Taking Care of Your Soil

Tyre Setup

Iain Johnston
Cafre Crops Development Adviser
Why worry about tyres?
– Soil Compaction
– Efficiency
– Traction
“Soil compaction is the consolidation of soil particles into closer proximity with each other. This reduces pore space, soil aeration and natural drainage.”

- **Two forms of compaction:**
  - Surface compaction
  - Subsoil compaction
Causes of Soil compaction

• **Surface Compaction**
  – Impact energy of rain on bare soils
  – Contact with light machinery

• **Subsoil Compaction**
  – Heavy machinery
  – High axle loadings
  – High tyre pressure
  – Soil type
  – Soil moisture
How compaction affects yield in spring barley

![Graph showing the effect of soil bulk density on grain yield of spring barley.](image)

**Fig. 3.** Effect of soil bulk density on grain yield of spring barley.
80% of damage done on the first pass

Water Infiltration

Chyba, 2012
85% of land is trafficked annually in a plough based system
Effect of Axle Load

Inflation Pressure 12psi

Axle Load

Compaction Depth (in.)

300kg  500kg  750kg  1000kg

psi
As vehicle weight increases, so does the depth to which compaction penetrates, regardless of the pressure at the surface.

Timeline from the 1930s to the present day

- 2.5 t vehicle
- 850 kg Horse
- 11.2-28
- 12.4-36
- 16.9-34
- 18.4-38
- 16.9 R 34
- 710/70 R 38
- 800/65R32
- 1050/50R32

33 t vehicle
Effect of Soil Moisture

Effect of soil moisture on load penetration under a tractor tire. (Tire size 11-28 inches; load 1,650 lb; inflation pressure 12 psi.)

Source: USDA, adapted from Soehne 1958.
How to reduce compaction

**Solutions ?**

- Adjust tyre pressures to recommended settings
- Keep axle loadings below six tonnes
- Increase organic matter
- Fewer passes
- Wider tramlines
- Controlled traffic farming
Footprint size and pressure

• 600/65R38
  – 0.6 bar 397cm²
  – 1.0 bar 307cm²
  – 1.6 bar 286cm²

• Almost 40% larger footprint at 0.6 bar

• Measured on flat surface.

• The difference will be greater in soil.
Traction

Drawbar Pull at Three Inflations — 710/70R38

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<th>Tyre Load</th>
<th>0.6 bar</th>
<th>0.85 bar</th>
<th>1.2 bar</th>
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<td>2750 kgs</td>
<td>3220</td>
<td>2990</td>
<td>2810</td>
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Tyre Load = 2750 kgs
## Ohio State University Field Results

<table>
<thead>
<tr>
<th>Tractor</th>
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<th>Fuel Use</th>
<th>Time</th>
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Tyre Technology

- **Increased Flexion (IF)**
  - The same load at 20% lower pressure

- **Very Increased Flexion (VF)**
  - The same load at 40% lower pressure
Central Inflation
Conclusion

• “Make the most of what you’ve got”
• Know axle weights with different implements
• Check tyre pressures on current equipment
• Be prepared to adjust pressures for field use
• Use the lightest equipment you can
• Consider options when upgrading tyres
• Assess ground conditions
“The development of agricultural machinery can be considered as almost completed”

The Director of the Agricultural Academy of Hohenheim, Germany, 1893.