Case Study:

Reducing Compaction at Mertoun Estate

Mertoun Estate manages 1,800 ha of cereals, oilseeds and potatoes across four farming units in the Scottish Borders.

Jack Parsons is the Estate Farm Manager and understands the importance of reducing soil structural damage from large machinery.

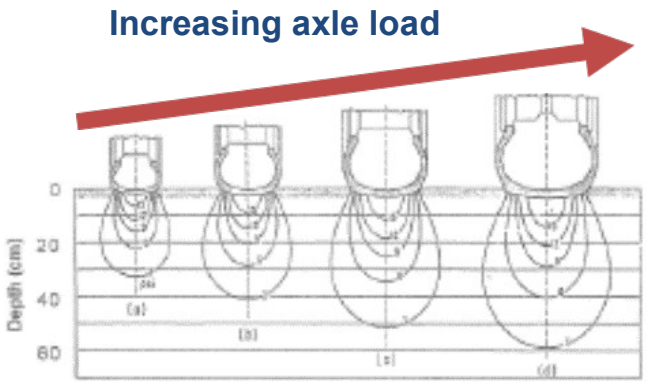
Managing Soil Structure

Many growers are good at managing the nutrient status of their soils but how many look deeper by digging a hole and taking a look at the structure of their soil or checking levels of organic matter?

Soil can be easily damaged by tyres and the interaction of the metal of establishment machinery with the soil and the resulting compaction will reduce crop yield. At a recent farm meeting guest speaker independent soil and cultivation consultant Philip Wright stated ***'prevention is preferable to cure,'*** when it comes to caring for your soil structure.

Compaction occurs when the air within the soil is compressed. Below ground this reduces the pore space which will result in poor nutrient exchange, impacting on field drainage with reduction in infiltration and passage of water as well as restriction of root development through the soil. Above the soil waterlogging may occur causing increased run-off and risk of soil erosion and associated environmental damage.

Soils with higher levels of organic matter are naturally more resilient to the impacts of cultivation and wet weather and are also likely to support a greater level of soil life be it bacteria, Mycorrhizal fungi or worms. Organic matter in a mineral soil should be greater than 2% and ideally 5-6% in a mineral arable soil.



Tyres transfer the weight of the tractor and equipment onto the soil surface. Axle weight and tyre pressure are key factors which influence soil compaction.

A poorly balance tractor will transfer greater weight through one of the axles, equally high tyre pressure will transfer compaction to greater soil depth.

The pressure exerted on the soils varies depending on the tyre pressure. A higher tyre pressure has more vertical stress compared to a low pressure which applies less pressure to the soil. If the vertical stress is too great it restricts root development and penetration.

The pressure of the tyre is more important than the weight of the vehicle. Dispersing the weight with a lower pressure across a greater area has the least amount of soil damage. Keeping a tyre pressure of 1.1bar (15psi) will minimise the compaction impact on crops. Drilling with lower pressure tyres also improves the consistency of the drilling depth giving a more even and competitive crop.

Wheelings caused by the drilling tractor has been commonly found to cause a 15% yield reduction compared to the untrafficked yield. Consider the example of a 3m drill width with 750mm tractor tyres giving a potential compacted tyre width of 1.5m with a yield reduction from tyre compaction occurring across 50% of the field. On a 10t/ha crop a 15% yield penalty over 50% of the area is worth £100/ha with higher reductions occurring on field end-rigs.

Tractors have continue to get bigger and heavier which in turn can put more pressure on the soils. Dual wheels have been successfully used for many years to spread axle weight over a wider area. New advancements in tyre technology and design allows single tyres to be run at lower pressure without damaging the tyre wall. The wider tyres footprint at low pressure helps to disperse the weight and reduce the depth of damage.

Mertoun Estate

Whilst the financial benefits from reduced compaction are clear retrofitting low pressure tyres to an existing tractor can be expensive. It is more cost effective to select the correct tyre when replacing a tractor. When considering a replacement drilling tractor for the 8m Vaderstad Rapid drill, Mertoun Estate farm manager Jack Parsons made a

point of discussing tyre selection with his supplier.

Previously they ran the drilling tractor on dual wheels which incurred down time when moving from farm to farm as the duals needed to be removed. Jack opted for a Michelin AXIOBIB 1F 900/65 R46 to be fitted. With the new setup the area of tyre foot print in contact with the soil has increased when compared to the duals and the tractor road width is no longer an issue.

The tyre manufacturer's agent also help to set operating pressures for different tasks. Each axle is weighed and the optimum low pressure is calculated.

Road work requires a higher tyre pressure to reduce rolling resistance.

The new drilling tractor has the following tyre pressures.

Tractor Tyre Pressure in bar (psi)

	Front	Rear
Road work	1.5 (22)	1.3 (19)
Field work	1.0 (14.5)	0.9 (13)

Smart Technology

The manufacturer of the new Mertoun drill tractor has gone a step further by fitting an integral tyre pressure system which allows tyre pressure to be automatically adjusted by the press of a button on the operators screen monitor.

Reducing compaction may seem expensive, but the prevention of compaction is rewarded by an even crop yield and ultimately generates better returns.

For further information about soil management visit www.fas.scot

To access the "Soils and tillage podcast: an interview with soil cultivation consultant, Philip Wright", visit www.fas.scot/?p=19490

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