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Global warming is palpable. The last 9 years have been the warmest since the pre-industrial era, and the most optimistic scenario predicts +1.8°C by 2100. Some consequences of this change may be positive including a reduction of frost incidence and expansion of new arable land at high latitudes and we could benefit in the short term by adjusting the choice of genotypes and sowing dates. But the increase in average daily temperature is asymmetric, with a greater increase in night temperatures. Night temperature affects grain yield mainly by shortening the duration of the critical period when grain number is determined. In addition, recent discoveries indicate that plants sense temperature through phytochromes, so higher night temperatures may affect crop development per se, in ways not currently captured by crop simulation models using mean temperature and photoperiod.

Climate change is also modifying the frequency, intensity, and duration of extreme events. This phenomenon has been documented in several productive regions of the world and causes very severe damage to crop production. There are no positive consequences of these effects of climate change and predicting and adapting to them is more complex. Drought, flood, and heat shock reduce crop productivity and grain quality, especially when they occur in the reproductive stages of the crop cycle, which are more sensitive to environmental stresses. We understand some effects of these individual stresses, but know much less about the effects of stress events in combination.

Given some insights into the probability of stress, it is possible to escape or tolerate it. Escape can be achieved by adjusting crop phenology with genotype and sowing date, to time the sensitive reproductive window in periods of low risk. Reliable climate forecasts to predict risks and improved understanding of likely crop damage will be needed. Rapeseed has a wide range of winter and spring genotypes, with flexibility to adjust flowering time. By contrast, the variability of the post-flowering duration, and its environmental regulation, are less understood and areas for fruitful research.

To tolerate environmental stresses, rapeseed has interesting vegetative and reproductive plasticity traits, to allow compensation for the loss of yield components well into the crop cycle. The floral branching capacity and adjustment of the grain number per pod provide pathways to achieve high grain number in a range of environmental conditions and agronomic management. Genetic improvement seeks stress-tolerant genotypes, particularly for pollen formation, flower fertilization, and grain set. Improvements in oxidative damage repair mechanisms, rapid recovery of water status, and recovery of enzymatic activity post-stress are promising attributes to improve tolerance to multiple stresses. The ability to increase grain weight when grain number falls, and to remobilize stem reserves to sustain grain growth are beneficial plasticity attributes which have scope for improvement in the short term.

The challenge to maintain rapeseed productivity in the face of climate change is significant but there is scope to use improved physiological understanding of crop response to underpin co-ordinated genetic and agronomic adaptations relevant to key production regions. There is no time to lose.