



THE EFFECT OF ALTERNATIVE TRAFFIC SYSTEMS AND TILLAGE ON SOIL CONDITION, CROP GROWTH AND PRODUCTION ECONOMICS - EXTENDED ABSTRACT

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Extended Abstract

The effect of soil compaction, depending upon its severity, can significantly reduce crop yields by 10 to 15%, increase tillage energy requirements by 200 to 300% and drastically reduce infiltration rates, increasing the problems of run-off, diffuse pollution and flooding. The pressure on the soil at depths of 0.5m has been estimated to have increased by a factor of 10 over the past 80 years, due to the increase in vehicle weight. Work in the Czech Republic has shown that crops grown using traditional mouldboard plough (deep) tillage systems have 85% of the field covered by wheel tracks, this reduces to 65% and 45% when using wider equipment for shallow and no-till practices respectively. This paper reports the detailed effect of improved traffic management on soil conditions and crop yield by focusing on the results of two major studies:

- 1. A seven-year programme at Harper Adams University, UK to compare controlled traffic farming (CTF) practices, reduced inflation (very high flexion) pressure tyres and standard inflation pressure tyres for deep, shallow and no-till practices. For a rotation of winter wheat, winter barley (x2), spring oats, spring wheat and field beans on a sandy loam soil.*
- 2. A three-year programme at the University of Illinois, USA to compare reduced inflation (very high flexion) pressure tyres and standard inflation pressure tyres for deep, shallow and no-till practices. This consisted of a maize and soya bean rotation in two adjacent silty clay loam fields.*

Both studies have shown, using both classical soil physical measurements and X-ray computed tomography, that soil macro-porosity is enhanced by both CTF and reduced tyre inflation pressure systems.

The results from the six cropping seasons in the UK study have shown 3 years where the CTF practices have significantly improved crop yield, 2 years where the yields have been higher, but not significantly so and one year (2017: spring wheat) where they were significantly lower. This was a year where overall spring wheat yields were approximately 50% of the norm due to abnormally low rainfall in April, May and June. Discounting the 2017 data, the overall economic yield benefit for CTF (with a wheeled area of 30%) was 4.6%. The economic yield benefit for CTF with a reduced wheeled area of 15% was estimated to increase to 8.8%. The yield benefit of the reduced inflation pressure tyres was 2%. The deep and shallow tillage yields were significantly greater than those of the no-till for winter wheat, winter barley and spring oats.

The results from the two cropping seasons in the US study have shown significant increases (4.3% and 2.7%) in maize yield in 2017 and 2018 respectively from the use of reduced inflation pressure tyres. There was no increase in soya bean yield in 2017 but a significant 3.7% increase in 2018. The effect of tillage was significant for the soya bean yield in 2017 and maize yield in 2018, when for both crops the deep tillage yield was greater than the shallow tillage, which was greater than no-till. The economic analysis, which included the additional cost of the very high flexion tyres, showed that the maize/soya bean rotation would produce a benefit of US\$38/ha and US\$43/ha for the 200ha and 800ha farms respectively.

Key words: plough, tillage, management, soil, compaction, Czech, USA, UK



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