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NEWS FROM THE WONDERFUL WORLD OF SOIL AND PLANTS

By John Ferguson

As gardeners we often hear about and must deal with compaction. Compaction reduces oxygen entering the soil, reduces plant growth, reduces nutrient uptake, causes less water infiltration, leads to loss of soil life (microbial and larger organisms like earthworms and beetles), and leads to growth of pathogens to name a few issues.

Compaction occurs from two major causes, pressure (weight) and chemical cementation. When we drive on a soil or use heavy equipment, compaction from weight can occur in seconds but may take years for the soil to recover. Compaction from cementation occurs when salts (artificial fertilizer), carbonates (limestone), and other minerals re-crystalize and glue soil particles together.

For example - Minerals are formed from the chemicals in our municipal water supply that cement our soils and create hardpan which is a form of compaction. Two common ones are Fluorapatite $\text{Ca}_5(\text{PO}_4)_3\text{F}$ and Chlorapatite $\text{Ca}_5(\text{PO}_4)_3\text{Cl}$, (from Principles of Soil Chemistry, 4th Edition, Kim H. Tan).

If you notice in the chemical formulas above, we first notice our friend the phosphate ion (PO_4) that is required for healthy soils and plants is locked up chemically. We next notice calcium (Ca) that all gardeners know is essential to having healthy plants is also locked up and unavailable. When these nutrients that are good guys are exposed to fluorine (F) as in the fluoride and chlorine (Cl) that are found in our water systems it often turns them into minerals that cement our soil particles together creating hardpan.

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So, the more one waters with municipal water, the more often one will need to aerate and in general the more problems one will have. Additionally, nutrients required by plants like calcium, phosphorus and a few others become unavailable to plants, which weakens the plant leading to poor growth, and increased disease and insect problems.

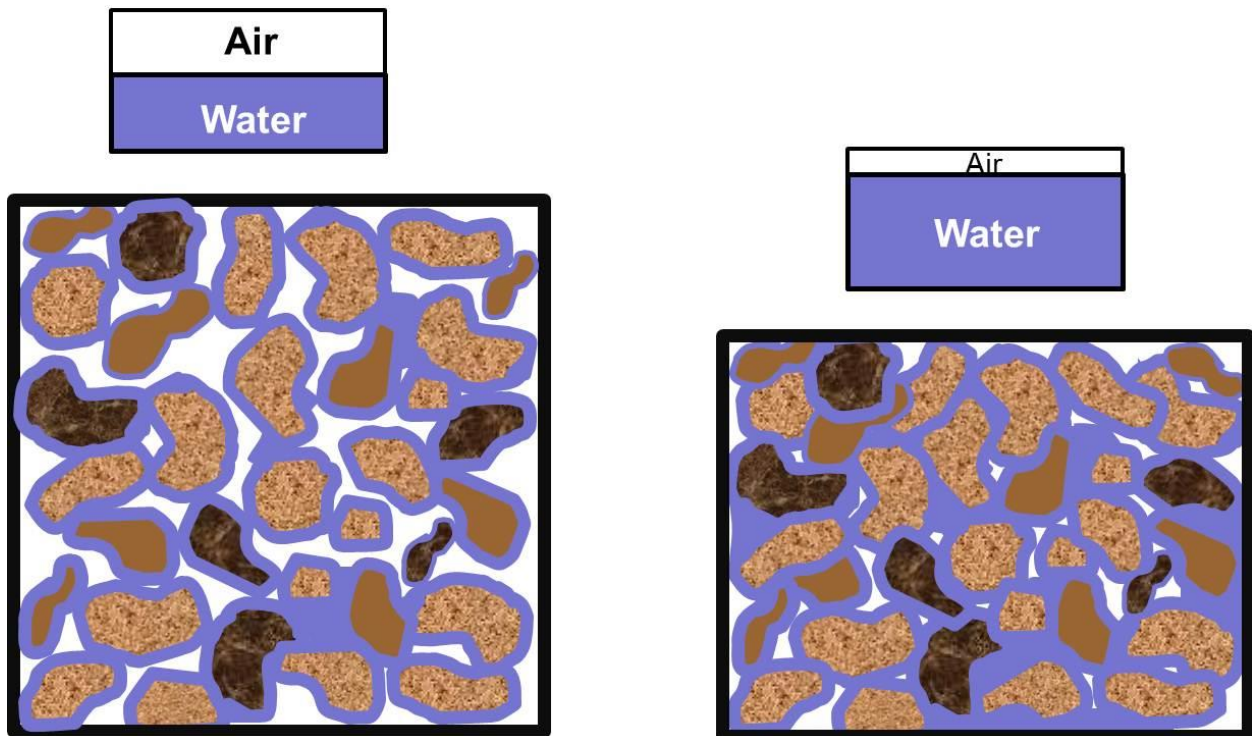
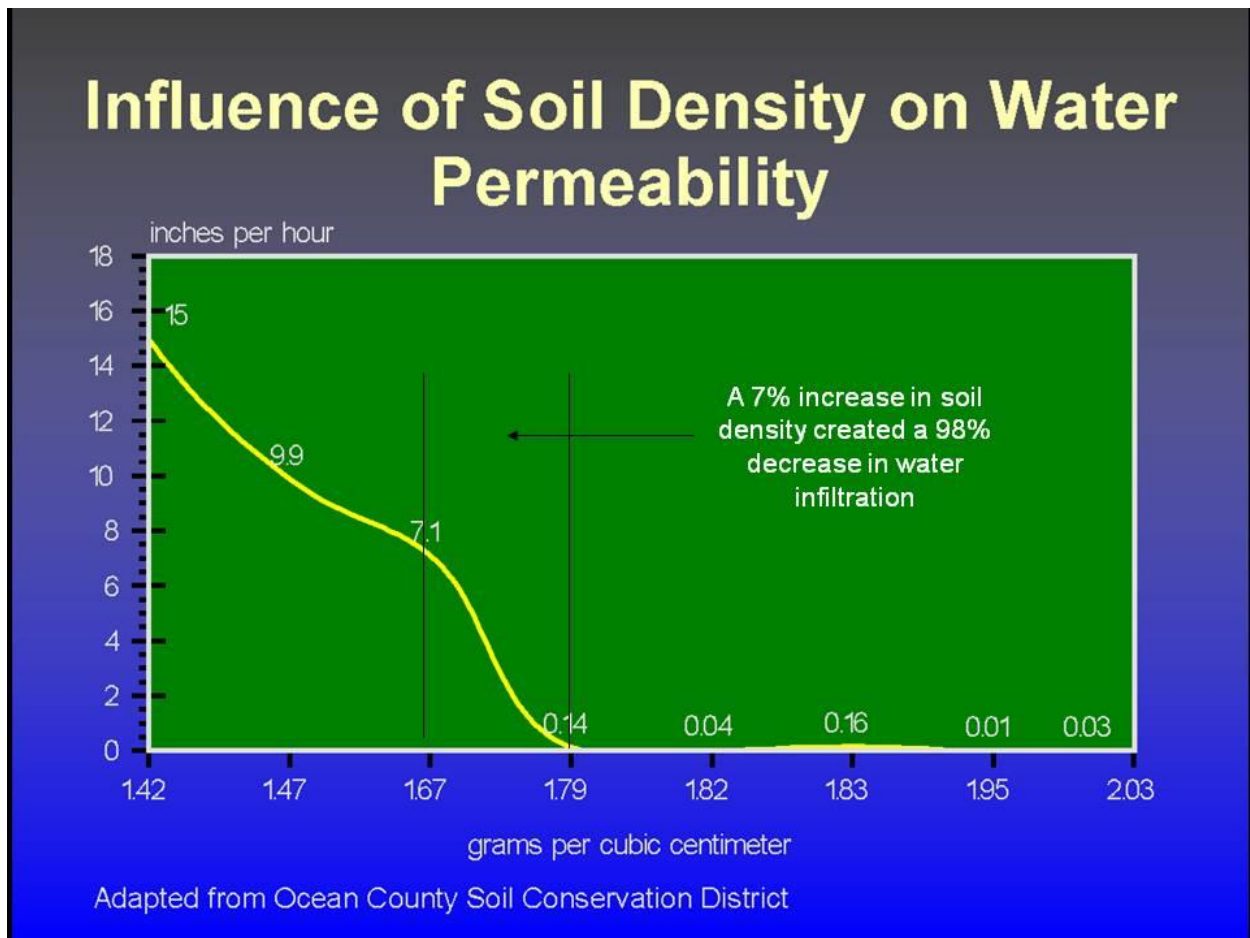


Diagram from the University of Minnesota Extension Service website

Whether from pressure or cementation this diagram illustrates that after compaction there is less room for air and water to move into the soil.

As the chart below indicates, even a small increase in soil density (compaction) results in a huge decrease of water entering the soil that in science is referred to as permeability.



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To prevent compaction there are several things a gardener can do:

1st - use a good compost as it is full of beneficial microbes that fight disease, break up compaction and help plants absorb nutrients.

2nd – only use a good quality organic fertilizer (my favorite is Microlife) and re-mineralize one's soil.

3rd - use a good quality aged (partially composted) native mulch. This will also provide food for microbes that will break up compaction and turn heavy clay into rich loam over time.

4th - water as little as possible with municipal water. If you must use it, one can filter out the chemicals that cause problems. There are hose end filters one can purchase to do this. Best is to use rainwater as that is what plants like best. As one's soil gets healthier more of the rainwater infiltrates the soil and is stored till the plants need it. Rich organic soils are less susceptible to damage from municipal water.

5th - do not use toxic chemicals that kill soil life (herbicides, pesticides, fungicides, etc.) or artificial fertilizers.

6th - do not use dyed mulch as it messes up soil biology, plant nutrition and may contain toxic chemicals.

7th - use mechanical aerators as little as possible and only in extreme cases. There is mounting evidence that the weight of the machines offsets the good they may do. By using compost and native mulch one feeds the microbes and earthworms that provide this service for free.

8th - wet soils are more susceptible to compaction hence do not mow or other activity when soils are wet.

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9th - pay attention to the weather. Common evaporation can also cause dissolved minerals like salts to rise from the sub-soil as the water was removed and recrystallize creating hardpan compaction. We saw a lot of this occurring during the drought of 2011.

10th - repeated wetting and drying of the soil can also lead to destruction of soil health and end in some compaction. Hence, avoid bare ground and use a 3–4-inch layer of aged native mulch. If the soil is not mulched, even raindrops (or drops from sprinklers) can cause a thin layer of compaction to form at the soil surface preventing the air and water from entering the soil.

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