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A sensitivity analysis study for improving Sulphur management strategies in Winter Oilseed Rape

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Because sulfur (S) depletion in soil results in seed yield losses and grain quality degradation, especially in high S-demanding crops such as oilseed rape (Brassica napus L.), monitoring S fertilisation has become a central issue. Crop models can be efficient tools to conduct virtual experiments under different fertilisation management strategies. Using the process-based model SuMoToRI (brunel-Muguet et al. 2015), we aimed to analyse the impact of different S fertilisation strategies coupled with the variablility observed in major plant characteristics in oilseed rape i.e. radiation use efficiency (RUE), carbon (C) allocation to the leaves (β) and specific leaf area (SLA) on plant performance-driven variables encompassing total biomass (TDW), S in the photosynthetic leaves (QSmobile.GL) and leaf area index (LAIGL). The contrasting S supply conditions differed in the amount of S (5 levels), and the timing of application (at bolting and/or at flowering, which included a fractioned condition). For this purpose, we performed a global sensitivity analysis (GSA) and calculated two sensitivity indices i.e. the Partial Raw Correlation Coefficient (PRCC) and the Sobol index. The results showed that whatever the timing of S supply, TDW, LAIGL and QSmobile.GL increased as S input increased. For a given S supply, there was no difference in TDW, LAIGL and QSmobile.GL between a single and a fractioned supply. Moreover, delaying the supply until flowering reduced the TDW and LAIGL whereas QSmobile.GL increased. Results showed that RUE had the greatest impact on TDW under all levels of S supply and all application timings, followed by β and SLA. RUE mostly impacted on QSmobile.GL, depending on S supply conditions, whereas it was the parameter with the least impact on LAIGL. Ultimately, our results provide strong evidence of optimised S fertilisation timings and plant characteristics that will guide producers in their agricultural practices by using specific varieties under constrained S fertilisation strategies.