Demonstrating the importance of sulfur in fertilizer plans for corn and barley using polyhalite

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Sulfur (S) can be considered the fourth essential plant nutrient in a fertilizer plan required by crops to reach their full potential in terms of yield and quality. Over the last century, S was supplied to soils and crops by anthropogenic emissions leading to atmospheric deposition of S. During the 1970s, SO_2 emissions peaked across Europe and North America and have been declining until the present day (Smith et al. 2011). Deficiency in soil S has started to manifest in areas of low deposition, such as the US and Europe, to the point where S is required in NPK fertilizer plans (Webb et al. 2016).

Polyhalite, commercially known as POLY4, compromises of potassium (14% K_2O), magnesium (6% MgO), calcium (17% CaO) and sulfur (48% SO_3) with the chemical formula $K_2SO_4 \cdot MgSO_4 \cdot 2CaSO_4 \cdot 2H_2O$. The natural optimized ratios of nutrients can be useful for improving fertilizer use efficiency by addition of polyhalite to fertilizer plans. Exploration by Sirius Minerals and characterization work by Kemp et al. (2016) identified a resource of over 2.5 billion tonnes of polyhalite in the UK with an estimated supply for over 50 years. Therefore, research has been undertaken across the UK and North America to demonstrate the value of polyhalite as a multi-nutrient to supply K, Mg, Ca and S.

Trials on corn and barley were established in the US and the UK between 2014 and 2016 to determine the effectiveness of polyhalite under field conditions. The addition of polyhalite to NPK fertilizer plans to supply S demonstrated improvements in crop yield (15 – 135%), nutrient uptakes and plant quality compared to commercially available NPK plans. The use of polyhalite as a multi-nutrient fertilizer to supply K, Mg, Ca and S in fertilizer plans supports improvements in fertilizer efficiency.

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