Ways to cut FUEL COSTS

Prices may fluctuate but there's no getting away from the fact that fuel continues to represent a significant proportion of production costs for all farm businesses. To cut usage, farmers need to look at options across the board, from investment in more fuel-efficient power units to fundamental changes in farming techniques. Peter Hill looks at how some of the latest technology can help.

Tests by MF revealed that its AutoDrive auto-shift gearbox produces a 12% reduction in fuel consumption compared to manual gear shifting.

Above: Michael Gillon of Case IH points out the numerous fuel consumption read-outs that feature on the Case IH monitor available for Puma and other tractors.

Above Left: Examining the soil profile with a spade will help decide whether power-thirsty sub-soiling is needed and how shallow cultivators can be worked.

ASK ANY FARM MANAGEMENT consultant about how to make significant cuts in farm diesel usage and you will probably get another question in return: "How much fuel are you using now?"

It's a fair question because anyone serious about making changes to equipment or farm practices to curb the cost of fuel needs to know their starting point. Only then can the impact of different measures be properly assessed.

Figures from Gary Markham, agricultural director at accountants Grant Thornton, show that the average arable farm spends £19/acre on diesel, with some growers splashing out £25/acre and more. Mixed arable and dairy units spend similar sums, although some get away with a more economical £14/acre.

So, what can be done to reduce diesel fuel usage? Measures can broadly be summarised in three categories. Firstly, there's the 'Strategic' approach. This may involve changing from a plough-based regime to minimum tillage for crop establishment or simply using more combination implements.

Then there's 'Practice'. This can be done relatively easily by modifying driving behaviour and paying more attention to servicing and tyre performance.

Last but not least there is 'Technology'. Investing in more fuel-efficient engines, new auto transmissions, GPS steering etc can result in big fuel savings.

Individually, these measures will have different levels of impact on overall fuel usage, some small, some more substantial. Yet collectively they should result in the delivery tanker making fewer trips up the farm drive.

The biggest impact on fuel usage on arable farms in recent years has come from switching from plough-based seedbed preparation to minimum tillage.

Trials carried out by TAG (The Arable Group) suggest that energy savings of about two-thirds can be made by adopting shallow non-inversion tillage and it doesn't necessarily mean investing in big, shiny new kit. Existing disc and tine cultivators can be pressed into service to adopt this technique.

Savings arise in the long term by allowing the structure of soils to improve naturally so that they become easier to work and require less power. In the short term, savings will come simply from expending less effort moving soil.

Sobering

It's a sobering thought that ploughs and cultivators typically move 150 tonnes of soil per hectare for every 1cm working depth. Across 50ha (120 acres), that amounts to a staggering 7500 tonnes per centimetre depth or 450,000 tonnes for an implement working 6in deep.

For those who want or have to stick with current practices, using implement combinations is a practical route to cutting fuel usage by eliminating separate passes from a series of tasks. This can be achieved in several ways by using implements purpose-built to do more than one job; by coupling two or more implements together; or by utilising the capability of most tractors to operate front-mounted as well as rear-mounted equipment.

Halving the number of passes required will not necessarily halve the fuel bill because the tractor will be working harder, but it will make an impact.

In the arable field, using a power harrow-seed drill or 'one-pass' combination is the most widely used and accepted example of this approach; seedbed preparation and sowing are completed in one go when previously they would have been done separately. Adding a front-mounted press makes this a three-in-one operation.

> *"The biggest impact on fuel usage on arable farms in recent years has come from switching from plough-based seedbed preparation to minimum tillage"*

Examples in the grass sector include using a baler-wrapper combination in place of separate machines and mounting a rake in front of a baler to eliminate a separate pass; put it ahead of a baler-wrapper and that's three operations performed in one go.

The remarkable 'soil movement' statistic mentioned earlier is also relevant when it comes to making assessments of current practice to see whether changes can be made that reduce power requirement and the amount of fuel consumed to achieve a given goal.

Some cultivation equipment operators seem content only when their implement is working deep enough to make the tyres or tracks scrabble for grip. The reality is, cultivation depth should relate to what's needed: there is no point sub-soiling or soil loosening much below the depth of any compacted soil layers and there's no point creating a 6in deep seedbed when the seed is going to be sown at 2in. In that context, a spade is a man's best friend, because only by digging into the soil profile can a proper assessment of cultivation need be made.

Tyre choice and management are also relevant here: How often is cultivator depth determined by the need to take out wheelings from the tractor pulling it rather than the needs of the forthcoming crop?

Tyres of a lower profile than the conventional 80 series provide an economical way of improving flotation because wider sizes can be fitted to existing rims. The key thing is to choose the size that gives more width and a longer footprint (as a result of being able to carry a given load at a softer

Above: Contractor Tim Walker raking a thin second-cut grass crop into a swath for baling and then wrapping – all in one pass. What a saving on time and fuel.

Above Right: One tractor, three sets of tyres for different circumstances. Left to right: 800/65 x 32 off the combine for maximum flotation; 650/65 x 38 for general purposes; and 420/80 x 46 for row-crop operations.

Fuel Initiatives

Strategic

- Benchmark by recording current fuel usage by operation and by vehicle, and then plot the effect on fuel usage of any changes made.
- Consider combination implements to reduce passes, e.g. power harrow-seed drill; subsoil loosener with surface discs; cultivator drills; drawbar for roller behind power harrow, tine or disc cultivator or drill; baler-wrapper.
- Consider minimum tillage and other techniques requiring fewer field passes.
- Look for opportunities to 'zone' field operations – such as spraying and fertiliser spreading.

Good Practice

- Keep tractors and other vehicles serviced according to recommended schedules.
- Use 750 ECO PTO setting for 540rpm implements with low power demand.
- Shift up to achieve working velocity at lower engine speed.
- Capitalise on power and torque characteristics of individual engines by running at optimum speed.
- Accept steady speed gains in place of full-throttle acceleration.
- Use foot pedal for easy engine speed adjustment on headlands, instead of running at fixed speed using hand throttle.
- Switch off rather than leaving engine to idle unnecessarily.
- Use minimum cultivation depth necessary to achieve required results.
- Get ballasting correct to optimise traction and draft pull.
- Adjust tyre pressures to the optimum for load and speed for best tractive efficiency and flotation.
- Manage machinery operations to avoid soil compaction that might then require remedial work.
- Exploit 'economy' settings on tractors with modern powershift and stepless transmissions.
- Exploit specialist operator training to increase 'fuel use' awareness and good economic practices.

Technology

- Invest in machines with modern, more fuel-efficient engines.
- Use wider tyres to improve tractive efficiency and reduce rolling resistance through improved flotation.
- Consider tractors with lower rated speed and auto low idle engines.
- Use GPS guidance or auto steering for optimum implement matching.
- Consider 'engine tuning' solutions that improve fuel efficiency.
- Use a fuel conditioning additive to maintain performance of high-pressure common rail diesel engines.

inflation pressure) but has the same rolling radius as the 80 series tyre it replaces to maintain the correct gearing.

This is especially important on four-wheel drive tractors, which must be operated with matched tyres front and rear to maintain the correct front axle 'lead' and prevent damage to the transmission.

As an example, if you replace an 18.4 x 38 Michelin Agribib, which has an 80% aspect ratio (sidewall height versus section width) with a 65% aspect ratio 600/65 x 38 XM108 you get a 5in or 26% increase in the width of the tyre and a 27% increase in the contact patch area. This is because its greater load carrying capacity means it can be run at a 'squashier' inflation pressure.

Advantage

Spend a bit more money on the Michelin XM108's replacement, the OmniBib, and the performance advantage is greater still.

Without back-to-back tests, it will be impossible to quantify the impact on fuel consumption on the day, but it is fair to say that the larger footprint will give the tractor more traction and enable it to complete the work more quickly. The improved flotation will also reduce the depth of the wheelings, meaning cultivators will be able to work shallower.

A recent test by Michelin demonstrated the impact on fuel consumption of inflating a tyre to the optimum pressure compared with one that was pumped up too hard. The test involved making comparative runs across a cultivated field pulling a consistent draft load of four tonnes.

Fuel consumption with tyres inflated to their optimum pressure for the axle weight and draft load provided the reference figure. Increasing the inflation pressure from 0.7bar (10psi) to 1.9bar (27psi) resulted in a loss of grip that saw wheel-slip increase from 6% to 15% and the amount of fuel consumed over the 100m run increase by an average of 23%.

"With every bit of air that goes into the tyre a little less rubber remains in contact with the ground," points out Lionel Mathat of Michelin. "A traction tyre is designed to work best at a certain deflection, which is a factor of the load imposed on it and the amount of air needed to support that load. Using more air than necessary simply reduces the tyre's efficiency."

There are, of course, several simpler things that tractor drivers can do to reduce fuel usage, such as keeping their machines serviced according to the

Right: EcoPower versions of the Valtra N, pictured, and T-Series tractors give operators a choice of power and economy engine settings. The electronic management on the Sisu engines drops idle speed below 1000rpm after a few moments with the transmission in neutral and the parking brake applied.

Main Picture: Using combination or front- and rear-mounted implements, as on this McCormick tractor on a farm in Scotland, saves fuel by completing tasks with fewer passes.

recommended schedules to keep the engine running as sweet as possible.

Using a 750rpm PTO setting, if available, for 540rpm implements that have a low power demand is another practical measure, along with switching off during lunch breaks, easing off the revs for headland turns and avoiding the sort of full-throttle acceleration that causes clouds of black smoke.

Getting to know an engine's power and torque characteristics, and then driving the tractor in a way that makes best use of them, will also make a contribution.

Powershift transmissions can help by providing close steps and plenty of ratios within typical working and transport speeds. Rather than being affronted by automatic shifting, technology should be embraced, not ignored, because it can provide considerable efficiency gains.

"Operators can be inclined to find a comfortable gear and stick with it rather than keep shifting," notes Richard Hollins of New Holland. "An auto-shift gearbox is always prepared to go to the best ratio."

Most semi-powershift gearboxes have auto-shift for road use, but Massey Ferguson Dyna-6 AutoDrive and Claas Hexactiv have auto-shift for field work as well. AutoDrive allows the operator to set the engine speed for up-shifts at between 1600rpm and 2200rpm. Massey Ferguson's own field comparisons between manual and auto-shifting show a 10% improvement in area worked and a 12% reduction in fuel consumption.

A well-matched engine and stepless transmission can also produce fuel savings. Fendt has made much of the performance of the 200hp 820 Vario TMS tractor in trials carried out by the DLG organisation in Germany. It came out top for fuel economy versus rivals for heavy cultivation and mixed work, a close second for PTO operations and first overall.

"Compare the 'powermix' result for the Fendt and the worst performer and the difference is a staggering 9.4 litres/hr," said Tony Bourne, product specialist. "At 65p/litre, that's a potential saving of more than £6000 over 1000 hours."

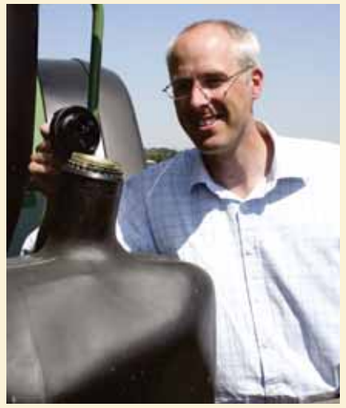
On transport operations, stepless transmissions automatically 'gear up' and allow engine revs to fall off once the required cruising speed has been reached. Powershift tractors with 'economy' 40kph gearing will do the same, with revs typically allowed to fall to 1800rpm once the tractor has accelerated up to speed.

The 40kph Eco transmission on New Holland T7000 and Case IH Puma tractors has a unique direct drive design that minimises power loss. In top gear, drive goes through the power take-off shaft from the engine and is picked up by the rear axle through a set of transfer gears.

"Combined with good fuel management at the engine, this system can help drive down fuel

What the experts say...

David Kinnersley



David Kinnersley of Fisher German advises farmers to record consumption against individual operations so that the impact of changes can be assessed.

"With the cost of diesel fuel now being such a significant factor on many farms, farmers would do well to start recording consumption against individual operations so that it is properly accounted for," says David Kinnersley, farm business consultant with Midlands-based firm, Fisher German.

"Because the price of diesel has changed rapidly in recent years it has become much more difficult to assess and analyse what fuel is being used just from farm accounts.

"Farmers can establish where they are using their fuel simply by recording the fuel used each time the tractor's tank is filled up against the work it is carrying out at the time. Only then can the true impact of different fuel saving measures be properly assessed."

Mark Turner

Mark Turner of Goodyear points to the tough but flexible sidewall that allows the Optitrac R+ to support heavy loads but also operate at low inflation pressures.

Making the most of any tyre's performance potential requires active ballast and inflation pressure management, emphasises Mark Turner of agricultural tyre manufacturer Goodyear.

"Remove ballast when it's not needed and add enough in the right place to get maximum traction," he advises. "If you then alter tyre inflation pressures so that they are at their optimum for each job, you'll make best use of the fuel the engine is burning."

In terms of tractive efficiency for draft work, a radial tyre performs at its best with slip levels of between 9 per cent and 15 per cent, says Mr Turner. Anything more wastes fuel and causes excessive wear; anything less fails to make the most of the tyre's pulling power.

Paul Wade

Technology can help improve fuel consumption but operators must learn how to make the most of it, says McCormick product specialist Paul Wade.

"There is no point running a modern tractor engine at full speed because that's not where it produces the most power or torque," says McCormick product specialist Paul Wade. "Today's engines develop maximum power a few hundred revs lower down the speed range, closer to where torque output is highest."

His advice for draft work is to keep changing up through the gears to get the engine working hard but to leave some torque increase in reserve to cope with the additional load imposed by moving into a patch of stiffer, heavier soil.

"You'll definitely see an improvement in productivity and it will also make a tremendous difference to fuel consumption by running the engine at peak efficiency," he says.

Using implement combinations, in this case a front-mounted cultivator and a rear-mounted disc drill, saves fuel by eliminating separate operations.

The tubes on the left and right highlight the difference in fuel consumed over just 100m with a tractor with its tyres correctly inflated to 0.7bar (10psi), far right, and over-inflated to 1.9bar (27psi), far left. The ensuing loss of traction and efficiency resulted in an average 23% increase in fuel consumption.

consumption during road transport," says Richard Hollins of New Holland. "In comparative tests, we've seen a T7000 tractor use 15% less fuel than a competitor."

Valtra has taken a different route with its EcoPower tractors, using engine control electronics to provide two sets of power and torque characteristics.

"In Power mode, rated engine speed is around the universal 2200rpm; Eco mode drops the rated engine speed to just 1800rpm," explains product specialist Andy Miller. "Despite this speed reduction, torque is increased by between 5% and 20% with a wide, constant range and with maximum torque coming in between 1100rpm and 1200rpm."

The slower engine speed of the Eco mode not only reduces engine wear and noise but also fuel consumption. Valtra claims around 10% but real-life comparisons of daily work routines are said to be showing bigger savings than that.

Giving operators good information about fuel consumption will encourage them to be more fuel-efficient, says Michael Gillon, product specialist at Case IH.

"Some read-outs give you litres per hour but that's a very narrow viewpoint and of limited value if you're trying to improve fuel consumption," he suggests. "Consumption has to be related to work done so the pillar display on our Magnum, Steiger and CVX tractors shows litres/hr and litres/ha."

Add an ISOBUS-standard Case IH AFS monitor and the driver gets more information, including fuel consumption by distance as well as area, and fuel efficiency measured as kW/litre.

"Once armed with that information, operators can experiment with different driving strategies to find out what gives the best balance between productivity and fuel usage," Michael Gillon suggests.

It raises the question of whether an industry training scheme to increase operator 'fuel use' awareness and the driving practices that promote greater fuel economy would be a worthwhile initiative. Caterpillar's Eco Driving Training scheme for construction machine operators aims to do just that; agriculture would do well to have something similar.