Sulfur availability from organic materials applied to winter wheat and winter oilseed rape crops

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This paper reports results from experiments investigating crop available sulfur (S) supply from organic materials. The findings will help improve current recommendations on the use of organic materials as sources of crop available S and enable farmers to reduce their manufactured fertilizer S use accordingly. Field experiments were carried out at three sites cropped with winter wheat over three harvest years from 2010 to 2012 (two harvest years at each site; six harvest years in total). At each site, there were seven organic material treatments, namely autumn applied cattle farm yard manure (FYM), pig FYM, two biosolids products and broiler litter, and spring applied broiler litter and cattle or pig slurry. Crop yields and quality on the organic material treatments were compared with those on inorganic fertilizer S response treatments (supplying 0, 12.5, 25, 50 and 75 kg/ha SO_3) to determine the fertilizer S replacement values and hence the S availability of the applied organic materials.

Field experiments were carried out at four sites cropped with winter oilseed rape over three harvest years from 2014 to 2016 (two sites in 2014, one site in 2015 and one site in 2016). In 2014 and 2015 there were ten organic material treatments, namely autumn applied pig FYM, broiler litter and four biosolids products and spring applied cattle slurry, broiler litter and two biosolids products. In 2016 there were six organic material treatments including autumn applied cattle FYM, pig FYM, cattle slurry and pig slurry, and spring applied cattle slurry and pig slurry. Crop yields and quality on the organic material treatments were compared with those on inorganic fertilizer S response treatments (supplying 0, 30, 60, 90, 120 and 150 kg/ha SO_3) to determine the fertilizer S replacement values and hence the S availability of the applied organic materials.

There was a response to S at three of the six sites/years for the winter wheat and at all four winter oilseed rape sites. For the spring applied organic materials to winter wheat, ‘extractable’ SO_3 (i.e. readily available SO_3) was a good indicator of crop available S, ranging from *c.*15% of total SO_3 for cattle FYM to *c.*60% of total SO_3 for broiler litter. Results showed that for spring applied organic materials, ‘extractable’ SO_3 was equivalent to inorganic fertiliser S i.e. the S use efficiency for spring applications was 15% of total SO_3 for cattle FYM, 25% for pig FYM, 60% for broiler litter, 35% for slurry and 20% for biosolids. Lower S use efficiencies were measured from the autumn applied organic materials to winter wheat i.e. 5–10% of total SO_3 for livestock manures and 10–20% of total SO_3 for biosolids, suggesting that readily available S supplied by the organic materials was lost via overwinter leaching. In contrast, there was little effect of organic material application timing (autumn or spring) on S use efficiency by the oilseed rape crop. The increased S use efficiency from autumn applications to oilseed rape probably reflect greater crop S uptake by the oilseed rape crop in the period between application and the start of over winter drainage, resulting in lower S leaching losses.

This work has led to a better understanding of the available S supply from organic materials, allowing guidance to be produced for farmers on the availability of S from applications of organic materials (AHDB, 2017). This is likely to improve farm profitability by reducing S applications to crops receiving applications of organic materials.

AHDB (2017) Nutrient Management Guide (RB209) Section 2 – Organic materials. Available from http://www.ahdb.org.uk/projects/RB209.aspx