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Ongoing climate change has been reported to have far-reaching impact on agriculture worldwide owing to increased mean temperatures, higher precipitation variability and higher frequency of extreme temperature events. However, there is paucity of information on the potential effect of climate change on crop establishment that includes three stages: seed germination, seedling emergence and beginning of competition among young plantlets. A better understanding on the evolution of seedbed conditions under future climate change not only facilitates adaptation of crops in their original area of production but also helps explore new areas that were not suitable in the past for a given field crop establishment, but may result opportune in the future.

Here we used a model-based framework to pinpoint whether the establishment quality of soybean and sugar beet in northern France will be affected by future climate change. To this objective, we first parameterized the SIMPLE crop emergence model and tested its prediction quality on seed germination and seedling emergence in relation to temperatures, water content, and soil structure. We then performed a simulation study over the 2020-2100 period, for early, conventional and late sowing dates. We generated soil temperatures and water contents of seedbeds for these three sowing dates using the STICS soil-crop model with the most pessimistic IPCC scenario (RCP 8.5). We then used these data to feed the SIMPLE crop emergence model to run simulations.

Our results showed that, when analyzed by sowing date and for successive 20-year period from 2020 to 2100, there was a significant increase in average seedbed temperatures 30 days after sowing by 2 °C after 2060, while no change in cumulative rainfall 30 days after sowing was found, compared with the past. Emergence rate of sugar beet was generally higher for 2081–2100 while there was no significant change for that of soybean. Main causes of non-emergence for both crops were: seedling death due to clods or soil surface crust, non-germination, and seedling mortality due to drought. Our study shows that the use of future climate scenarios coupled with crop

models provide an important insight into future sowing conditions, and result particularly helpful to better project future adaptation of cropping systems.

Keywords: *seed germination, seedling emergence, seedbed conditions, modeling*