Under Pressure: Managing Manure Application & Field Compaction

Manure Management Update 2015
Lethbridge, Alberta
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Scope

- Presentation will discuss methods to manage agricultural equipment to avoid soil compaction
  - Some specific to manure application
Axle Load

Source: University of Minnesota
Limit axle loads

- Limit axle loads to 10 tons and preferably 6 tons
- Increase the number of axles on implements to reduce the load on each axle
Contact Pressure

- Lower contact pressures reduce soil surface compaction
- 10 psi

Source: Penn State University
850/50R-30.5 Tire

16 psi

25 psi
Limit contact pressure by using

- Lowest allowable tire pressure
- Flotation tires
- Radial ply instead of bias ply tires
- Larger diameter tires to increase tire footprint
- Tractors with 4WD, FWA, Tracks or Duals.
- Tractors that are properly ballasted
Wheel Tractor

Each axle causes a pressure spike

Source: Modern Corn and Soybean Production
Tracked Tractor

Each axle and roller causes a pressure spike

Source: Modern Corn and Soybean Production
Tracked Tractor

- Tracked tractors cause the same compaction at the same total vehicle load as tire-mounted tractors
- Advantage of tracks
  - Flotation
  - Pulling power
- Advantage of tires
  - Steering
  - Cost
Other ways to avoid compaction

- Travel over a lower percentage of the field
- Concentrate repeat traffic in travel lanes
- Drive faster to shorten load dwelling time
Solid Manure Spreaders

Vertical Beaters
Hose Drag System
Automatic Air Inflation Deflation (AAID) System

- Allow operator to lower pressure in field and raise pressure on road
- Rapid deflation to limit idle time

PTG

AgriBrink
## Flotation Tires

Load, inflation and speed table for 710/40R22.5 flotation tire

<table>
<thead>
<tr>
<th>Pressure (psi)</th>
<th>Recommended load (lbs)</th>
<th>Static</th>
<th>6</th>
<th>16</th>
<th>19</th>
<th>25</th>
<th>31</th>
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</table>
Key Points

• Limit Soil Compaction
  - Keep axle loads below 10 tons and preferably below 6 tons to prevent subsoil compaction
  - Keep tire pressures as low and tire footprints as large as possible to prevent topsoil compaction – 10 psi
  - Use a drag hose system to inject liquid manure
  - Use an automatic AAID System
Agricultural Soil Compaction: Causes and Management

Soil compaction can be a serious and unnecessary form of soil degradation that can result in increased soil erosion and decreased crop production.

Compaction of soil is the compression of soil particles into a smaller volume, which reduces the size of pores available for air and water. Most soils are composed of about 50% percent solids (clay, silt, sand) and 50% percent pores. High compaction can reduce the size of pores to 30% or less, which reduces water infiltration rates and decreases the amount of air available in the soil for crop yield and root growth.

Compaction concerns

Soil compaction can impact water infiltration into soil, crop management, root penetration and crop nutrient and water uptake. All of which result in impeded crop yield.

Highly compacted soil can be the result of using heavy equipment during soil agricultural or erosion. Compacted soils can also be the result of reduced soil nutrient processes. Nutrient soils can reduce the amount of annual soil compaction (see: Alberta Agriculture’s Research/Agri-315A, Management of Soil Fertility).

The following section will review the various types of farming induced compaction, the causes and consequences of soil compaction and prevention and management.

Effects of soil compaction

The massive forces of soil compaction by agricultural equipment can cause soil particles to become compacted closer together into a smaller volume. As particles are compacted tighter, the space between particles (pore space) is reduced, thereby reducing the space available to the soil for air and water. The compaction force may cause the crushing of soil aggregates, which has a negative effect on soil aggregate structure.

Soil compaction can have a number of negative effects on soil quality and crop production including the following:

- Increases the potential for water, wind, gales, and wind erosion.
- Reduces the ability of a soil to hold water and air, which are necessary for plants root growth and function.
- Reduces crop emergence as a result of soil compaction.
- Increases root growth and limits the volume of soil exploited by roots.
- Limits soil exploration by roots and decreases the ability of roots to take up nutrients and water efficiently from soil.
- Decreases crop yield potential.

Compacted soil will restrict root growth and penetration into soil. This situation can be created by leaving cohesive clods or plant debris on the surface of soil. Compacted soils can be improved by using a cover crop or tilling after the crop is removed. If the soil is already compacted, leaving a cover crop of plants on the surface can help to loosen the soil and improve soil structure.

Avoiding Soil Compaction

Source: ARD

Source: Penn State University