

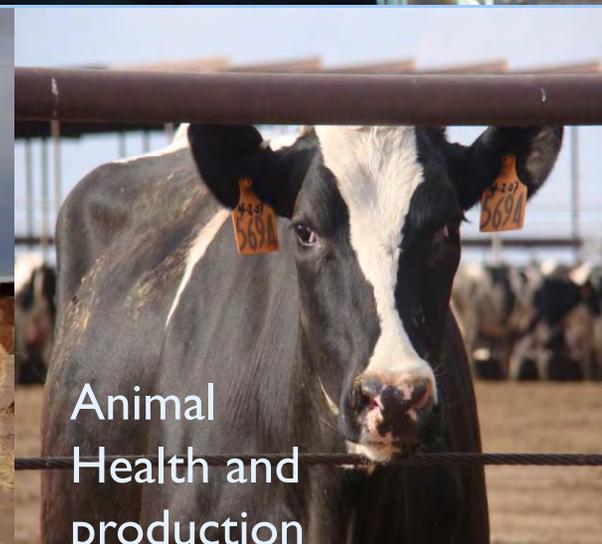
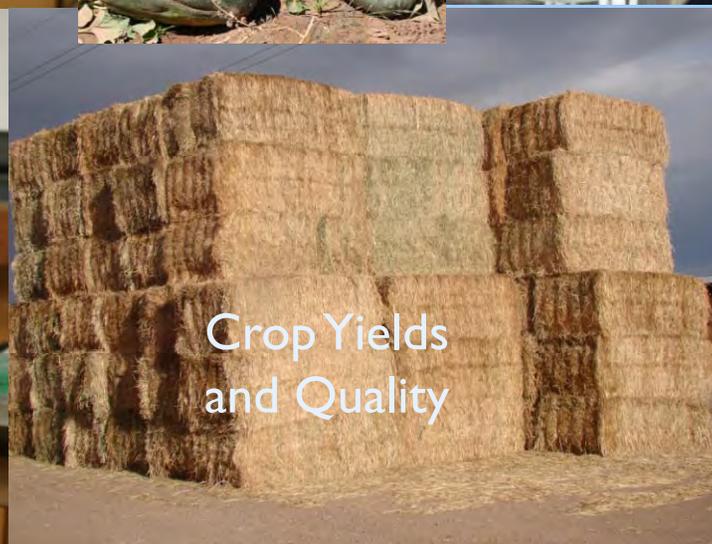
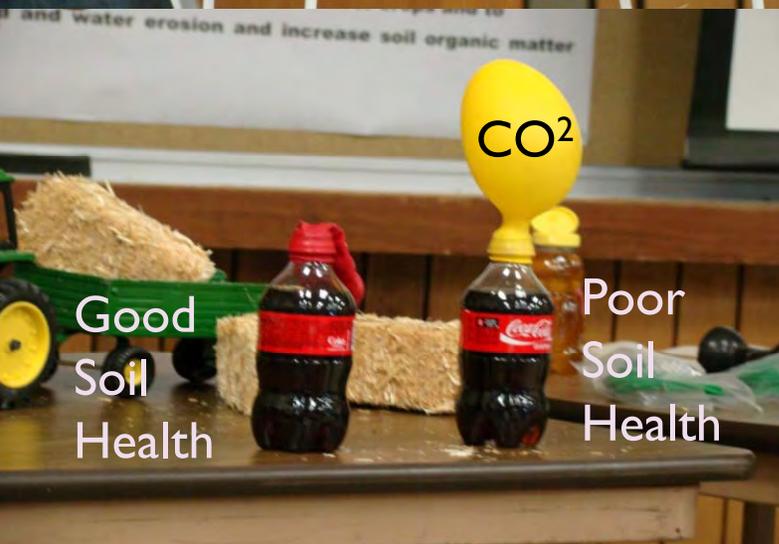
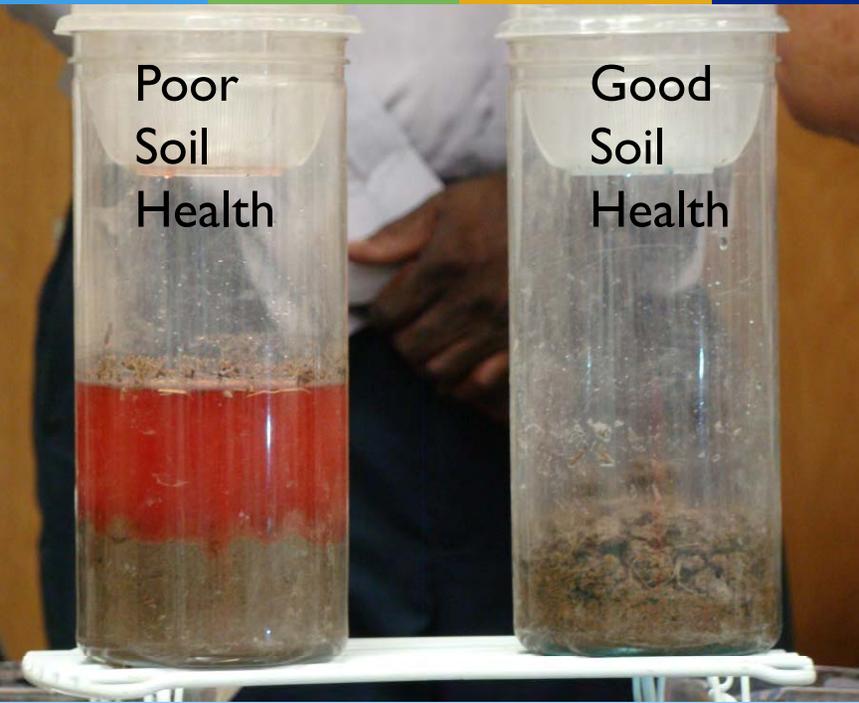
Soil Compaction / Pore Space

Bulk density is defined as the ratio of oven dried soil to its bulk volume, which indicates the volume of particles and the pore space between particles.

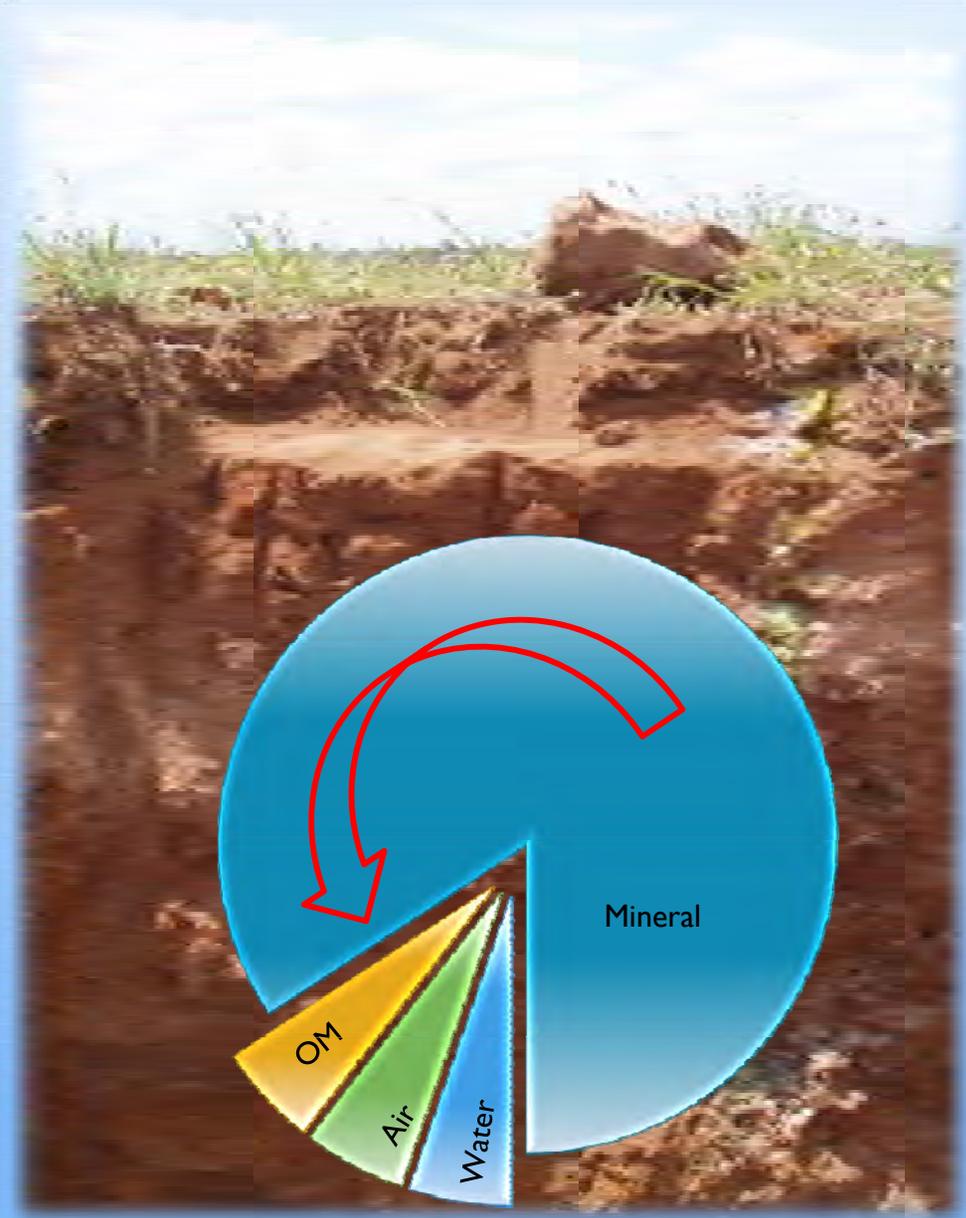
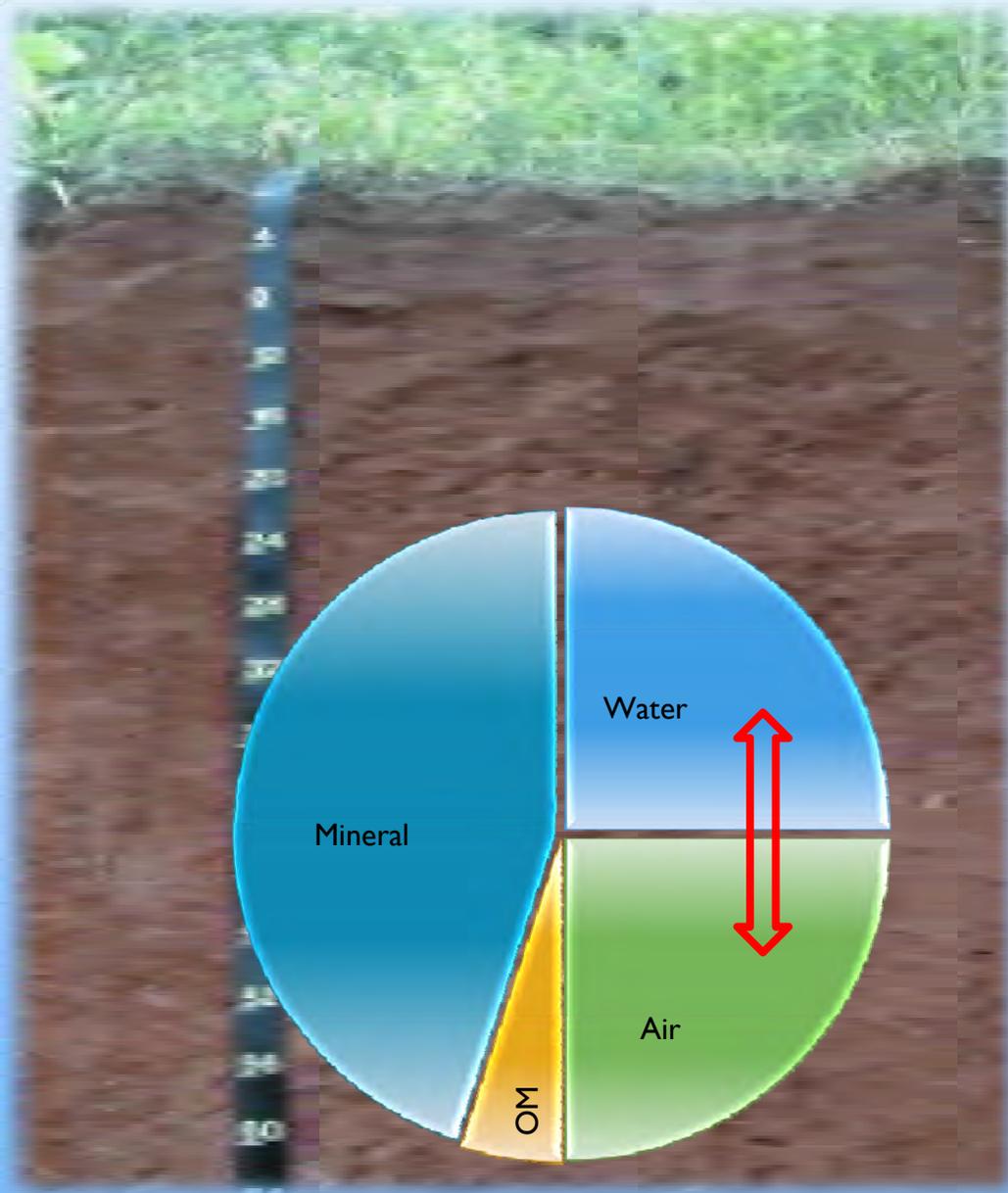
By Clarence Chavez



Aggregate Stability and Infiltration Demonstration



Non-compacted VS Compacted Soil Types



Note: IWM 3 soil data interpretation table for IWM planning can be used also.

Bulk Density Field Testing



Bulk Density (Soil Type Table 4. pg. 57)	Ideal Bulk Densities (g/cm³)	Bulk Densities that restrict root growth
sands, loamy sands	< 1.6	> 1.80
sandy loams, loams	< 1.4	> 1.80
S. C. loams, loams, clay loams	< 1.4	> 1.75
silts, silt loams	< 1.3	> 1.75
silt loams, silty clay loams	< 1.4	> 1.65
S. clays, silty clays, some clay loams (35-45% clay)	< 1.10	> 1.58
clays (> 45% clay)	< 1.10	> 1.47

Soil Penetrometer: Use and Cost



The ideal resistance of your top soil should be less than **200 psi**.

If you take a reading of more than 200 psi in the field at Field Capacity then you may start to have the making of a hardpan or compacted soil.

**Cornell Soil Health Assessment Training Manual
2nd Edition (2009)**

\$150 to \$300 ea.

Soil Penetrometer: PSI Table



10 to 300 PSI

300 to 400 PSI

> 400 PSI

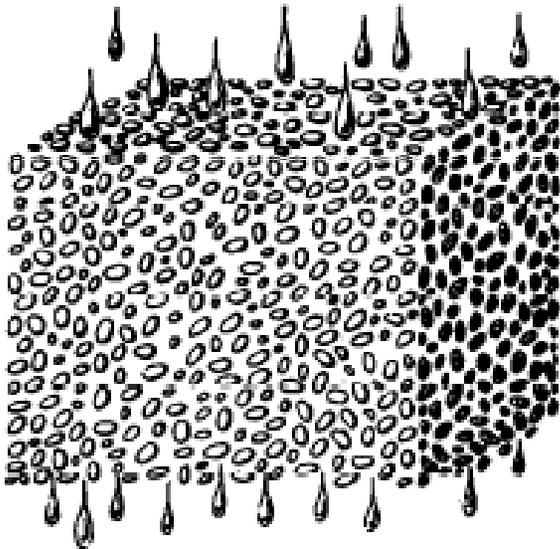
Moisture Content
should be at field
capacity.



Figure 1-3.

Types of Soil Structure and Their Effect on Downward Movement of Water

Single grain



Rapid

Blocky



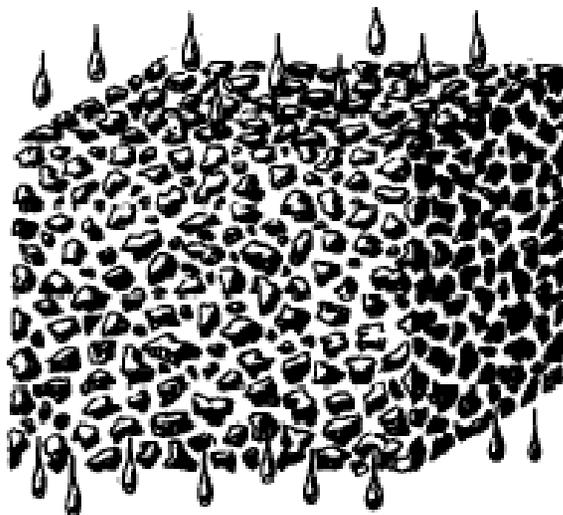
Moderate

Platy



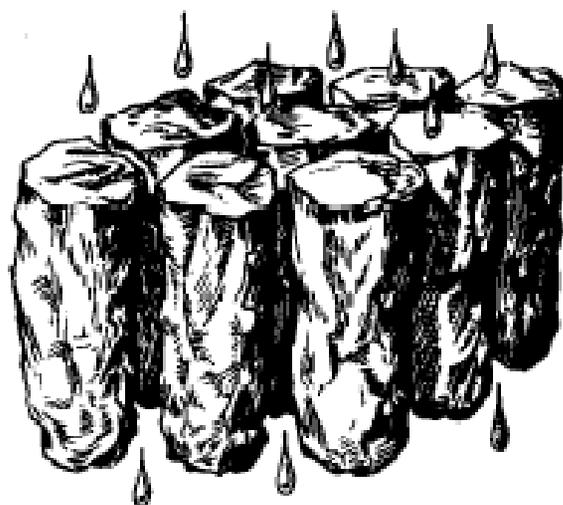
Slow

Granular



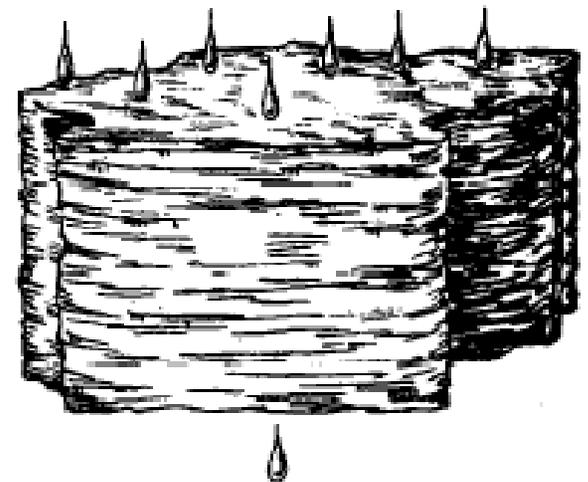
Rapid

Prismatic



Moderate

Massive



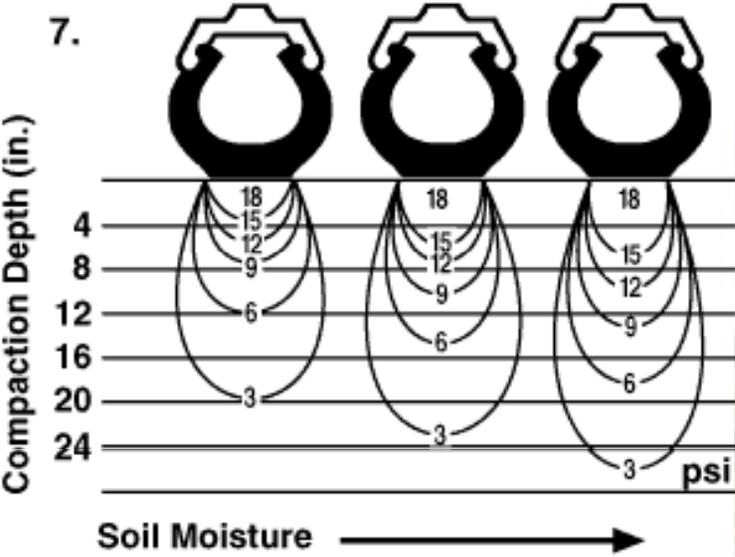
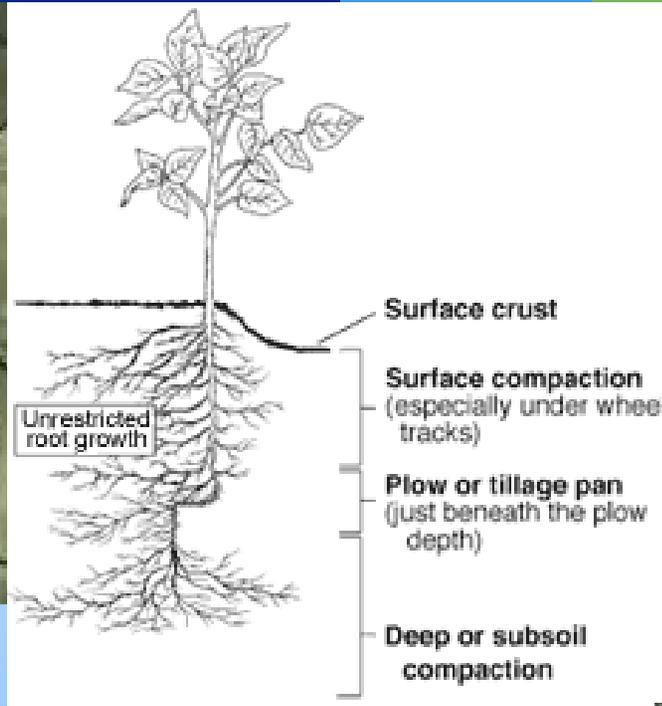
Slow

Bulk Density / Compaction / Intake



The intake rate of the soil under irrigation is affected by many factors such as: Soil Texture, Soil Structure, Compaction, Organic Matter, Stratified Soils, Salts in the soil, Water Quality, Sediments in the irrigation water, etc. Therefore, the above irrigation time can vary for a given application depth and intake family number.

DENSITY EFFECTS DUE TO – Farm Equipment



Raindrop Impact, Tillage Operations, Wheel Traffic and Minimal Crop Rotations

Hydrology and Infiltration rate

(sometimes called intake rate)



Water standing in fields delays planting.

Delayed planting is a delayed harvest.

Cost to the farmers livelihood.



Hydrology and Infiltration rate

(sometimes called intake rate)



A compacted soil:
Will Stunt root growth
and reduces yields.

Increases fuel costs
from trying to break
up hard soils.

Adds stress on
equipment.

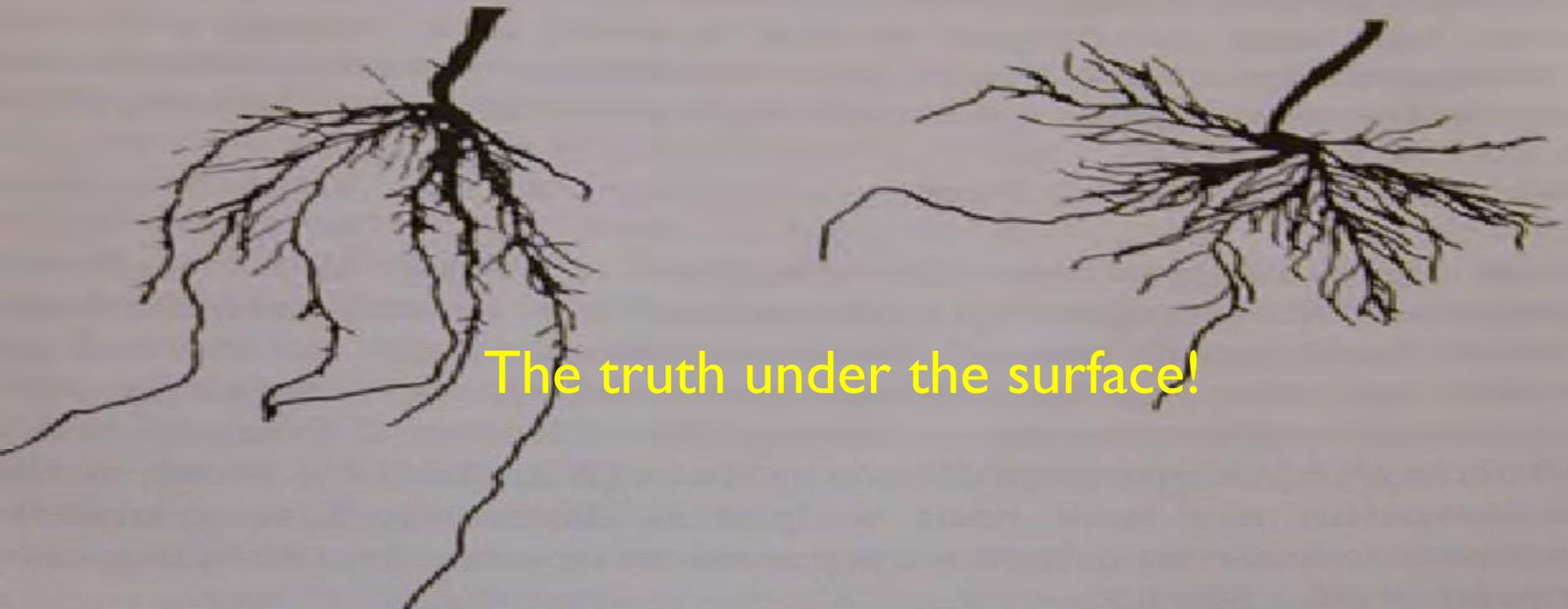
Poor seed germination.

Poor root growth.

Less air getting to the
roots



Review



The truth under the surface!

WHAT ARE THE CONSEQUENCES OF SOIL COMPACTION FOR PLANT GROWTH?

U of Minnesota

1. The effects of compaction on plant growth and yield depend on the crop grown, soil type, and weather conditions.
2. Under dry conditions, slight compaction is beneficial but too much is detrimental to yield.
3. Under wet conditions, any amount of compaction can decrease yields as a result of N losses, reduced K availability, and inhibited root respiration due to reduced soil aeration. Also provides conditions for disease to thrive.

WHAT ARE THE CONSEQUENCES OF SOIL COMPACTION FOR PLANT GROWTH?

U of Minnesota

4. A moderate amount of compaction in the seed zone at planting is desirable in order to provide adequate seed-soil contact.
5. Excessive compaction decreases water infiltration and storage, decreases root growth, reduces the soil volume explored by roots and can reduce crop yields.
6. Depth of compaction increases as both the soil moisture content and axle load increase.

WHAT ARE THE CONSEQUENCES OF SOIL COMPACTION FOR PLANT GROWTH?

U of Minnesota

7. Compaction in the plow layer is largely related to contact pressure of the tire. Compaction below the plow layer is related to total axle load.

8. Surface compaction can usually be alleviated by shallow moldboard or chisel plowing. However, by implementing SHMS (soil health management system) these problems will decrease and become easier to manage.

WHAT ARE THE CONSEQUENCES OF SOIL COMPACTION FOR PLANT GROWTH?

U of Minnesota

9. Subsoil compaction takes years to alleviate.

10. In our region, research studies have shown few cases of positive yield response to sub-soiling and in some cases sub-soiling has decreased yields.

High Soil Bulk Density: gives you

- ▣ Reduction of soil biota
- ▣ Reduce or inhibits root growth
- ▣ Increase soil ponding
- ▣ Increased runoff
- ▣ Increased management costs
- ▣ Increased salt concentrations
- ▣ Etc...

**For more information Please
Contact Your Local Office of the:**

Natural Resources Conservation Service

or

Soil and Water Conservation District



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