Sensors : Use of Sensor Technologies to Improve NUE in Crop Production

One promising approach to enhancing NUE and crop yield in both Brazil and the UK is to ensure synchronicity of soil N supply with plant N demand throughout the cropping cycle (Sutton et al. 2011). This can be achieved through the better spatial and temporal targeting of N fertilisers, the use of new formulations (smart-fertilisers), the use of more efficient crop cultivars and precision agriculture (Gadanakis et al. 2015). Together, these represent a powerful combination, however, their adoption has been hampered by our inability to both routinely measure in real time and actively respond to soil N levels during the cropping cycle (Sylvester-Bradley et al. 1999). This is particularly relevant to agroecosystems, where real time information from in-situ monitoring could provide high resolution spatio-temporal information on the availability of plant nutrients. This can be combined with existing techniques involving GPS, crop canopy scanning and variable rate fertilisation. Current agronomic methods of soil N determination are limited to destructive sampling and analysis. This is time consuming, expensive and therefore, not suitable for generating the data needed to inform precision management of fertiliser applications (Kim et al. 2009). Currently, farmers rely on estimations based on previous cropping, soil type, growing conditions and fertiliser management (Rada & Valdes 2012), which have been shown to be seriously inaccurate (Sylvester-Bradley et al. 2008). The UK team has recently developed a range of *in situ* soil nitrate-N sensors which allow the real-time monitoring of soil N status. These low cost sensors are based on ion-selective membranes and have been validated *in situ* within grasslands but not yet in arable systems. In parallel, the Brazil team has developed new above-ground sensors for assessing crop canopy N status using field-portable Soil Plant Analysis Development (SPAD) chlorophyll meters. This allows the fast and non-destructive diagnosis and monitoring of plant N status. Working together, sensors capable of real time, *in-situ* measurement of soil and plant N, will be deployed in-field, throughout the growing season focusing initially on maize. Whole field heterogeneity will primarily be evaluated in the humid-tropical regions of Brazil using novel techniques (e.g. non-destructive electromagnetic induction; EMI) combined with traditional geo-statistical soil survey approaches of biological, chemical and physical soil quality indicators.

References:

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