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Modelling predicts that tolerance to drought during reproductive development will be required for high yield potential and stability of wheat in Europe

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Short periods of extreme weather, such as a spell of high temperature or drought during a sensitive stage of development, could result in substantial yield losses due to reduction in grain number and grain size. In a modelling study (Stratonovitch & Semenov 2015), heat tolerance around flowering in wheat was identified as a key trait for increased yield potential in Europe under climate change. Ji et all (Ji et al. 2010) demonstrated cultivar specific responses of yield to drought stress around flowering in wheat. They hypothesised that carbohydrate supply to anthers may be the key in maintaining pollen fertility and grain number in wheat. It was shown in (Nuccio et al. 2015) that genetically modified varieties of maize that increase the concentration of sucrose in ear spikelets, performed better under non-drought and drought conditions in field experiments.

The objective of this modelling study was to assess potential benefits of tolerance to drought during reproductive development for wheat yield potential and yield stability across Europe. We used the Sirius wheat model to optimise wheat ideotypes for 2050 (HadGEM2, RCP8.5) climate scenarios at selected European sites. Eight cultivar parameters were optimised to maximise mean yields, including parameters controlling phenology, canopy growth and water limitation. At those sites where water could be limited, ideotypes sensitive to drought produced substantially lower mean yields and higher yield variability compare with tolerant ideotypes. Therefore, tolerance to drought during reproductive development is likely to be required for wheat cultivars optimised for the future climate in Europe in order to achieve high yield potential and yield stability.