



Information when you need it



fact sheet

June 2015

Ripping depth and ground speed

IRRIGATED cotton growers stand to make substantial savings in fuel and greenhouse gas emissions in tractor operations if appropriate tractor engine and ground speeds are used and tillage depth is kept to the shallowest that is suitable for the task.

Studies by engineers from the University of Southern Queensland's National Centre for Engineering in Agriculture (NCEA) have found that the old adage of 'gear up, throttle back' still applies to modern, electronically controlled tractors.

NCEA's energy specialist, Gary Sandell said a recent trial showed that growers who 'gear up and throttle back' could save between 15 and 23 per cent of their fuel consumption and costs in tractor operations.

Mr Sandell also said that in addition to the fuel savings, the same level of reductions in greenhouse gas emissions were achieved.

All this was good news for the environment and for the Australian cotton industry.

Recently, tests were conducted on the black cracking clay soils of a large irrigation farm on Queensland's Darling Downs using a 4.5 metre wide fixed-tyne

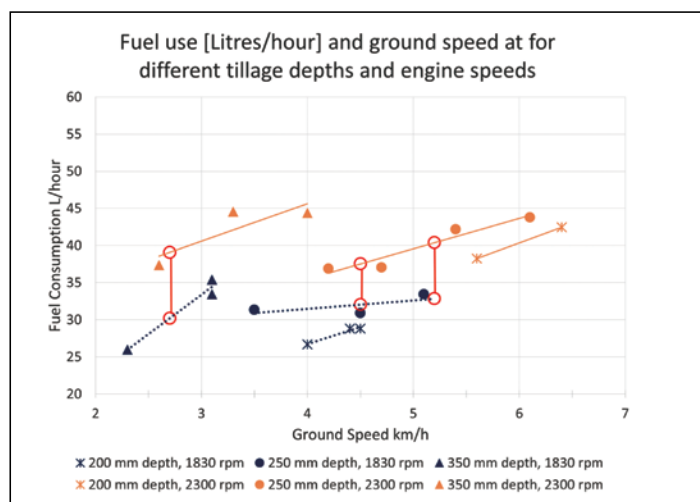


Figure 1. Fuel use, in litres per hour, for different ground speeds, tillage depths and engine speeds.

ripper behind a 2010 model John Deere 8220 tractor.

The tractor has an 8.1-litre, electronically controlled and turbo charged engine and rated power of 225kW (168 hp).

It was put through a series of tillage runs between depths of 200 and 350 millimetres across a range of engine speeds and gear selections to compare ground speed and fuel consumption.

Figure 1, above, shows the effect on hourly fuel burn rate of changing engine speed and gear selection for two ripping depths.

Two different ripping depths are shown: 350mm (triangles) and 250mm (solid circles). For each ripping depth, two engine speeds were tested: 2300 rpm (lighter, solid lines) and 1830 rpm (darker, dotted lines).

The tests found that reducing the tractor's engine speed from around 2300rpm to 1830rpm reduced fuel use by 6 to 9 litres per hour across three selected pairs of equal ground speed and ripping depths (shown by the red circle/bar pairs in figure 1) with an average reduction of 7 litres per hour. This shows that 'throttling back' reduces fuel consumption.

In this heavy tillage trial, Mr Sandell said that a work rate of 1.8 hectares per hour, a depth of 250mm, shifting gears from 5th up to 7th, and throttling back the engine from 2200 to 1830 rpm, reduced fuel consumption by 6.7 litres per hour while maintaining the same ground speed and work rate. This equated to a reduction in fuel use of 3.6 litres per hectare, which represented a reduction of 0.14 gigajoule of energy per hectare and 10 kilograms per hectare less greenhouse gas emitted into the atmosphere. Because ground speed (and work rate) was mainlined, all other costs remained equal so this would have realised a saving of \$3.60/ha for diesel at \$1.00/litre.

Across a cotton growing farm of 1000 hectares, this represents 3600 litres of fuel per tillage operation and 10 tonnes of greenhouse gas reduction.

Mr Sandell said the results highlighted that the old strategy of 'gear up, throttle back' would still significantly reduce fuel consumption in modern, electronically controlled tractor operations.

He said those savings were still definitely applicable in lighter operations, such as planting, because the same principles applied.

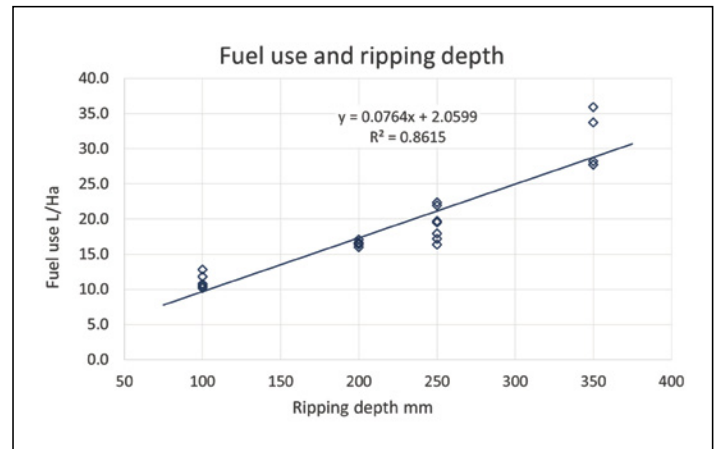


Figure 2. Fuel use [L/Ha] verses ripping depth.

Figure 2 plots the litres per hectare of fuel used, for all ground speeds and engine speeds, against ripping depth.

Mr Sandell said the tests also showed that for every 25 millimetre increase in the depth of heavy tillage, tractor fuel consumption rose by 2 litres/ha (see Figure 2).

"A 10 per cent reduction in energy costs and emissions per hectare is possible if your tillage depth could be reduced by 25mm," he said.

Funding from the Commonwealth Department of Industry and Science was made available under the Energy Efficiency Information Grants scheme to the Cotton Research and Development Corporation for engineers at the National Centre for Engineering in Agriculture to complete energy measurements and analysis on Australian irrigated cotton farms.

For more information:

Visit www.cottoninfo.com.au/energy-use-efficiency