

Sulphur for grass yield and quality



The difference Sulphur
could make to your grass

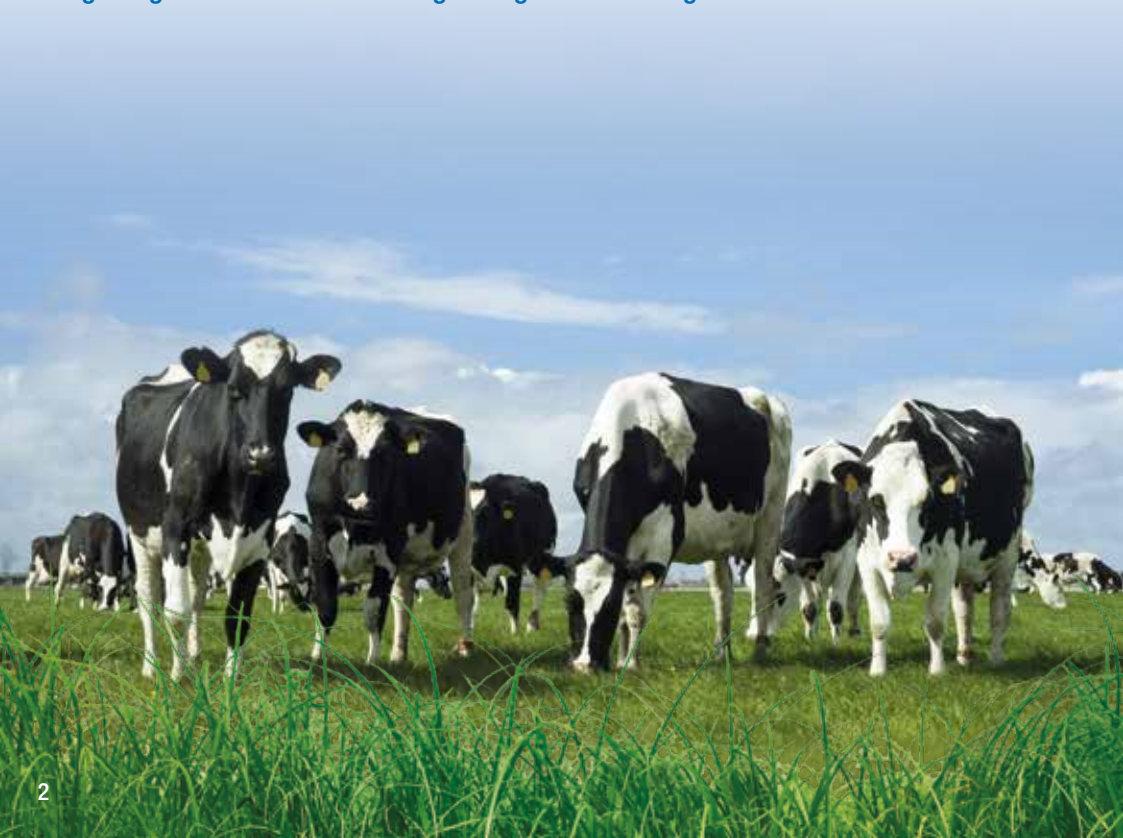




Our role in your business

CF Fertilisers is the only British producer of True Granular Compounds and Nitrogen fertilisers.

We are here to support profitable British milk and meat production. Our contribution is to provide the best fertilisers and advice to help optimise grass production and utilisation. We believe that regardless of production system, getting the most out of home-grown grass and forage is the base for success.





Sulphur is critical to grass yield and quality

Sulphur is as important for grass growth and quality as Nitrogen, Phosphate and Potash. Where Sulphur is in short supply, using Sulphur-containing fertilisers is key to achieving grass yield with the energy and protein content required.

Like Nitrogen, Sulphur is vital for grass protein production. Sulphur is at the core of 2 of the 12 essential amino acids that make up proteins. So lack of Sulphur means less protein production, which reduces yield.

Because proteins are involved in all plant processes, a lack of Sulphur leads to:

- **Reduced protein content.**
- **Reduced sugar content.**
- **Reduced yield.**

So a lack of Sulphur could leave you disappointed in grass yield and palatability.



Why do we need Sulphur in fertilisers?

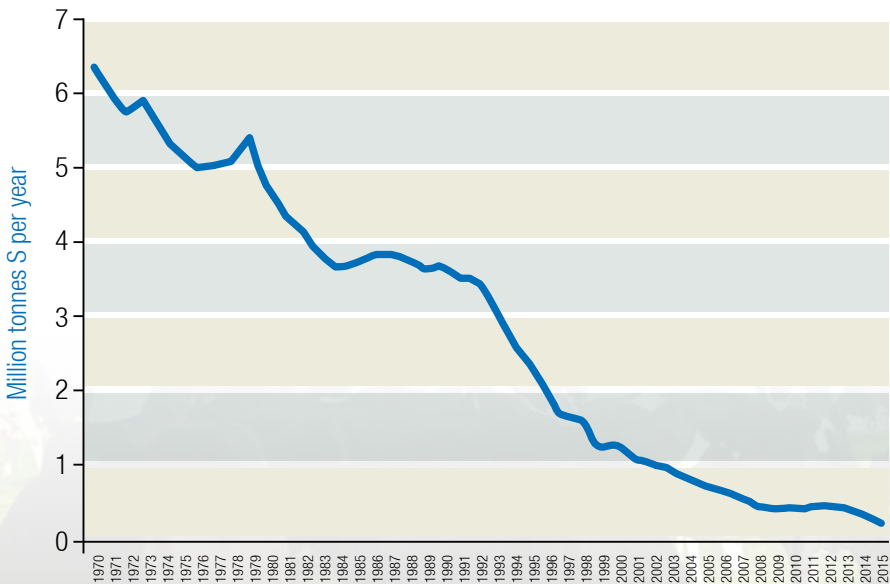
Grass requires almost half as much Sulphur as Nitrogen and this Sulphur used to come down as atmospheric deposition from industry. But anti-pollution measures from the 1970's have reduced Sulphur emissions and therefore very little is falling on agricultural land. According to Government figures (see below) "Emissions of sulphur dioxide in 2015 have fallen by 96% since 1970".

Grass needs around 100 kg Sulphate (SO_3) per ha and in the 1970's when 70 to 80 kg SO_3 /ha came from deposition, we didn't need Sulphur in fertiliser's. But the levels of deposition reduced to less than 5 kg SO_3 /ha in the 2000's and are now not routinely measured, because they are so small.

The Sulphur content in manures is low, variable and 80 to 95% unavailable for grass growth. So, we now need to have Nitrogen based fertilisers with Sulphate in them.

Note that we talk about Sulphate (SO_3) in fertilisers and not Sulphur (S), because Sulphate is the plant available form of Sulphur.

Sulphur emissions in the UK



Find out if you need Sulphur

The vast majority of grass production areas in Britain are now S-deficient. As time passes we mine the remaining S out of soil organic matter, so where we once saw responses only in silage grass on light soils from 2nd cut and onwards, we now see responses on medium soils for silage and grazing and from the start of spring. Even grass on heavier clay loam soils are starting to show small responses to S applications.

We can measure S in the soil, but it's variable and unreliable, so the best way to test if you need S-containing fertilisers is to sample and test the grass. This is best done when grass is growing rapidly in spring, or on silage and grazing aftermaths and regrowths.

The amount of S in grass is normally 0.2 to 0.4% and we should have at least 0.25% to avoid deficiency.

A sample can be analysed at a laboratory to give a Nitrogen to Sulphur (N:S) ratio. More than 13:1 and the grass is definitely S-deficient, but it may respond from 10:1 up. We also have to take into account the S content of the grass along with the ratio, so use the following table.

Diagnosing Sulphur deficiency with Grass N:S ratio

N:S Ratio	Grass S less than 0.25%	Grass S more than 0.25%
Over 13:1	S-deficient	S-deficient
10:1 to 13:1	S-deficient	Grass OK
Below 10:1	Grass needs more N	Grass OK

- A Nitrogen concentration of 4.6% and a Sulphur concentration of 0.35% gives a ratio of 13:1, which appears 'Sulphur deficient', but the need for Sulphur is borderline as the Sulphur content is relatively high.
- A Nitrogen concentration of 2.5% and a Sulphur concentration of 0.21% gives a ratio of 12:1, which appears 'Sulphur sufficient', but the Sulphur percentage is low and the sward would benefit from Sulphur applications.

We can also use a malate:sulphate analysis ratio to diagnose S-deficiency. Malate is an intermediate step in how plants make sugar and needs Sulphur to process beyond this stage, so low S gives high malate. The test is available from your FACTS trained fertiliser advisor and is more accurate than N:S.

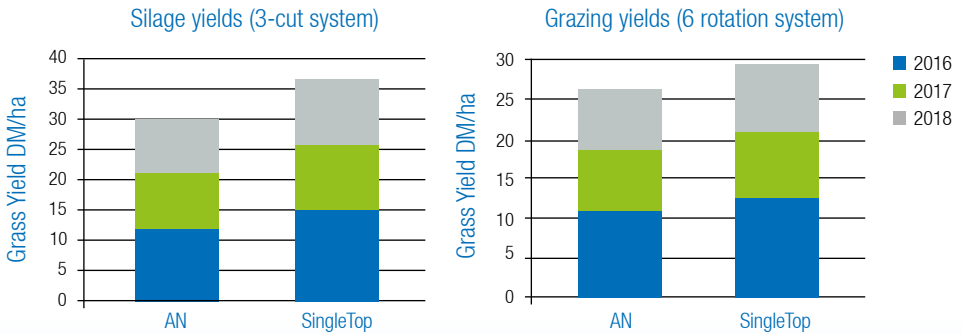
Grow more grass with Sulphur

Silage grass dry matter DM yields can be increased by 10 to 35% and grazing yields by 5 to 20%, simply by putting Sulphur into your fertiliser programme when your soils are S-deficient.

The example below clearly shows this effect from a replicated trial over three recent years on a medium loam soil in Cheshire. Using S-containing CF SingleTop®, rather than straight ammonium nitrate, increased silage yields over the 3 years by 7t DM/ha (+23%) and grazing yields by 3.4 t DM/ha (+13%).

If the extra grass energy is used in your system to replace concentrate feed, then the Return on Investment (ROI) for using a S-containing fertiliser in silage grass is 8:1, and it's 5:1 for grazing grass.

Yield response to Sulphur over three years

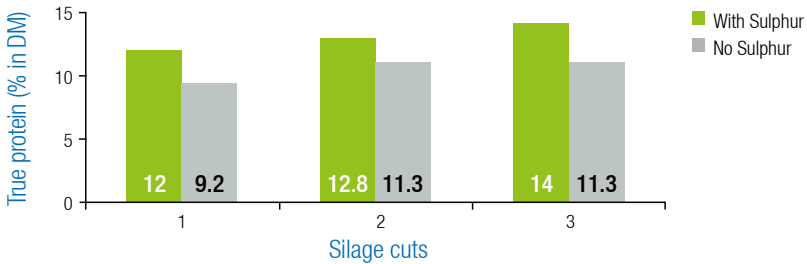


Sulphur improves grass quality

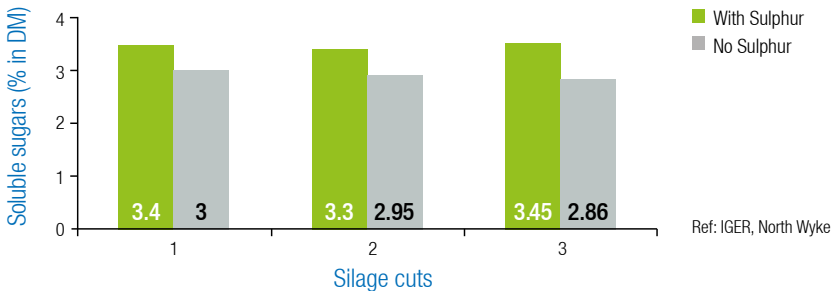
The grass plant needs Sulphur to make proteins and some of those proteins are needed for making sugars. So, a lack of Sulphur will tend to reduce grass sugar content, as well as protein. And this can impact on dry matter intake for both silage and grazed grass. This means that having enough Sulphur in your fertiliser programme not only gives you yield, it provides your livestock with a more palatable forage.

The effects of Sulphur on grass protein and sugar contents can be seen in the graphs below. These are from independent replicated trials at IGER North Wyke (now Rothamsted research).

Sulphur increases grass protein



Sulphur increases grass sugar content



Recommendations:

Responses to Sulphur can vary for a number of reasons including soil type, season and winter rainfall, but suggested rates over the season should be:

Grazing: 50-100kg SO₃/ha in total over the season. Cutting: 30-50kg SO₃/ha for each cut.

Some situations could well respond to higher rates, speak to your FACTS Qualified Adviser.

Capturing the benefits of Sulphur in your system

Getting the yield and quality benefits of Sulphur in your fertiliser programme is relatively easy. Incorporating those benefits into your milk or meat production system is more challenging. But planning to capture the benefits will enhance your efficiency and therefore your profitability.

More yield means more energy

If you have an extra 1 tonne dry matter per ha of grass as cut for silage, or grazed, that means more energy and energy drives the system.

Best practice silage making will get an energy content of around 11.5 MJ ME/kg DM, and that's 11,500 MJ ME in the extra tonne. We can plan on 75% of that extra energy produced in the field getting into livestock, so 8,600 MJ ME.

For grazing, we should aim for 12 MJ ME quality in our extra tonne of dry matter, and a well-managed paddock grazing system will get 85% of that into your livestock, so 10,200 MJ ME.

Two ways to capture the benefit

We can plan to use our extra energy in one of two ways:

1. Make more milk or meat

The energy it takes to make milk depends on milk quality, but it's generally 5.4 MJ ME for every litre of milk. For meat, the conversion varies according to type of stock, breed and stage of fattening, and on average it takes 47 MJ ME to get 1kg of liveweight gain. The table below shows what that means for milk and meat output.

Using extra grass energy to produce more milk or meat.

Extra utilised energy in 1t DM	Potential in milk or meat production	
	More Milk	More Meat
Silage – 8,600 MJ ME	1,590 litres	180 kg LWG
Grazing – 10,200 MJ ME	1,890 litres	215 kg LWG

2. Replace concentrate/supplementary feed inputs

The extra energy and grass palatability that Sulphur brings can be used to replace concentrate inputs. Using the same 1 tonne dry matter extra analogy from the more milk or meat option, the table below shows how much of a 12.5 MJ ME/kg DM concentrate feed you can plan to replace if you take this second option to capture the benefits.

Using extra grass energy to replace concentrate feed.

Extra utilised energy in 1t DM	Potential in concentrate replacement (fresh weight)
Silage – 8,600 MJ ME	0.75 tonnes
Grazing – 10,200 MJ ME	0.90 tonnes

Gaining from the quality

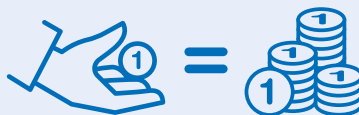
Modern grass varieties bring improved yields and sugar content. The grasses have been bred for increased yield at a set Nitrogen input, so they also tend to have lower protein (CP%) content, which is a dilution effect (more yield, same Nitrogen). As demonstrated, Sulphur can help with both these issues of protein and sugars.

Independent research at Teagasc in Ireland suggests that improving grass quality to the levels that can be achieved where Sulphur is used in your fertiliser programme, can increase grazed grass intakes with dairy cows by around 2kg DM/ha per day – enough for an extra 2 to 4 litres of milk.

Return on Sulphur investment

The financial gain will depend on product prices, yield and quality impact, how the benefit is captured and farmgate product values. Making more milk or meat captures more value than replacing concentrates, but generally you can expect a £5 to £15 return for every £1 you spend on putting Sulphur into your fertiliser programme.

For every £1 you spend on putting Sulphur into your fertiliser programme you can expect a £5 to £15 return.



Sulphur and copper lock-up

- Fertiliser Sulphur is only replacing atmospheric deposition, not applying additional Sulphur.
- The availability of Cu can be reduced when S is supplied in excess AND soil has a high Molybdenum (Mo) content.
- This is a rare combination of circumstances, because Sulphur deposition is now so low.
- Sulphur-containing fertilisers do not contain enough S to push S supply to excess.
- There is more benefit to the system in using Sulphur fertilisers to improve grass yield and quality and handle any Cu issues through the diet.

CF Sulphur-rich products provide the solution...

Our belief in the need for Sulphur-containing fertilisers in grassland systems has led to CF developing a full range of NS, NKS and NPKS True Granular Compound products to meet the needs of grassland farmers.

Product	Analysis (NPKS)
SingleTop®	27-0-0 (12 SO ₃)
NK Sulphur	27-0-6 (6 SO ₃)
KayNitro® Sulphur	25-0-13 (7 SO ₃)
CropMaster® Sulphur	27-4-4 (7 SO ₃)
MultiCut® Sulphur	23-4-13 (7 SO ₃)
PremierCrop Sulphur	20-8-12 (7 SO ₃)

Because sulphate can travel through the soil profile like nitrate, moving out of the reach of plant roots, the general approach should be to apply Sulphur 'little and often' to maximise efficiency and optimise the effects. This is why it is best to apply Sulphur with every fertiliser Nitrogen application.

Using Sulphur-containing fertilisers can help water quality

It is becoming ever more important to make sure that we use our fertiliser nutrients as efficiently as possible and reduce losses to the environment. Regulations on this topic started with Nitrate Vulnerable Zones (NVZs), include the Water Framework Directive (WFD) and continue with the Clean Air Strategy.

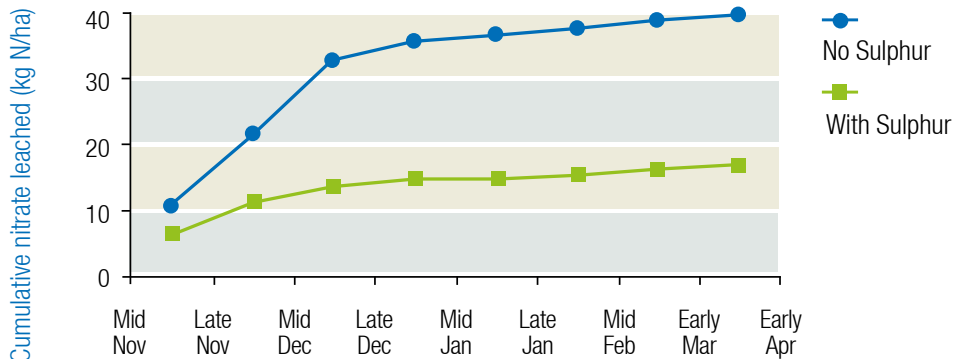
Measures of improvement include Nitrogen Fertiliser Use Efficiency (N^fUE) and nitrate losses to water, and Sulphur helps with both.

Because Sulphur and Nitrogen are so integral to protein production, a lack of Sulphur leaves more Nitrogen unused by plant growth and left in the soil from which it can potentially be lost. But evidence shows that N^fUE and actual leaching losses are reduced where Sulphur is included, regardless of region and soil type.

Nitrogen fertiliser use efficiency (N^fUE) improved by at least 10% where Sulphur is included

Fertiliser	N ^f UE on SILAGE	N ^f UE on SILAGE
AN	65	74
SingleTop	79	84

Nitrogen losses reduced by 57% over winter from grassland using Sulphur fertiliser



Blue bags grow better crops



www.cffertilisers.co.uk

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