil is as dry as possible.