



Soil Compaction: What Can You Do?

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As you start heading back into the fields this spring, try to think about reducing your soil compaction. As the weight of farm tractors and field equipment becomes larger and heavier and as the annual precipitation increases in Minnesota, there is a growing concern about soil compaction. Soil compaction can be associated with a majority of field operations that are often performed when soils are wet and more susceptible to compaction. Heavy equipment and tillage implements can cause damage to the soil structure. Soil structure is important because it is the number one defense the soil has against compaction and it determines the ability of a soil to hold and conduct water, nutrients, and air necessary for plant root activity.

Myths about Soil Compaction

There are two wide spread myths about compaction; 1.) Freeze-thaw cycles will alleviate a majority of soil compaction created by machinery, and 2.) What compaction “Mother Nature” does not take care of, deep tillage or subsoiling will alleviate.

Although soils in this region are subject to annual freeze-thaw cycles and freeze to depths of 3 feet or more, only the top 2 to 5 inches will experience more than one freeze-thaw cycle per year. The belief that freeze-thaw cycles will loosen compacted soils may have developed years ago when compaction would have been relatively shallow because machinery weighed less and grass and legumes were grown in the rotation.

Both heavy axle loads and wet soil conditions increases the depth of compaction in the soil profile. Compaction caused by heavy axle loads (greater than 10 tons per axle) on wet soils can extend to depths of two feet or more. Since this is well below the depth of normal tillage, the compaction is more likely to persist compared to shallow compaction that can be largely removed by tillage.

While deep tillage (greater than 18 inches) is capable of shattering hard pans created by wheel traffic, it has not been proven to increase yield consistently or for long periods of

time. In the Midwest, research results have shown few positive yield responses to subsoiling, and when they occur, are variable and relatively small. It is difficult to accurately predict the effects from subsoiling because of differences in soils, degree of subsoil compaction, soil moisture, future traffic, weather conditions, and differences in the crop grown and in tillage methods.

Tire Inflation Pressure (psi) versus Axle Load

Tractors equipped with either tracks or tires can create surface compaction. The question is “Which one creates the least amount of compaction”? The answer: both radial tires, properly inflated, and tracks will result in similar surface compaction.

Tractors weighing less than 10 tons an axle usually keep compaction in the top 6-8 inches, which can be alleviated by tillage. By and large, even the biggest tractors weigh less than 10 tons an axle. However, full combines, slurry tankers, and grain carts weigh much more (between 20 and 40 tons an axle) and whether equipped with tracks or tires, can create compaction as deep as 3 feet.

Compaction in the surface layer (6-8 inches) is largely related to the **inflation pressure (psi)** of the tire while depth of compaction is related to **total axle load**. This is important when comparing tracks and tires for compaction effects and depth.

Tracks exert a ground pressure of approximately 4-7 psi depending on track width, length, and tractor weight. Radial tires exert a pressure of 1-2 pounds higher than their inflation pressure. For example, if a radial tire is inflated to 6 psi, the tire exerts a pressure of 7-8 psi on the soil. Since tracks and tires carry similar loads and have low soil pressure, they both exert similar stress onto the soil.

Management Strategies

One of the most important factors for decreasing the potential for soil compaction is staying off the soil when it is wet. Since farmers have a small window of opportunity for planting their crops, this is not always possible. Other effective strategies are to maintain proper tire inflation rates and decrease axle loads. Radial tires can be inflated as low as 6-8 psi. Check with your dealer to establish the proper tire pressure for your tractor. Before using any equipment in the field make sure to check your tire pressure. Not only does this help reduce soil compaction, it also improves tractor efficiency.

Your soil is one of the most important factors when growing a healthy crop. Preventing soil compaction will increase water infiltration and storage capacity, timeliness of field operations, decrease the stress on plant roots, and decrease disease potential. By simply inflating your tires to their proper air pressure, you can reduce surface soil compaction and by reducing axle loads, it will reduce the depth of compaction in the soil.