

## Choosing tyres to minimise soil damage

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The average size of tractors has increased over recent years and heavy tractors increase the risk of compaction damage. One way of reducing this potential damage is to fit larger tyres that operate at lower inflation pressures. But how much larger and how effective will any alternative tyre be in reducing damage? The choice of the right tyre is not simple and depends on both technical and commercial factors. SAC has a tyre selection service that helps farmers to make the right choice.

### Compaction and soil damage

Soil compaction has serious effects on agricultural production and damages the environment. Soils in wet areas are especially prone to damage and some soils are more sensitive to compaction than others.

Over compaction:

- reduces crop yield and quality
- increases the number and depth of cultivations needed
- increases harvesting problems
- increases wear on tillage machinery
- increases runoff and erosion.
- reduces the efficiency of nitrogen fertiliser use.

Nitrogen unused by the crop will cause water or air pollution.

Moderate compaction causes overall yield losses of 5% or more. On an average yield of 5 tonnes of barley per hectare (40 cwt per acre) at £100 per tonne, gross margins will be reduced by £2500 per annum on 100 hectares. An investment in tyres which minimise compaction will be recouped in two to three years, depending on the costs of the new equipment. This does not take into account the costs of the other consequences of compaction, listed above. On grass, yield losses may be similar to cereals but the reduction in gross margins would be less. When the compaction problem is more severe, the benefits are greater and the payback is faster.

Tramlines concentrate compaction and minimise its impact on yield but they are not useful for the most damaging operations, such as potato harvesting.

### Choosing the right tyre

Ground pressure is the main factor that determines *topsoil* compaction. We can reduce ground pressure by fitting larger tyres that run at a reduced inflation pressure. Wheel-slip is also an important factor that influences compaction damage.

The weight on the tyre, and not tyre size or inflation pressure, largely determines *subsoil* compaction. This seems contrary to what one would expect but we have shown experimentally that it is true. So if compaction extends into the subsoil there is no point in only changing tyres: you need to reduce the weight on each tyre. Possible solutions are to empty trailers before they are completely full or use multi-axle vehicles.

Besides compaction, there are other technical aspects that we must consider when choosing tyres. For instance:

- The overall diameter must be no smaller than the original.
- For four-wheel-drive tractors, the ratio of the diameters of front and rear tyres must be retained.
- The load carrying capacity and maximum operational speed of fully laden tyres must also be considered.
- The width of the tyres might be a significant feature for access through gates and for ploughing.
- The amount of road work required might also influence the final choice of tyre.

**SAC has developed a computer program that compares the soil compaction caused by different wheel systems and vehicle designs. We use this program to help us evaluate the likely benefits of alternative tyres in individual situations.**



Figure 1 Soil erosion associated with compaction

## A practical example

Figure 2 illustrates results from the compaction program. The problem here was to reduce the compaction caused by the rear wheels of a 60 kW (90 hp) tractor, fitted with standard 16.9R38 tyres, which was spreading slurry on wet grassland. We identified three alternative low profile tyres from manufacturers' tyre catalogues. In order of increasing width they were 600/65R38, 680/75R32 and 800/65R32. We used the program to estimate the compaction that each tyre is likely to cause. Figure 2 shows that the 600/65R38 tyre would cause slightly less compaction than the standard tyre. It would also be relatively cheap and would fit on the existing rims. Both the other alternative tyres would need new rims but they would reduce compaction even more.

The difference between the two widest tyres is small, so the 680/75R32 would probably be the best buy overall. The most suitable tyre would depend on the severity of the compaction problem, how much the farmer would lose as a result and his willingness to invest in alternative tyres. For this example we have looked at the tractor tyres only. In a real case, we would also consider the additional compaction caused by the tyres on the slurry tanker.

It is best to consider these options before buying new machinery. At that time it is possible to purchase a tyre and wheel rim combination for maximum future flexibility and avoid the cost of having two sets of tyres or rims.

## What we can do for you

SAC specialists can offer guidance on all aspects of choosing alternative tyres to reduce soil damage. To optimise selection, the following information is required:

- the type of equipment in use
- tyre sizes and inflation pressures
- what crops and operations cause problems
- the area affected and the severity of the problem
- any preferences for alternative tyres
- soil type

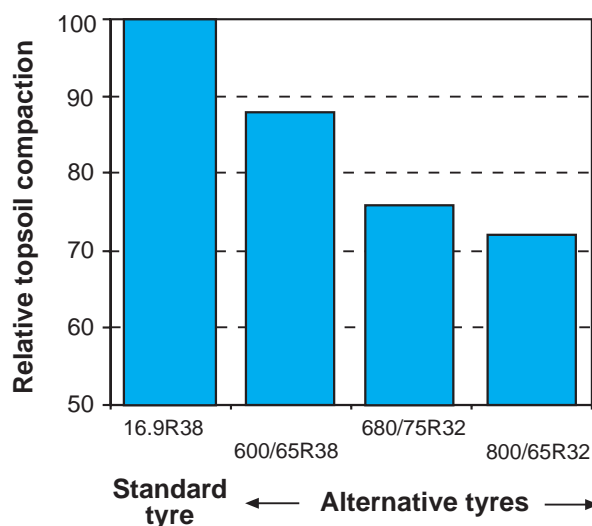


Figure 2 Compaction predicted by the program for four alternative rear tyres

SAC will provide a report of the tyre options applicable to your query. For example, the merits of duals or large single low-profile tyres on tractors for spring cultivations can be assessed. We can also assess alternative undriven tyres, such as on trailers or slurry tankers, including vehicles fitted with tandem and twin axles.

The costs of alternative tyres depend on whether

- a new machine is being bought
- old tyres are being replaced
- serviceable existing tyres are being upgraded.

Cheaper tyres may not give the performance expected for particular operations.

## Farm policy on soil care

Examination of individual tyres is the first step in adopting a policy of soil care for the whole farm. The next step is a critical examination of all the wheeled machines as part of the mechanisation system. One possible option might be to share complete low-ground-pressure wheels between vehicles at different times of the year. For example, it may be possible to use larger than standard combine wheels on a slurry tanker.

Other relevant SAC *Technical Notes* are:

T221 Soil damage by wheels – what it is – what it does – how to avoid it

T303 Selection and use of agricultural tyres

T316 Optimising tractor ballast for heavy draft operations

T338 Low profile radial tyres for agricultural tractors

If you wish to make use of this service, contact your local SAC office.

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