



*from theory  
to field*



# Taking the mystery out of muck

**As MANNER-NPK is launched, grower-funded research is bringing a better idea of how much sulphur manures deliver to the crop. CPM assesses what these advances will mean.**

*By Tom Allen-Stevens*

**Few growers would dispute that sulphur is now considered a major nutrient and that applications to many crops in most cases bring yield and quality benefits. Nor is the fact that most manures contain plenty of sulphur ever questioned.**

But while MANNER provides a fairly sophisticated and trusted model for accounting for the nitrogen content of manures, when it comes to sulphur, the contribution muck makes remains a mystery.

“For some time, RB209 has included a value for total sulphur content of manures,” notes James Holmes of HGCA. “But we still don’t know how much of that is readily available to the crop.”

In fact, although it recognises manure’s sulphur content, RB209 advises growers to make applications of inorganic S anyway, to ensure sufficient supply. “It’s an added cost and growers should be able to do better. But they’ve never had reliable data on which to base any recommendations.”

## **Grain sulphur**

That’s been the aim of a three-and-a-half-year HGCA-funded project that will shortly come to an end. Researchers at ADAS and Rothamsted Research have been looking at various manures in more detail, and the effect the sulphur content has on wheat yields and grain sulphur content.

Lead scientist for the project is Dr Lizzie Sagoo. “The sulphur value you get from a manure really does depend on what you apply and when it goes on,” she reports.

“The first step we had to address was

*“The sulphur value you get from a manure really does depend on what you apply and when it goes on.”*

the availability of sulphur in a manure. When you receive an analysis of FYM, slurry or biosolids, you’re given a measure of total S content. But extractable S gives an idea of the fraction the crop may utilise. This is the information you actually need, and that test is never normally conducted.”

Sulphur behaves in a similar way to nitrogen, she explains. Some is readily available in its mineral form, while the rest is locked up within the manure in its organic form. It’s available as highly mobile sulphate (SO<sub>4</sub>), so therefore it leaches readily.

An extract developed for soils was used to give an indication of extractable S (see table on p36). This revealed slurries and broiler litter have a higher extractable S than FYM. “We believe extractable S is a better gauge of what’s available to the crop than total S content.”

Field experiments were also set up to evaluate crop response to the sulphur in manures. Light, sandy soils were chosen as these would be the most likely to respond, on sites at Woburn in Beds, Brockhampton near Hereford and Frostenden in Suffolk. Each site was

*Lizzie Sagoo believes extractable S gives you a good idea of the total sulphur content of manure that's available to the crop.*



used in two of the three years, to give six years of site data in total.

"We applied cattle FYM, pig FYM, two biosolids and broiler litter in autumn. Broiler litter was also applied in spring, along with a slurry. These were applied at a rate equivalent to 50kg/ha total SO<sub>3</sub> with N, P and K topped up across each site to ensure these nutrients weren't limiting. We compared the manures to inorganic fertiliser S applied at five different rates, from 0-75kg SO<sub>3</sub>/ha, to work out the optimum rate of S."

### Statistically significant

Across the six site years, half showed a crop response to the sulphur applications. "The crops at Brockhampton didn't show a statistically significant response at all. But when extractable S in the soil was measured, this was found to increase at depth at this site, which is unusual and wasn't the case on the other two sites."

But what the researchers did find consistently across all sites is that timing makes all the difference. "Crop offtake of sulphur from spring applications is much higher than from autumn applications. In fact, applying a manure in spring was as



*If you make a spring application of slurry or broiler litter to winter wheat, you don't need any additional fertiliser S, the research has concluded.*

effective as a fertiliser S application.

"Crops did respond to an autumn application, but the lower grain offtake suggests much of the available S content of the manure leached before the crop had a chance to take it up."

There was also a marked difference in how the various manure types performed, with spring-applied broiler litter and slurry delivering the highest grain S offtake and yields. Autumn-applied biosolids performed on a par with, or just below, ▶

## Software helps with all MANNER of manure

Muck fulfils a valuable role across the 5700ha of Wilts, Avon and Somerset farms looked after by independent agronomist John Clark. "Most growers will be applying manures of one form or another, whether that's cattle FYM and slurry, poultry manure or sewage sludge. Poultry manure in particular is much sought after."

There's been a gradual change in appreciation for its nutrient value as fertiliser prices have increased, he notes. "It used to be the devil's own job finding out what a grower had applied and where, let alone accounting for its nutrient value. Sometimes the crop would go flat as a result.

"Now there's much greater recognition of the financial importance of manure. As a route to improve the soil organic matter content, workability and water-holding capacity, it's also incredibly valuable."

He classes poultry manure as "rocket fuel" for crops, with its high, relatively concentrated nutrient value, and high-N pig slurry is also sought after in the area. "These are best placed under a winter oilseed rape or spring maize crop. You want a crop that develops a large root structure fast and will harness the nutrient value quickly. But one of the biggest challenges is

uniform application — getting it wrong will result in uneven crop growth and/or lodging."

He uses MANNER routinely to calculate the nutrient value of what's been applied. "It's a superb route to working out the available N. MANNER is incredibly easy to use, and that's important. You just enter in the postcode for the farm, type of manure and rate applied, then date and interval to incorporation."

John Clark has also been involved in road-testing the new MANNER-NPK. "The old version was always very good at working out available N. The new version does the same for P and K, and gives you total S and Mg, too. It's again very easy to use and now gives you the financial value, which is useful.

"You can also now put in multiple applications of manure. During testing, they took on board comments we put forward and made further improvements. The one development for the future I'd like to see is to have it available as smart-phone app."

He's keen to see the results of the sulphur project and put these into practice. "It's no surprise that S availability is higher in spring — manures are better utilised at that time of year because there are fewer losses as winter



*Growers now have a much greater recognition of the financial importance of manure, believes John Clark.*

rainfall declines, and nutrient availability can be more accurately calculated.

"You try to take account of the S content of manures, but it's not easy, and in the end you're guessing at the availability because the information hasn't been there and utilisation isn't well documented. This research will put a few principles in place that'll help us get a better grip of just how much we're applying. It's doing for sulphur in manures what previous research has achieved for N availability, which has helped growers realise the value of what they're applying."



*The beauty of MANNER-NPK is that it's really simple to use, says James Holmes.*

► fertiliser S, while autumn-applied cattle FYM increased neither yields, nor SO<sub>3</sub> offtake.

"These results reflect the lower

proportion of the total manure S in the extractable form in the cattle FYM, compared to other manures," notes Lizzie Sagoo.

### Spring application

The project has helped clear up a lot of the mystery behind how much sulphur manures deliver to a crop, she maintains. "The main message is that if you make a spring application of slurry or broiler litter to winter wheat, you don't need any additional fertiliser S. Autumn-applied manure, especially FYM, is more questionable in terms of its sulphur value, and the S the crop takes up depends more on the type of manure, rainfall and leaching losses from the soil."

But there's quite a bit more work needed before extractable S data can be incorporated into MANNER-NPK, she believes. "Extractable S is useful as an indicator of S utilised by the crop, but there's quite a bit of variability. We'd also need to have a better idea of how S is lost through leaching."

And one of the difficulties of this work is that crop response depends very much on the nature, history and location of the site. "Where we did get a response, it wasn't

that great — a 0.3t/ha yield benefit in Suffolk in 2012 from around 15kg SO<sub>3</sub>/ha, for example, but little extra yield benefit above that rate.

"But it would be useful to evaluate the S content of other organic materials, such as green and food compost — our work has shown these materials also supply S. Anaerobic digestate has a lower total S content, but it's often applied in the spring, so could still be delivering a significant proportion of the crop's requirement."

So where does this leave MANNER-NPK, the new version of the software

### Sulphur and extractable S content of various manures

Manure type	Total SO <sub>3</sub> (kg/t FW)	Extractable S
Cattle FYM	2.4	15%
Pig FYM	3.4	25%
Broiler litter	8.0	60%
Cattle/pig slurry	1.0	35%
Biosolids cake	6.0	20%

*Source: Total SO<sub>3</sub> – RB209; extractable S – HGCA Project 3606*

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developed to calculate the nutrient value of various manures? It's due for release imminently, reports James Holmes, and contains some significant improvements, compared with the original version.

"The main difference is that it not only gives you a quick, accurate assessment of crop-available N, but now includes available phosphate and potash, as well as total magnesium and sulphur." A wider range of manures and organic materials has also been brought into the new version, including digestate.

The software has been designed to require a minimal amount of user input, he maintains. "It's really simple to use, and that's the beauty of it. You supply basic details about your farm and field, and what manure was applied, on what date. Standard data such as rainfall and nutrient analysis are pulled in as default information, but these can be overwritten if you have your own figures."

For agronomists, there's a comments section that can be filled in, so that a recommendation report can be generated straight from the software. "It also checks that you're complying with NVZ regulations, and has been updated with the latest developments here."



*The new MANNER-NPK has been designed to require the minimum of information input from users, and (right) now gives results on available P and K, total SO<sub>3</sub> and MgO and financial value.*

The software tells you the financial value of what you've applied, based on current fertiliser prices. "You can use it to perform what-if analyses." Pre-release testing by growers and advisors has ensured it's easy to use and robust, he adds.

Like the old MANNER, the new version links in with PLANET, the industry-standard software that uses RB209 (or SAC technical notes in Scotland) for field-level nutrient planning and record-keeping.

Although total S figures from RB209 have been incorporated, data and findings from the current S project haven't been included, confirms James Holmes.

"A lot more sampling and analysis needs to take place before MANNER-NPK can give a definitive answer on how much crop-available S a manure will supply." ■

## Research round-up

HGCA project 3606, quantifying the sulphur (S) supply from farm manures to winter wheat crops, is running from Oct 2009 to April 2013. Its aim is to improve understanding of S supply from farm manures, and to provide guidance to farmers to help them make better use of manure S. Its total cost is £187,865 funded by HGCA, with additional funding from Anglian Water and Severn Trent Water. The research is carried out by ADAS and Rothamsted Research.

For more information on MANNER-NPK, and to download the free software when it becomes available, go to the PLANET website at [www.planet4farmers.co.uk/manner](http://www.planet4farmers.co.uk/manner) or for a CD, call 08456 023864.

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