

**“Gone are the days of just filling up your tank and forgetting about it”**



The farmers' guide to

# Diesel bugs

**It's six years since ultra low sulphur diesel first started appearing on farms, bringing with it the potential for fuel to contain up to seven per cent FAME biodiesel. This opened up the prospect of problems with diesel bugs, but there are other issues users of red diesel should be aware of**

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**A**s 2011 got underway, farms and other businesses that bought, stored and used red diesel were faced with the prospect of having to think carefully about how they handled that valuable commodity. Almost overnight, the stable fuel they were used to dealing with was potentially transformed into an unstable liquid that was difficult to store and could block the filters on their diesel tanks and tractors.

I say potentially because these problems would only appear if the fuel contained fatty acid methyl ester, or FAME, biodiesel, which was suddenly allowed to make up as much as seven per cent of the fuel. Unfortunately there wasn't - and indeed still isn't - any clarity on how much

FAME the diesel you buy contains. It needs to meet the British Standard EN590, but all that does is put an upper limit on FAME inclusion so that the fuel is compatible with diesel engines made to run on B7 fuels. Even today, it's entirely possible that there's no FAME biodiesel in your fuel at all.

On one level that might be considered a good thing. No biodiesel means no diesel bugs, but you've got to consider why the FAME was added in the first place. The new fuel had to have a very low sulphur level (10 parts per million) to allow it to be used with the electronic control systems on Stage IIIB engines that were being introduced at the time. That is all well and good, but as the sulphur was



Right: Farms with a high turnover of fuel are less likely to suffer problems with bugs in stored diesel

Far right inset: The diesel bug is the generic term for yeasts, moulds and bacteria that can grow in red diesel if water is present



Left, right and far right: Fatty acid methyl ester (FAME) that's found in conventionally produced biodiesel can leave a waxy residue on filters

▶ only there because of its lubricating properties, taking it out meant a new lubricant was required - and that's where the FAME came in.

So, as far as ultra low sulphur diesel is concerned, you've got problems if there is FAME in your fuel, and you've got problems if there isn't.

After a lifetime working as an engineer in shipping and the lubricant and engine sectors, Peter Weide set up his own company, MarShip UK, to offer air, fuel and oil filtering solutions to the ship operators, but has also found his products in demand from other industries facing similar problems. Maritime engines only switched to ultra low sulphur diesel in 2015, but Mr Weide's experience is still useful to those working on dry land.

"Gone are the days of just filling up your tank and forgetting about it," he says. "The FAME in your diesel is very hygroscopic and it will pull water in from the atmosphere, in fact it can absorb up to 30 times more water than normal diesel."

#### Water problem

Having water in the fuel could present an immediate problem, especially in modern equipment.

"Although most diesel engines can handle a certain percentage of water in fuel without obvious running problems, water will cause engine damage, particularly in high-power engines with common rail fuel injection," Mr Weide says. "Water can lead to misfiring, wear to

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injectors and pumps, corrosion and the possibility of explosive damage to fuel injectors as the combustion process superheats any water present. "Older engines will cope with some water without missing a beat, but now that components in modern diesel engines have tolerances of a thousandth of



# STANDARDS REMAIN UNDER REVIEW

Diesel fuel sold throughout Europe is currently produced to meet the ISO standard EN590, although that wasn't always the case. Until 1 January 2011, it only applied to road vehicles, but the implementation of EU Directive 2009/30/EC changed that.

The new legislation called for red diesel used in non-road vehicles to have its sulphur level cut from a maximum 1000mg/kg to 10mg/kg (a 99 per cent reduction); and at the same time the maximum amount of fatty acid methyl ester (FAME) biodiesel that could be blended into the fuel was increased from five per cent (the B5 standard) to seven per cent (B7).

The changes coincided with the introduction of Stage IIIB engines, which required low sulphur fuels to ensure that their control systems weren't damaged. The higher level of FAME biodiesel, meanwhile, was meant to substitute for the missing sulphur, which provided lubrication in the fuel - it also improved the environmental credentials of the fuel.

The current version of the EN590 standard dates from 2013 when it was updated to allow unlimited quantities of another renewable fuel, hydro-treated vegetable oils (HVO), to be included in the diesel as it's a hydrocarbon that's compatible with those that already exist in refined diesel.

FAME, on the other hand, has a different chemistry, properties and levels of impurities compared to hydrocarbons, and needs to be limited to ensure the fuel remains compatible with engines manufactured to use B7 fuel.

Both aerobic and anaerobic bacteria will affect diesel. "Aerobic bacteria are the main problem," Mr Weide adds. "They will create the sludge that blocks the filters. But if the tank gets really infested, anaerobic bacteria will start creating a layer on the tank sides and you'll get a rotten egg smell. If that happens, it's very important to get the fuel treated and to clean the tank as these bugs will eat through steel if they're not tackled."

## Lacking lubrication

Unfortunately, the lack of lubrication from your diesel can also be a major problem if there's no FAME in your fuel. Additives are normally included in road fuels to ensure they won't suffer any problems from a lack of lubricity, but there's no guarantee that diesel for industrial markets will get anything added other than red dye - indeed, the relative cost of FAME biodiesel versus the fuel coming straight from the refinery actually makes it more likely that FAME won't be used.

"The lubricity is important obviously to make sure the pumps, injectors and everything in the nozzle are all kept lubricated," Mr Weide of MarShip UK says. "Diesel without lubrication can be as damaging as water to the injectors and other components - especially in today's engines



a millimetre and they operate at fuel pressures in the tens of thousands of pounds per square inch, uncontaminated fuel is essential. Very high-pressure water will soon undo the lubricating effect of the FAME and damage the injectors on your engine, so water in fuel should be avoided at all costs."

Even if it doesn't make it anywhere near your engine, water in your stored diesel is also going to cause problems as the combination of FAME and water will almost certainly lead to contamination through diesel bugs.

"The water all ends up at the bottom of the tank, and the diesel bugs can live in that water," Mr Weide says. "They effectively live in the water and feed off the fuel above. The sulphur in the fuel used to act as a natural biocide, but now that's gone, there's no natural deterrent for the diesel bugs and they have become a lot more of a problem."

"The diesel bug is a generic name for yeast, mould and bacteria, and they can come in the diesel from your supplier, get into the fuel from the air, or may already be in your tank. When they have access to water and a food supply, they breed and can double their numbers every 20 minutes. The machine operator will only realise there's a problem when the filters get blocked up."



**Above left: Fuel storage on farms can vary from high-capacity fuel stations such as this metal tank to smaller plastic tanks (above)**



**Left: MarShip UK's DieselAid LD additive provides extra lubricity and deposit control**



**Left: Deposits that fall out of unstable diesel containing FAME can cause lacquering on components**



**Right: Peter Weide has seen a rise in fuel-related issues as a result of modern fuels and engines**

▶ that carefully manage how the fuel is put into the cylinder.

“In the old days, the engines I worked on used the pressure of the fuel to open the injectors and squirt the fuel into the cylinder. The introduction of common-rail systems saw a shift to solenoids to actuate the injectors, but these days the higher pressures and electronic control units (ECU) demand even faster systems.

“Whereas in the past you would have one injection per cycle, now you’re getting up to six injections per cycle, so the ECU is firing as it comes up to the top of the compression stroke and also a few times afterwards. These systems use Piezoelectric injectors that offer more accurate control over fuel delivery, but also work at a tremendous speed.

“If an engine is running at 1800rpm, each injector operates 900 times a minute, which in a standard tractor engine would be 15 times a second,” Mr Weide adds. “If you now multiply that by six in a modern ECU-controlled engine with common

rail, each injector is now firing 90 times a second. The correct lubricity is vital to maintain the performance of, and prevent damage to any system operating at that kind of level.”

### Additive range

MarShip UK offers a range of additives under the DieselAid brand that suit every situation.

“We do a catch-all that’s great for people who are storing fuel for longer periods, but a farm that’s got a decent turnover of fuel in its storage tank and is draining off any water regularly might just need to have extra lubricity and a deposit control agent,” Mr Weide says.

That’s very important because the ultra low sulphur diesel isn’t as stable as the product used to be, and compounds can settle out of the fuel that can lead to gumming and lacquering in the engine, which in a modern common-rail diesel engine is very bad indeed.

“Another problem that occurs when fuel degrades is that the cetane number - that gives an indication of how rapidly the fuel will burn - will drop off and that can make starting more difficult and affect overall performance. We also have an additive that puts the stability back in, increases the cetane number and provides lubricity.” **EMJ**

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