ARC CENTRE OF EXCELLENCE FOR
PLANT SUCCESS
IN NATURE AND AGRICULTURE

Managed-Stress Trials in Breeding

Mark Cooper

Outline

$$R_{t(T,M)} = \frac{i_{t(M)} r_{A_{t(M)}} r_{A_{t(M,T)}} \sigma_{A_{t(T)}}}{L}$$

- ***Can we use Managed-Environments to improve MET-TPE alignment?***
  - MET = Multi-Environment Trial
  - TPE = Target Population of Environments
  - Managed-Environments designed to represent key Envirotypes that have a “high” frequency in the TPE
  - Applied *Phenomics*, *Genomics*, *Enviromics*

- ***Wheat Breeding***: CIMMYT-Australia (1985-2000)

- ***Maize Breeding***: Gx(ExM) & Improving yield stability (1996-2017)

Wheat Breeding: Australia (1985-2000)

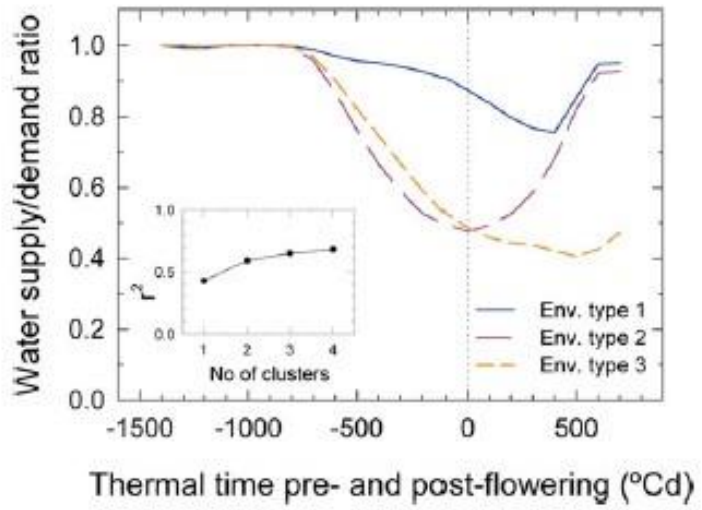
Journal of Experimental Botany, Vol. 62, No. 6, pp. 1743–1755, 2011
doi:10.1093/jxb/erq459

Journal of Experimental Botany
www.jxb.oxfordjournals.org

RESEARCH PAPER

Environment characterization as an aid to wheat improvement: interpreting genotype–environment interactions by modelling water-deficit patterns in North-Eastern Australia

K. Chenu[1,2,*], M. Cooper[3,†], G. L. Hammer[4], K. L. Mathews[5,‡], M. F. Dreccer[6] and S. C. Chapman[5]



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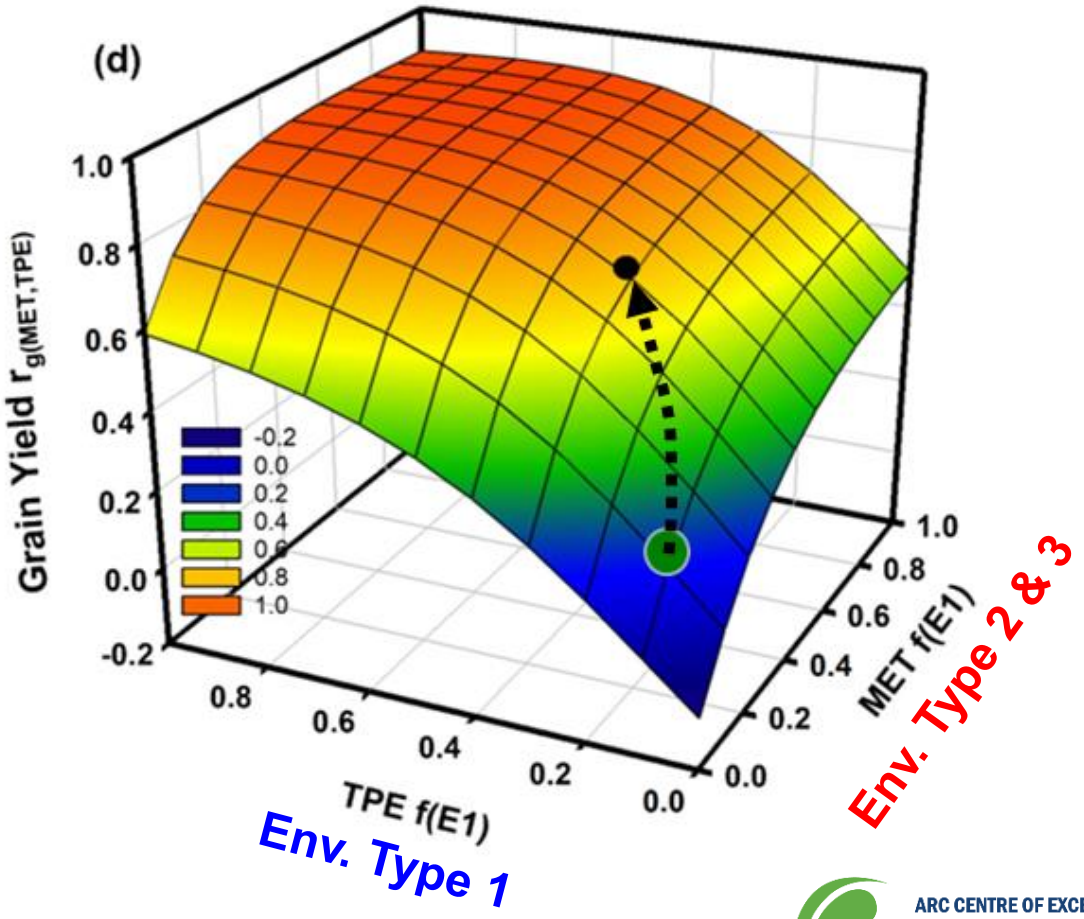

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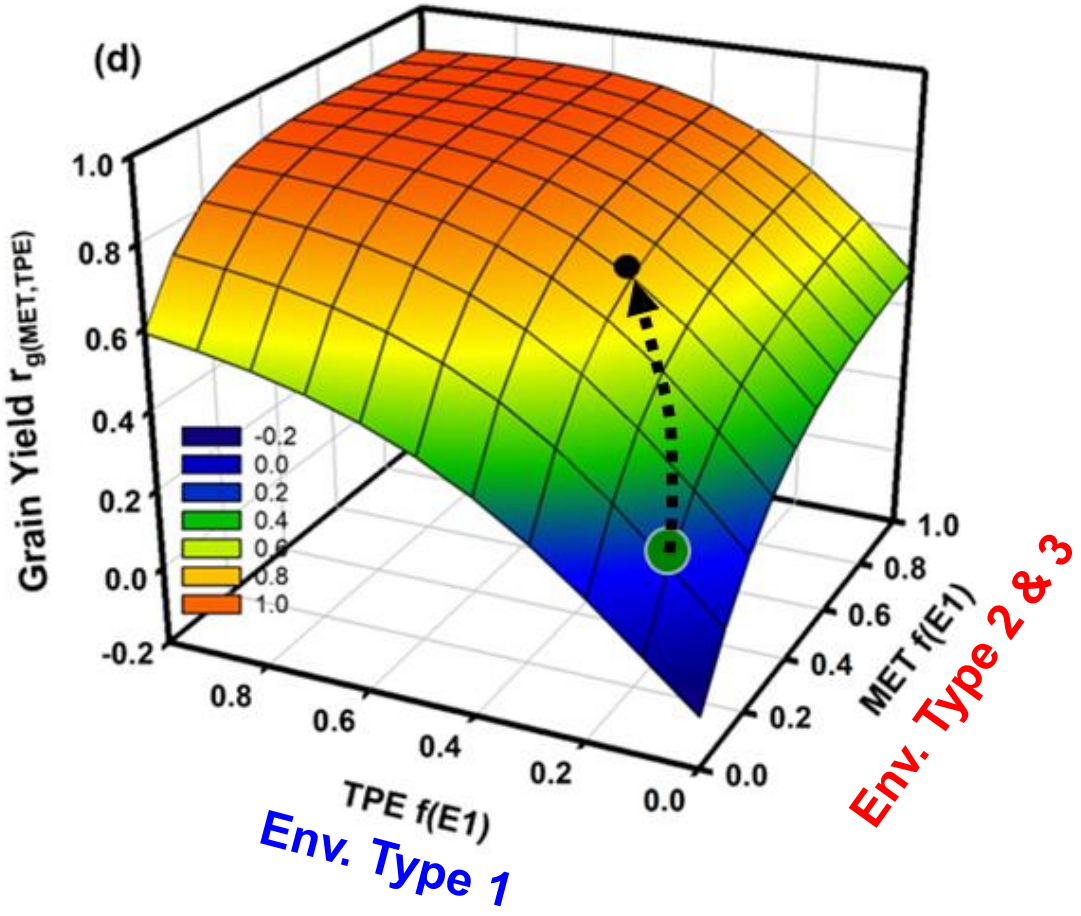
Wheat Breeding: Australia (1985-2000)



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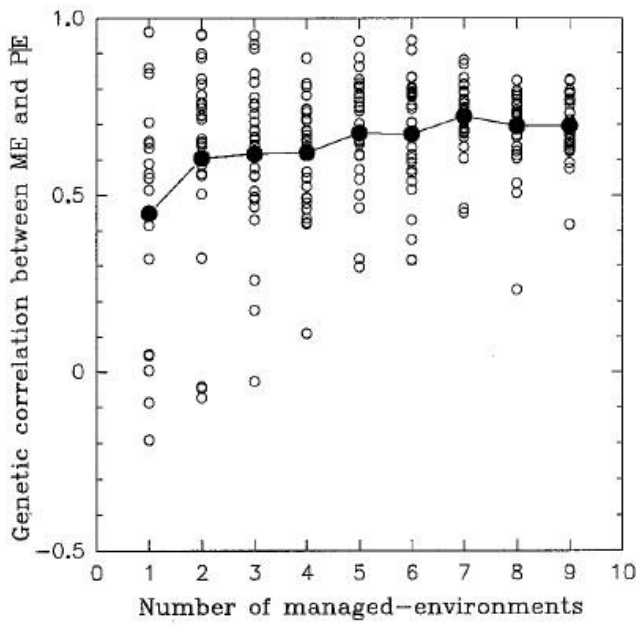

Theor Appl Genet (1995) 90:492–502

M. Cooper · D. R. Woodruff · R. L. Eisemann
P. S. Brennan · I. H. DeLacy

A selection strategy to accommodate genotype-by-environment interaction for grain yield of wheat: managed-environments for selection among genotypes

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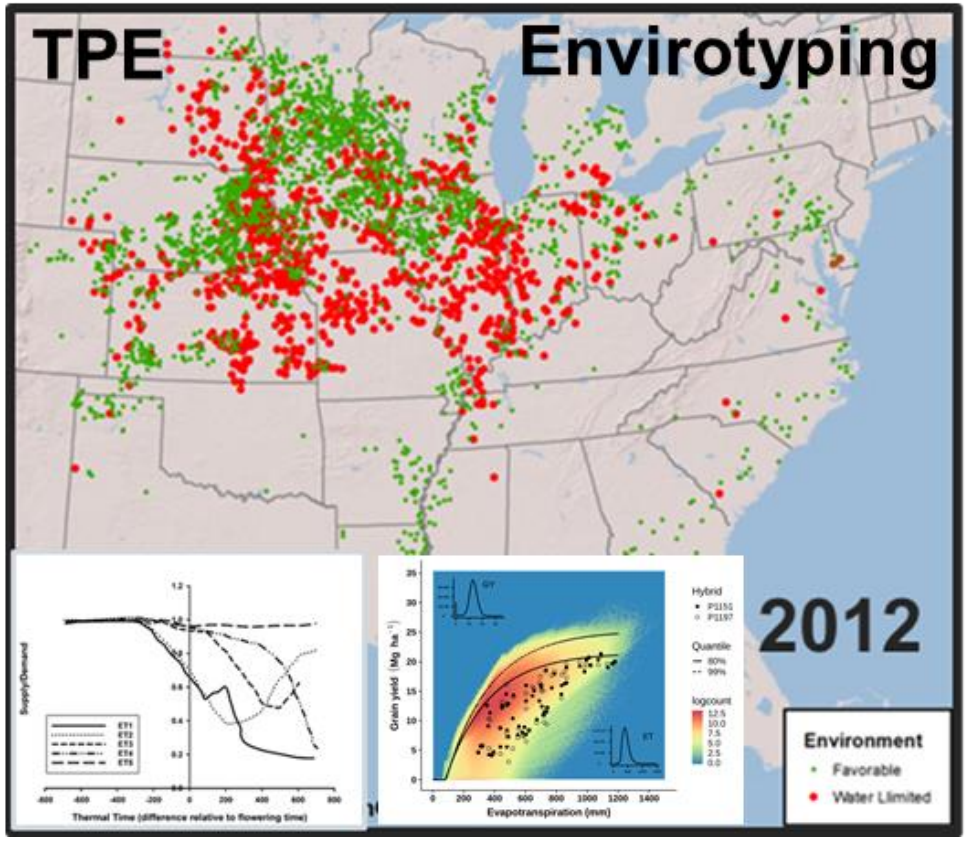
Maize Breeding: USA (1996-2017)



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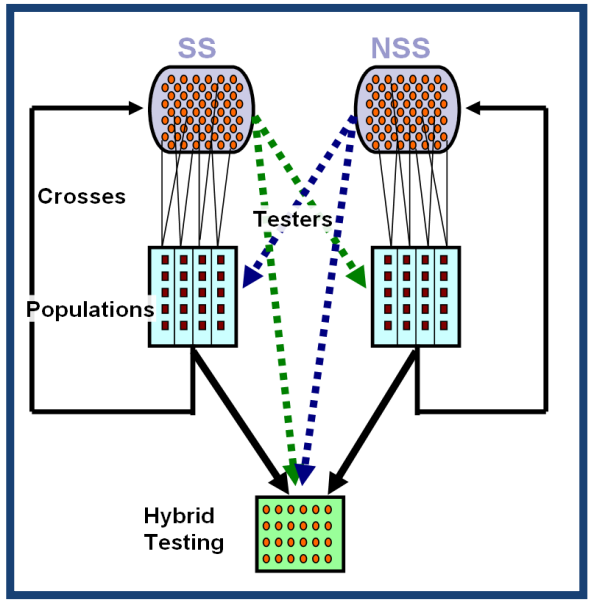
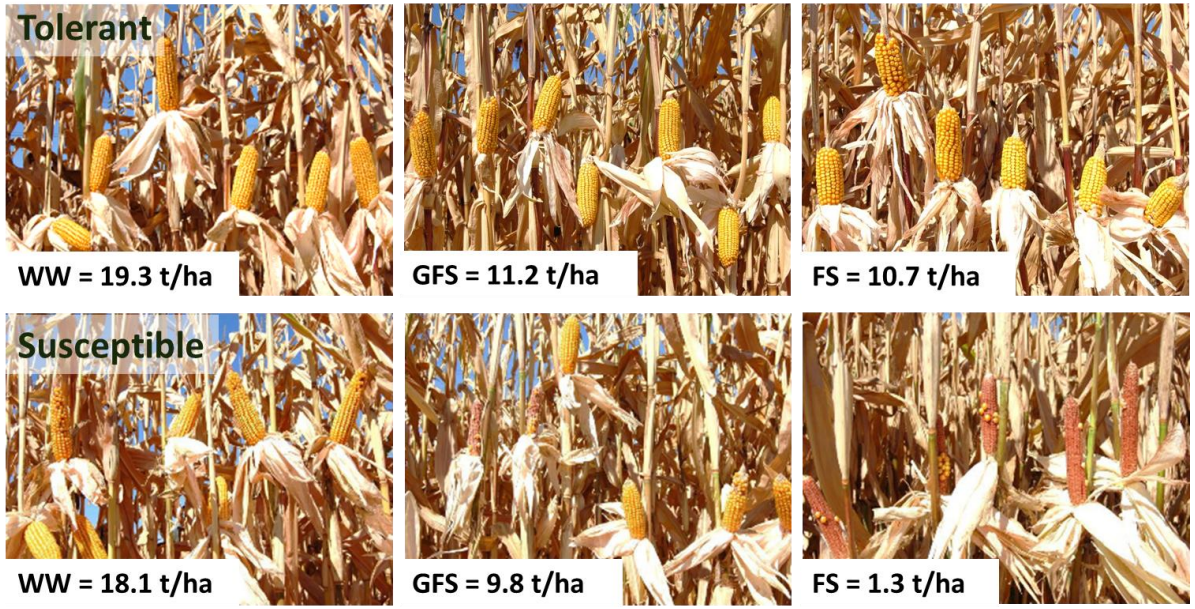


Full Irrigation *Grain Fill Stress* *Flowering Stress*



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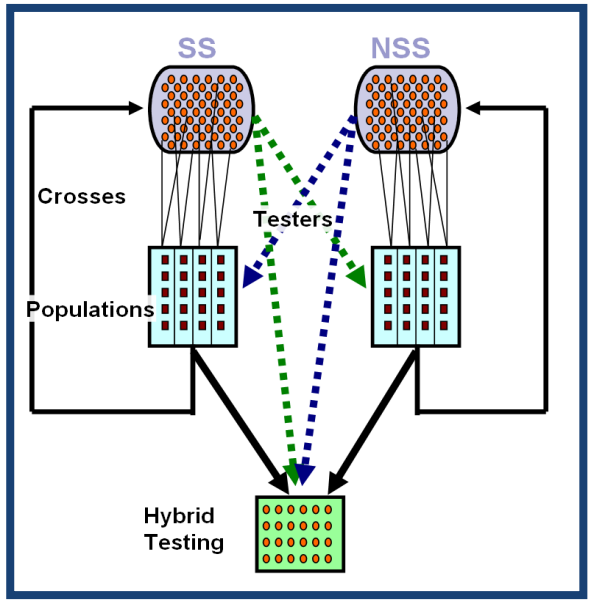

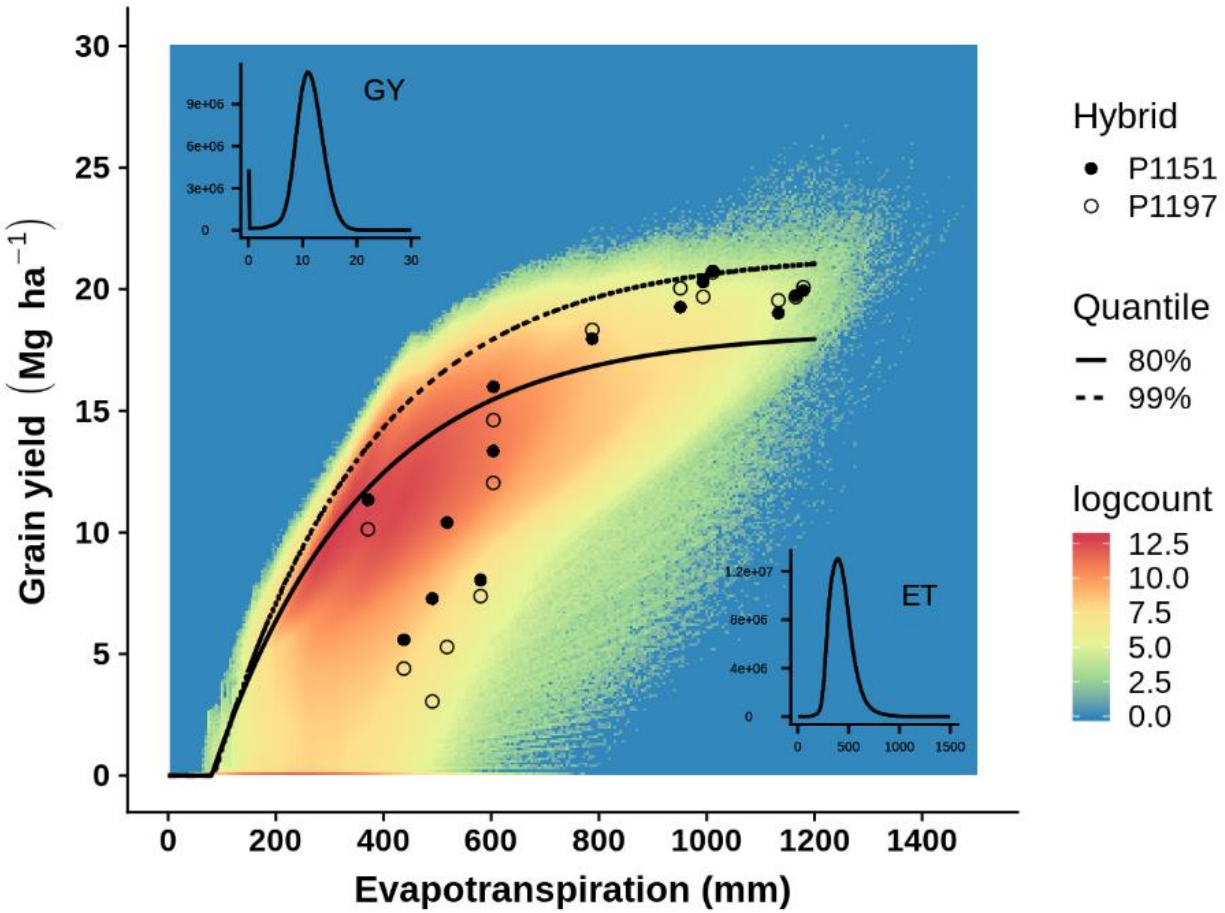

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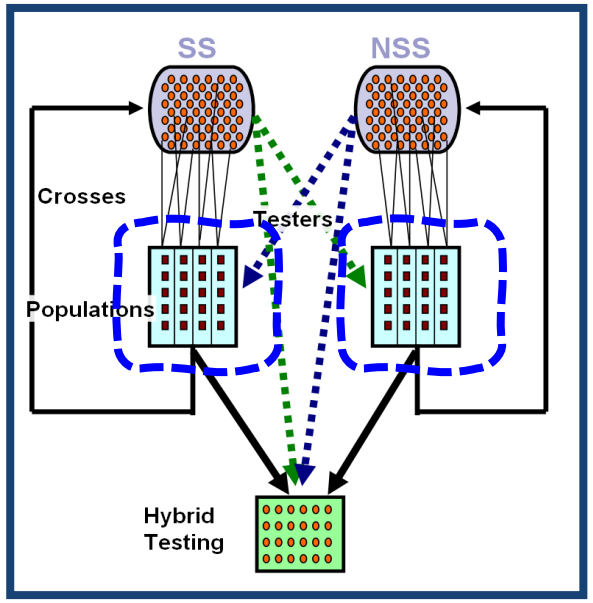

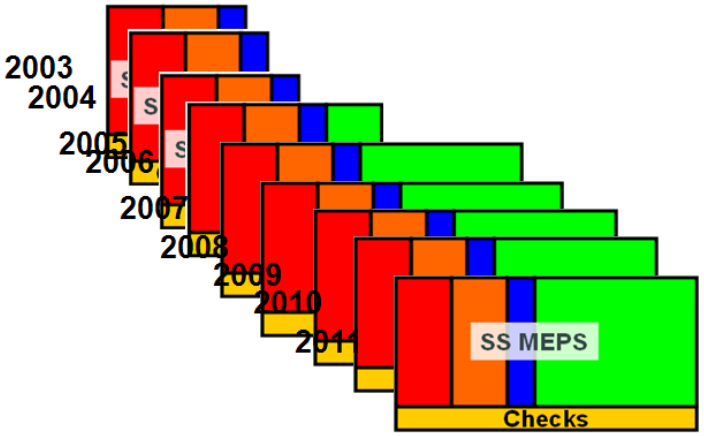

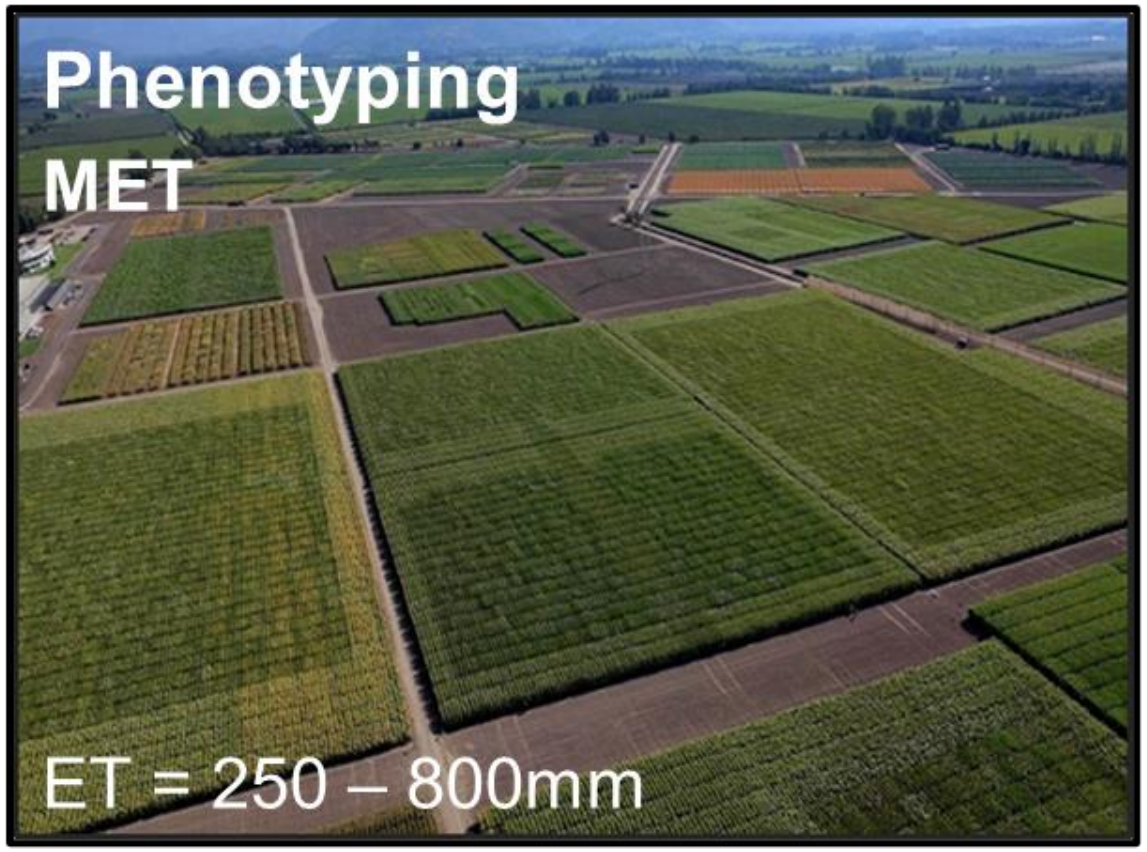

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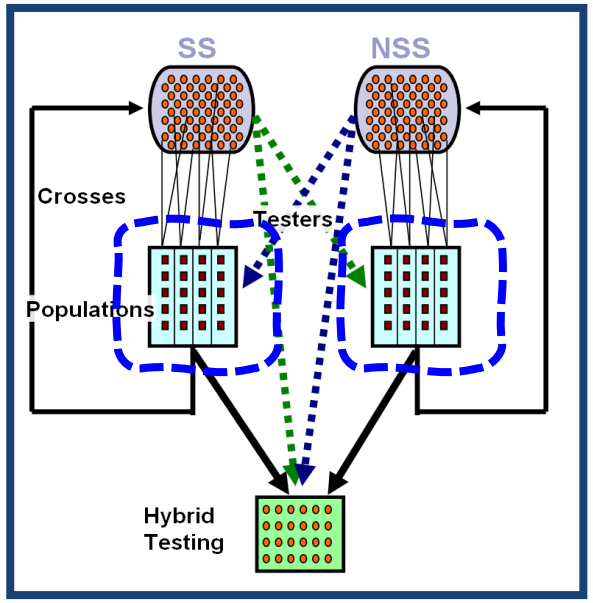

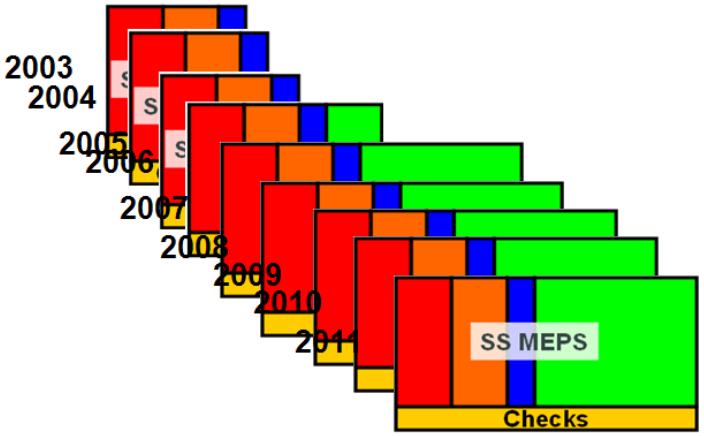

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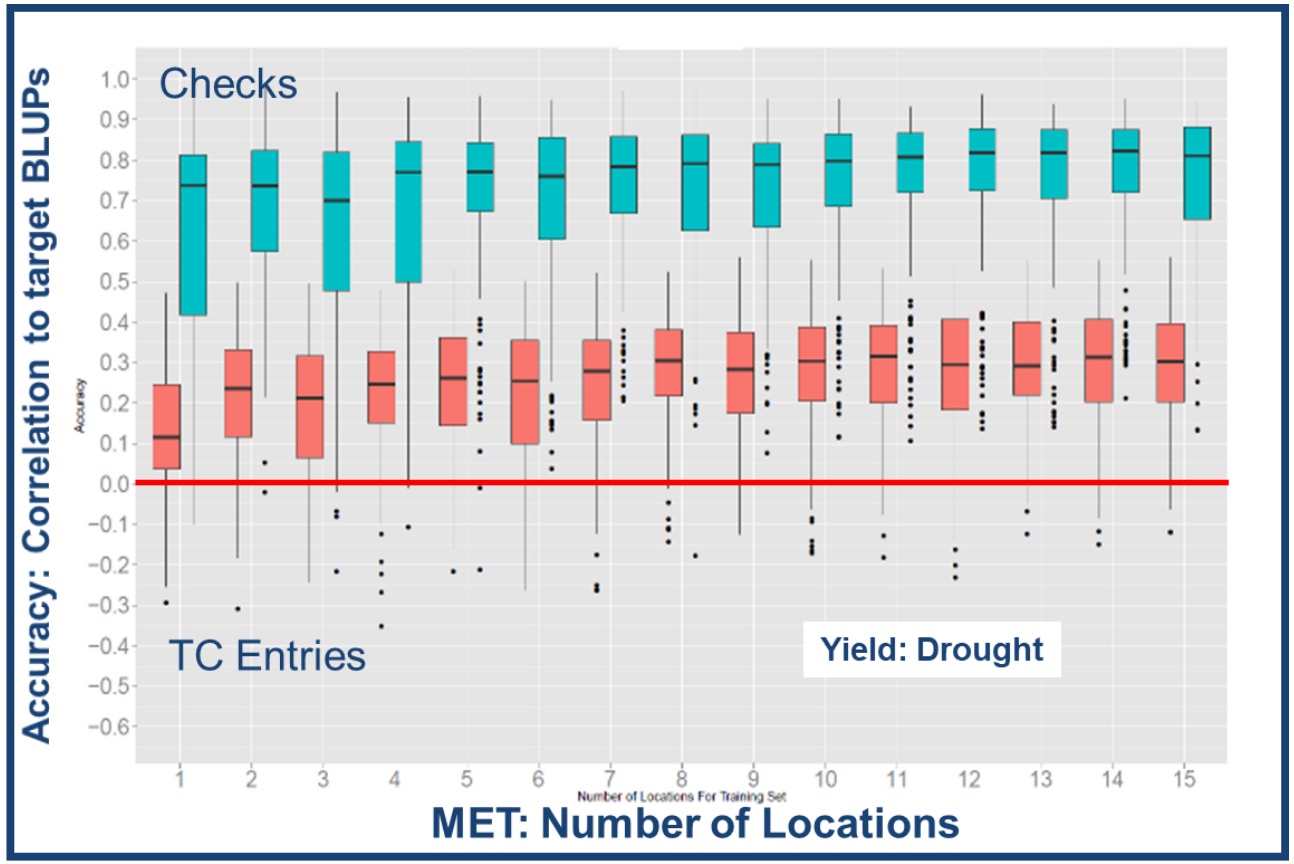
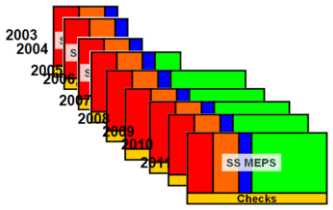
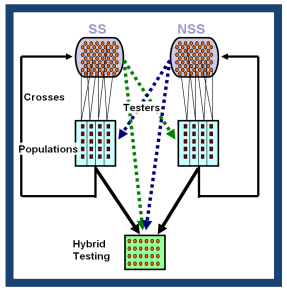


Predict: New Genotypes & New Environments (same Envirotype)

Maize Breeding: USA (1996-2017)





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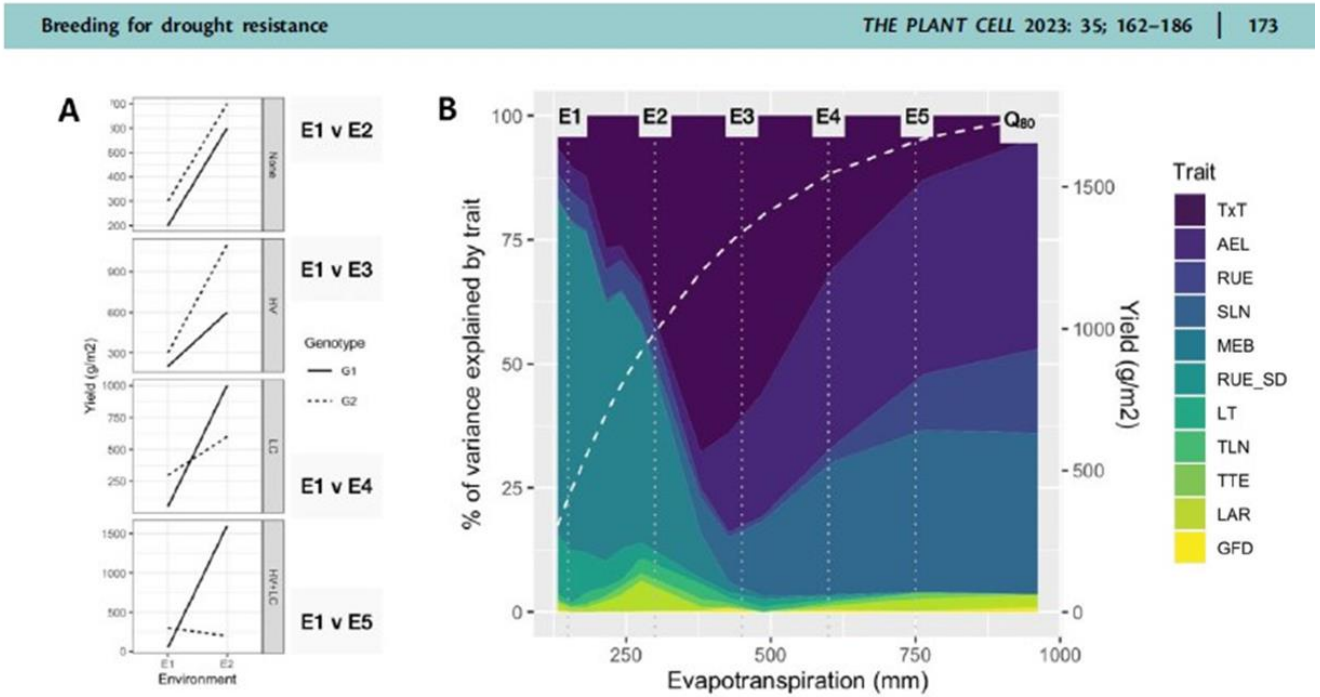
SS	WW	STRESS	TPE
WW	61.2	0.52	0.73
STRESS	22.4	30.8	0.34
TPE	31	10.4	29.7

NS	WW	STRESS	TPE
WW	22.2	0.55	0.90
STRESS	23.4	81.2	0.54
TPE	23.8	27.2	31.8



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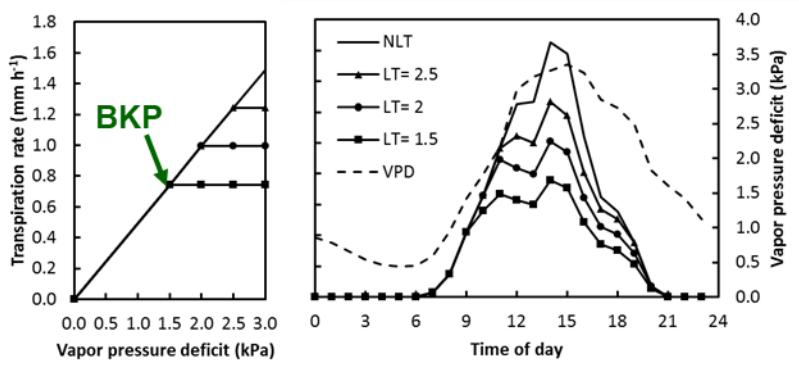
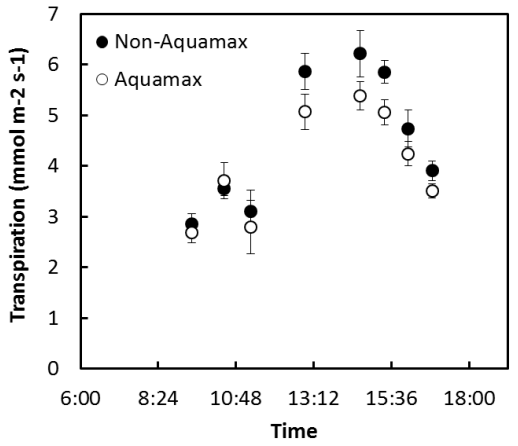
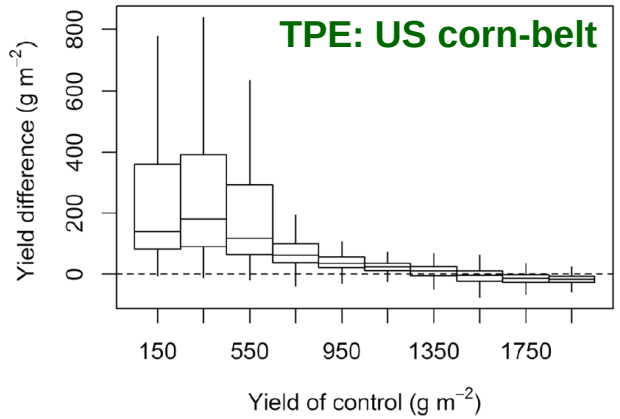
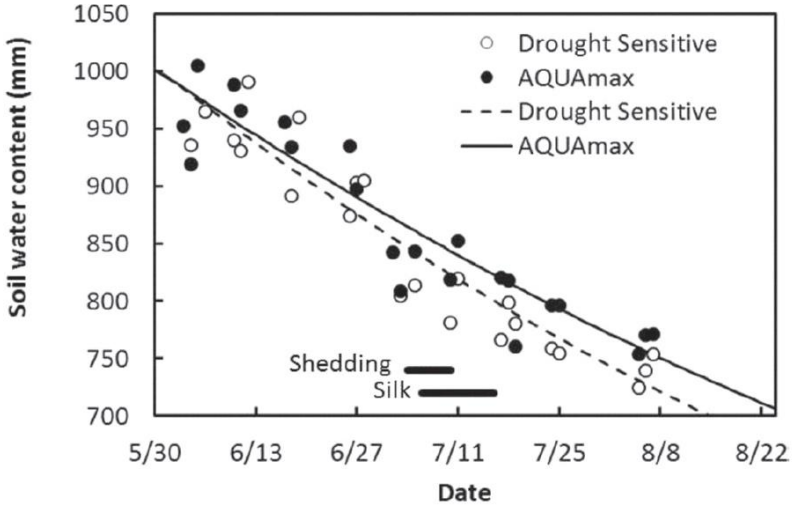
Maize Breeding: USA (1996-2017)

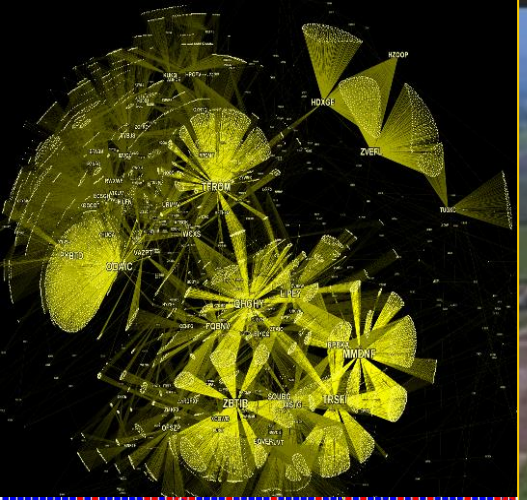
Restricted Transpiration

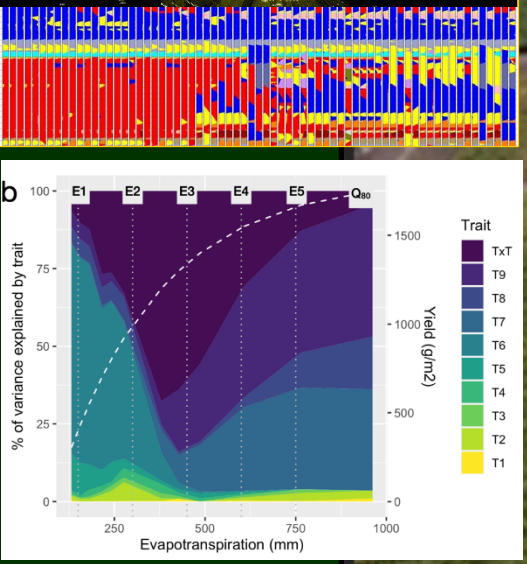


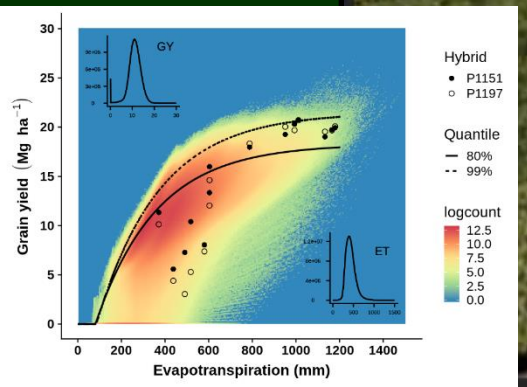




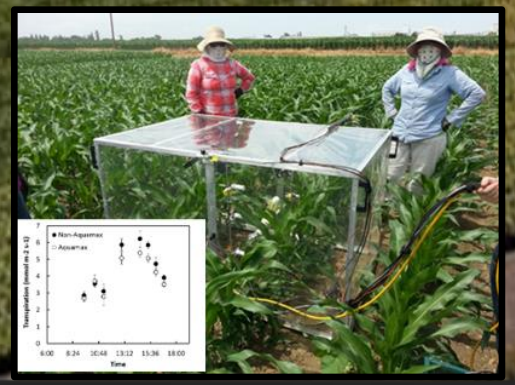








Questions



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ET = 250 – 800mm