

## **Assessment of optimal N fertilizer use on Portuguese maize yield using the STICS crop model**

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The optimal mineral N fertilizer use (timing and rate) for corn (*Zea mais* L.) yield has been known to vary regarding different environmental conditions. Previous research has shown that a primary N requirement should be met before the V8 stage, while the first two N applications should occur around seedling and stem elongation. Nonetheless, due to the high spatial variability of irrigated maize crop growth, it becomes rather difficult to assess optimal N application, which simultaneously consider variability of soil N supply (storage and mineralization) and N uptake efficiency. As such, the present study tries to integrate and model all of these factors to evaluate maize yield response to a multitude of possible mineral N treatment combinations (timing and amount). For this purpose, STICS, a state-of-the-art process-based crop model, was used to reproduce temporal changes in the soil-crop mineral N pool at three different sites in Ribatejo, Portugal, over the period of 1986–2005. The first two applications were fixed at the Julian Day (JL) 120 (seedling stage) and at JL 140 (stem elongation), with a typical value of 40 kg/ha. The impact of last N application on yield, ranging from 0–120 kg/ha (10 kg/ha step) and from JL 140–180 (10-day interval), was assessed under the historical pedoclimatic conditions. Soil mineralization and N uptake efficiency were also simulated. Our results indicate that JL 150 was the best timing for the third application in all sites. Ribatejo soils presented 200–300 kg/ha of mineralized N and a mean crop uptake efficiency of 65% was found for all possible combinations. Meanwhile, we found that the best amount was of 80-100 kg/ha, depending on the region. In Portugal, the prevailing Mediterranean-like climatic conditions favour the mineralization process, by which a large proportion of crop N demand could be satisfied. Nevertheless, further local field experiments are required to validate and complement our study outcomes.