Adapting Nitrogen Management to the Increasing Climatic Uncertainty

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ASABE : 250 words

With abbreviated return times of extreme events, management of nitrogen (N) will become even more a priority issue. The decision-making process of N application is complex because the N optimal rate varies spatially and temporally and the impact of a decision is delayed in time from its application. The objective of this paper is to develop a decision support system (DSS) to optimise N management in an ecosystem perspective, including crop production and environmental objectives.

Winter wheat response to N was analysed between 2008 and 2014 on Luvisols, in temperate climate (Belgium). The usual Belgian practice consists to apply 60-60-60kgN.ha^{-1} respectively at tiller, stem extension and flag-leaf stages. By using the STICS model, the effect of variable N rates on crop growth and N available for leaching (NAL) were computed. 300 stochastic weather time-series were derived from LARS-WG for actual and future climatic conditions. The farmer's marginal net revenues (MNR) were computed as function of N costs and wheat selling prices. For each climatic probability level, the ratio R=MNR/NAL was estimated in function of the N rates. To minimize the risks, the DSS considered the curve R=f(N) corresponding to the probability level of 75%. The best N rate was the maximum value of this curve.

Results indicated that, under actual conditions, the N rates applied at flag-leaf could, at least 3 years out of 4, be decreased by 10 to 30kgN.ha^{-1}. Under A1B scenarios, the optimal N practice could be decreased between 60-60-0kgN.ha^{-1} and 60-60-30kgN.ha^{-1}.