Night temperature effects on transpiration response to atmospheric drought and leaf area in wheat

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Context

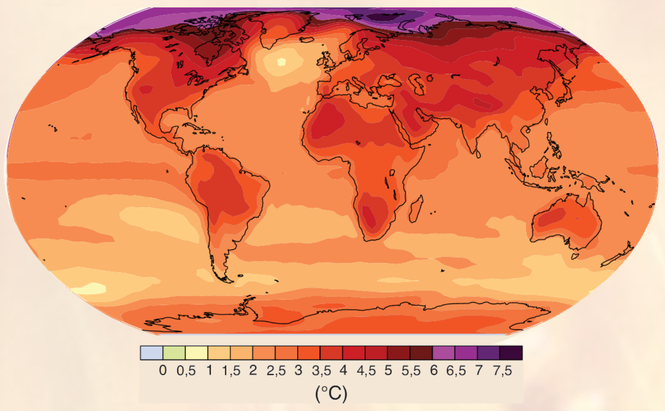


Fig.1 : Projected surface temperature changes for the decade 2090-2099 relative to 1980-1999 (IPCC, 2007).

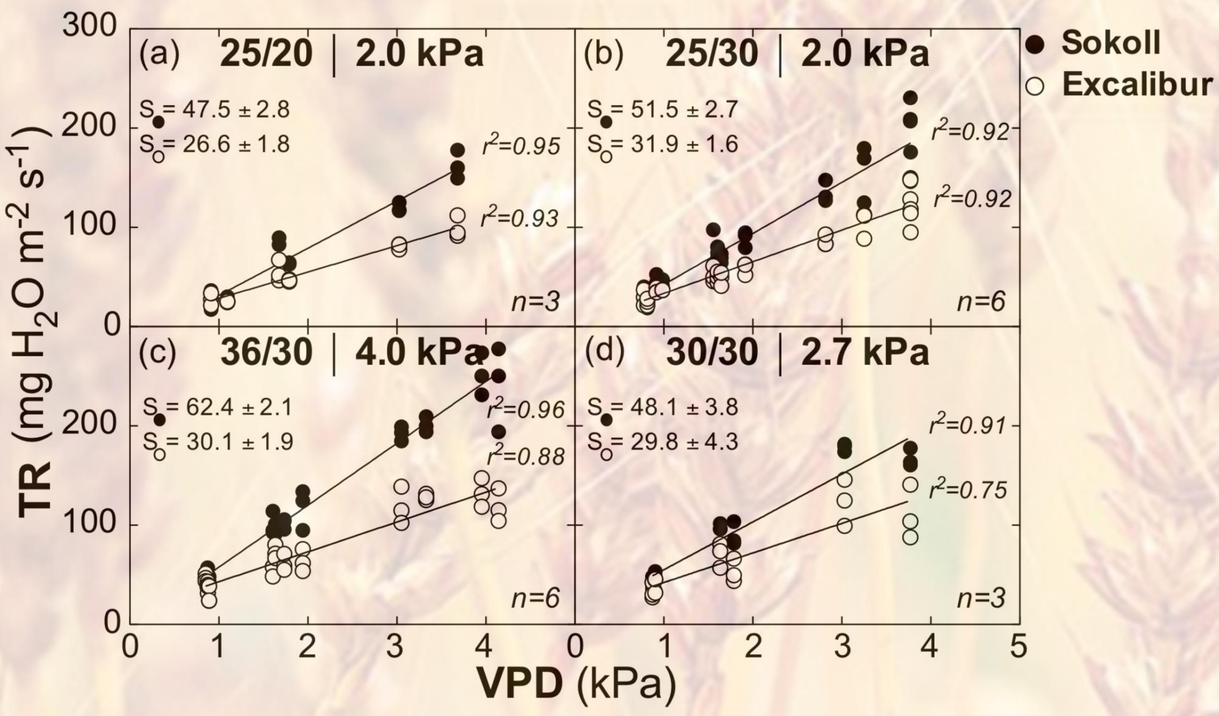
Yield = TR*HI*k/VPD

HI: harvest index; k a photosynthetic coefficient (from Tanner and Sinclair 1983)

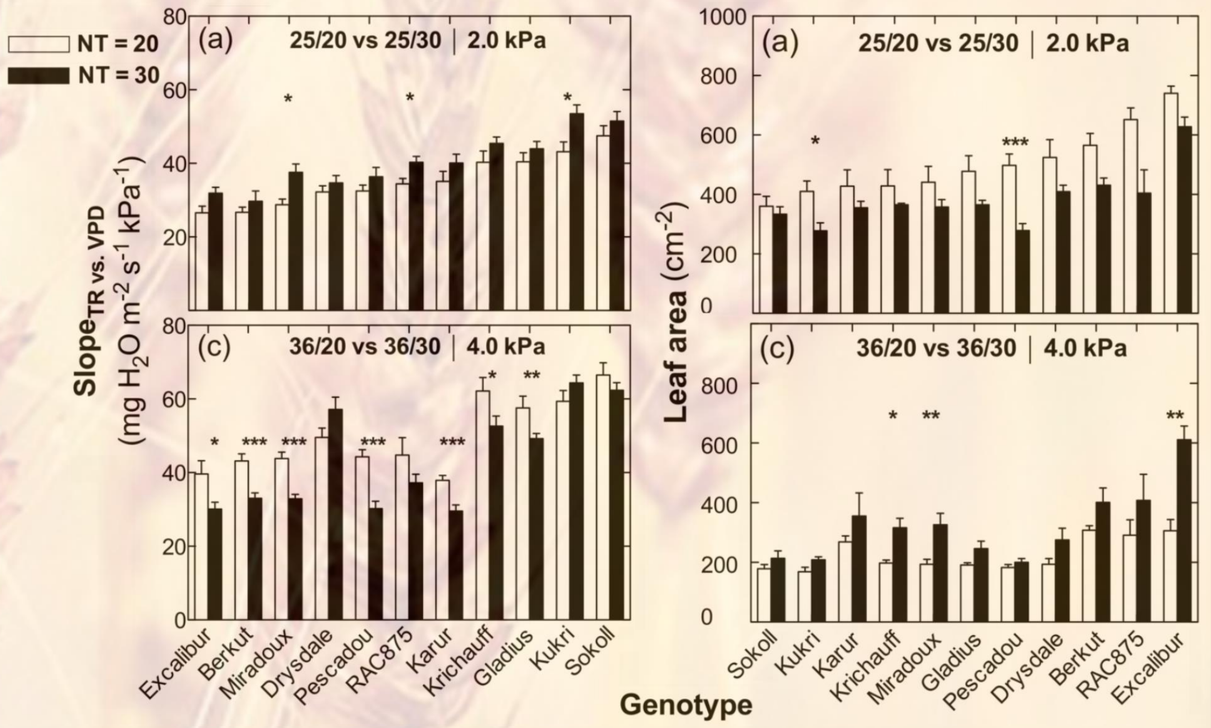
- **Increasing evidence indicates that limited transpiration rate (TR) response to high (>3 kPa) vapour pressure deficit (VPD) is a valuable trait in identifying water-saving, drought-tolerant genotypes.**
- **However, the relevance of this trait under a warming climate is much less investigated. In particular, the effect of different night temperature (NT) regimes on wheat TR sensitivity to increasing VPD and whole-plant evaporative area remains unknown.**
- **A controlled-environment study was undertaken on 11 diverse bread and durum wheat lines in order to identify the extent of variability in terms of (i) sensitivity of TR response to increasing VPD in the 0.8 to 4.3kPa range (Slope$TR_{vs}VPD$) and (ii) leaf area (LA) following 22d-long exposures to 2 NT warming scenarios (20 and 30°C).**
- **The effect of these two NT conditions was investigated in combination with 3 different daytime (temperature and VPD) warming regimes (25°C & 2kPa, 30°C & 2.7kPa and 36°C & 4kPa).**

Results

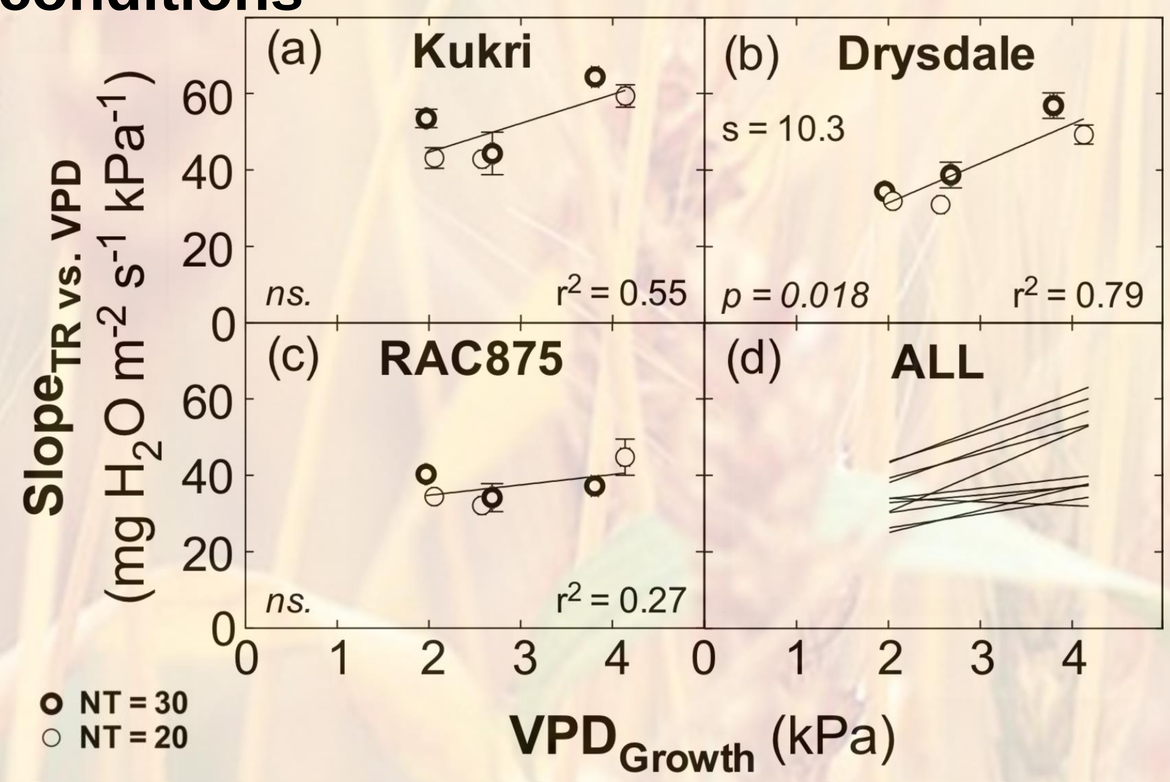
I. NT and VPD_{Growth} effect on Slope$TR_{vs}VPD$ is dependent on the genotype



II. Opposite NT effects on Slope$TR_{vs}VPD$ and LA in a VPD_{Growth}-dependent on way



III. Genetic variability of $Slope_{TRvsVPD}$ sensitivity to combined NT and VPD_{Growth} conditions



Conclusion

- **TR sensitivity to atmospheric drought (VPD) is responsive to the growing conditions and particularly NT even under continuously well-watered conditions.**
- **A compensation mechanism between LA and TR sensitivity to increasing VPD drives wheat adaptation to increasing temperatures.**
- **A substantial genetic variability characterizes the above responses.**
- **Those findings have implications in modelling crop water use under warming climates and in developing ideotypes with water-use dynamics that are specifically adapted to target warming scenarios.**

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