Jerry Faulring

Soils Have a Nasty Habit of Moving

I am writing this at the end of June, 2014. Soils have been at their field capacity for moisture for the last several weeks, actually oozing water in places. We have not seen these conditions since 2003 when we received 56 inches of rainfall for that year. Every little rain causes run off and ponding in low areas. Soils are on the move. Most growers include grassed perimeters and isles to stem soil loss from the site, but when the soil moves from planting areas to grassed areas, long term growing soil quality is diminished. A serious problem results in exposed root flares in areas of wash, and buried root flares in erosion receiving areas.

(continued on page 30

(continued from page 29)

Soils move, so erosion is common for several reasons:

1. Rate of rainfall exceeds a soil's ability to absorb the water
2. High water table
3. Slope or topography
4. Lack of vegetation
5. Compacted and or poorly drained soils limit infiltration

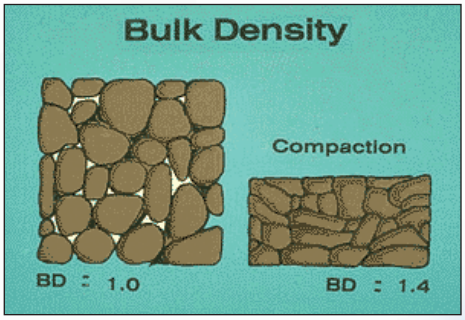
We cannot control the rate of rainfall, but we can control all other variables. A high water table may be a challenge if a drainage tile cannot be installed. The slope can be managed by planting perpendicular to the slope with grassed isles installed between rows or blocks; and vegetation in the form of cover crops can provide vegetation. Lastly, compacted soils can be improved through improved tillage systems and by using equipment only during ideal soil moisture periods.

Compacted Soils

Compacted or poorly drained soils become apparent during periods of high and persistent rainfall such as the ones we saw this spring. This is a great year to find those areas and work to resolve them.

A soil penetrometer is an inexpensive but very important tool for studying soil compaction. It can help you easily determine where you stand with regard to managing your soils.

Some labs perform bulk density testing, but you can learn how to do the test yourself by searching 'calculating bulk density of soils' in Google. Bulk density is the weight of soil in a given volume. Soils with a bulk density higher than 1.6 g/cm3 tend to restrict root growth. Bulk density increases with compaction and with depth.



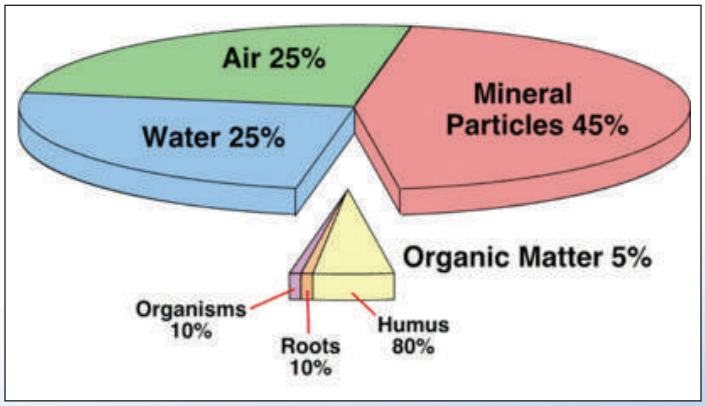
Symptoms of Compacted Soils in Nursery Production

1. Surface water remains for long periods after rainfall or overhead irrigation. A 'long period' is thought of as greater than 24 hours.
2. Equipment tracks holding water.
3. Premature foliage drop in any season, but excessive in the fall.
4. Variable plant productivity in the same row or block. Inconsistent plant development such as bushy growth when not the norm, a range of leader development, the wrong foliage color, and smaller than normal leaves can all be symptoms of compaction, but may also be signs of high or low nutrient values or pH problems.
5. Increased wind and water caused soil erosion.
6. We find ourselves thinking the tractor is loosing horsepower when in fact compacted soils require more horsepower to work.
7. Not seen before weeds start showing up and our old favorites disappear.
8. Irrigation water runs off prematurely instead of infiltrating to the roots where needed.
9. More mosquitoes than you remembered in previous years.
10. Increased sucker production on many different trees.
11. Plants show stress more readily in dry periods.
12. Pests such as Ambrosia Beetle are attracted to plants that are growing in high moisture areas.
13. Increased denitification in the anaerobic environment can lead to the loss of natural and synthetic nutrients. This may be difficult to detect as other symptoms may cause confusing results but lack of plant vigor is occurring due to the lack of available nitrogen and oxygen.

The take away message is that roots grow between the soil particles. If the particles become compressed, water, oxygen and pore spaces are squeezed out. (see graphic top of page 31)

Productive silt loam soils will contain 45- 50% soil particles, 20-25% air space and 25-30% water. The roots consume oxygen. When oxygen is absent because the pore space was crushed out of existence (compaction), plants will not flourish. Many plants will

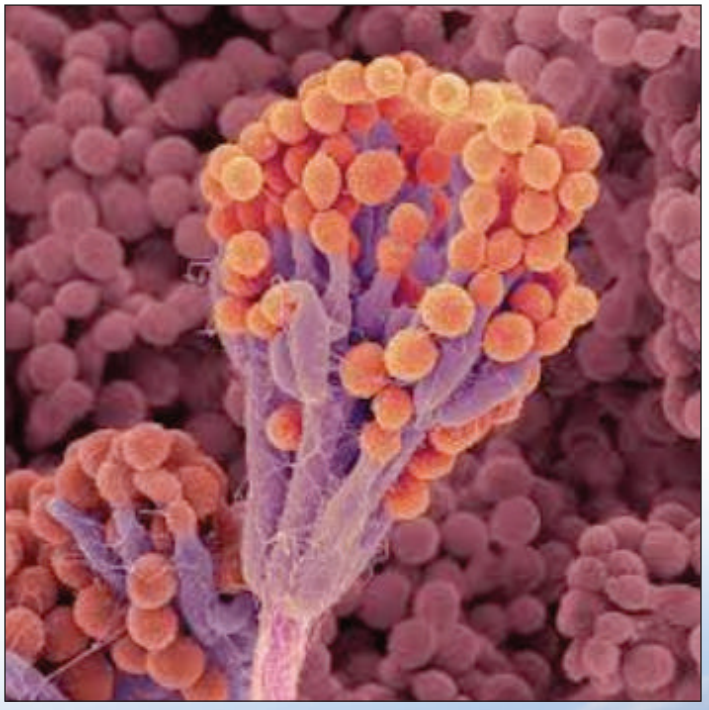
start to decline within 48 hours of having their roots flooded with water but the decline may not become obvious for months or years. Similarly, plants stressed for lack of water and oxygen due to compaction may not die for years or until a significant additional stress factor becomes involved. As a result, we will not be able to maintain the perfect relationship year round due to variation in weather cycles. However, the goal is to do so. Anything we can do or not do that nurtures the ratio will serve our best interest. The most important factor for maintaining the relationship is to avoid soil compaction by implementing every tool and practice available that still fits into an economically viable production system.



I came across a research paper related to soil compaction and its affect on corn production. The research showed that heavy compaction of silty clay loam soil reduced corn yield from 200 bushels per acre to 85. Is it possible that we could see a 50% decline in the productivity of horticultural crops due to soil compaction? Most definitely.

Improved Tillage Systems

In 2004 we began modifying our soils though the use of a spading machine and amendment with compost. I have written and spoken about this system extensively and will not revisit it at this time except to say that our initial findings are still true today. We know that for most plants we have seen about 40% increased growth rates with reduced pruning as compared to our previous growing system. The improved growth rates are the result of increasing the level of oxygen and increased deep pore space from the tillage system, which thus leads to improved drainage.



It is known that roots maximize their productivity and efficiency at an optimum soil temperature of 68 degrees F. Not surprisingly, that is the same temperature preferred by soil microorganisms.

(continued on page 32)

(continued from page 31)
That which lives invisibly beneath the soil allows our plants to thrive. Encouraging and protecting this vital resource insures our success.

Cover Crops

I believe the next big challenge toward the goal of making soils stay put relates to cover crops. Use of cover crops has been around almost forever but it has not been well received within an existing planting by nursery managers. I have avoided the use of cover crops due to equipment investment requirements. One way to partially solve the problem is to grow only single rows with grass isles on either side and to plant perpendicular to the slope. A common practice for many growers seeking better land utilization, including us, is to plant several rows in a block with the blocks separated by grass isles. This exposes a significant amount of bare soil, assuming no weeds, to erosion. It also causes the soil to heat up which reduces microbial activity down to a depth where microbes migrate to find cooler temperatures and moisture. A solution appears to include the aggressive use of cover crops until the plants reach a size whereby they can successfully dampen the affect of heavy rains and soil heating. (see examples below)

Another option is apply mechanically stable mulch. This is cost prohibitive except in small areas where very high value crops are grown over a period of many years. We did this for three blocks about ten years ago. The soil organic matter increased from 2.5% to 7% over several years, there was no soil erosion at all, there was zero requirement for irrigation and the plants thrived; however, it was cost prohibitive….I think. Sometimes what we think is expensive is really a bargain long term.

The wrong cover crop could impact growing conditions by robbing the soil of nutrients and water at the expense of the desirable crop. Some cover crops put nitrogen into the soil and some attract predator insects while one like forage radish will bore deep holes in the soil, die with the first frost and deliver nutrition back the desirable plants.

Much work has been done for nursery cover crops. Dr. Paula Shrewsbury, et. al. conducted a three year research program with a SARE grant. There is much useful information at: http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewProj&pn=LNE08-274.

My dream cover crop would:
1. Control soil erosion,
2. Be 12 inches tall, or less, so as to not take away from visual marketing of the saleable plants,
3. Attract predator insects,
4. Be perennial to avoid annual seeding,
5. Be effective in cooling the soil while not robbing nutrients and water, and
6. Finally, I would like it to have a very pretty flower; I can dream!

Jerry Faulring
Waverly Farm
1931 Greenfield Road
Adamstown, MD 21710
301-874-8300