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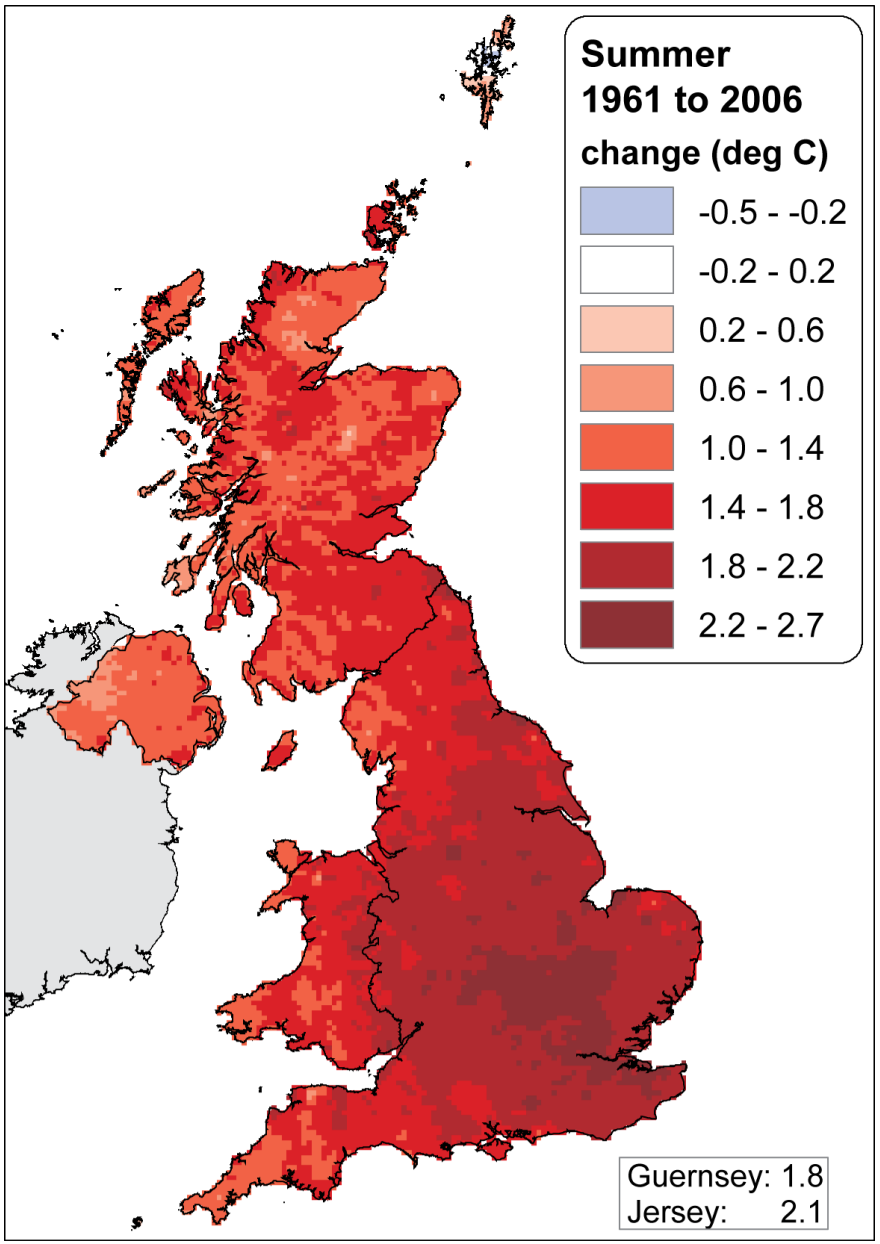
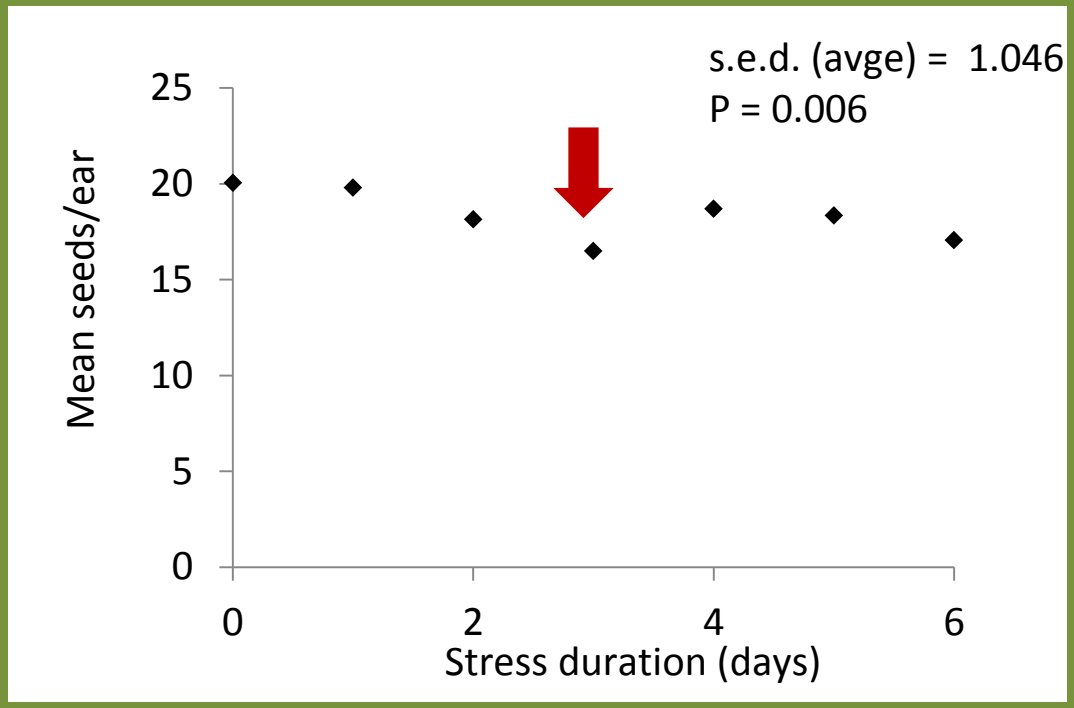
Genetic diversity, and yield stability for increased resilience against climate change in the UK

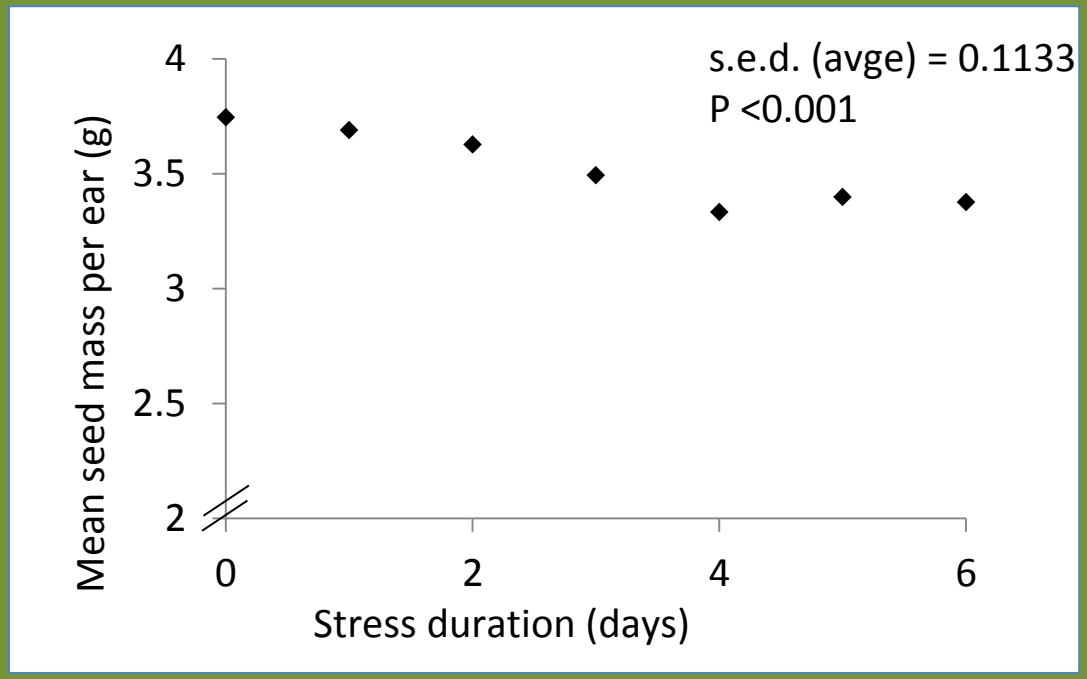
Hannah Jones

BBSRC bioscience for the future



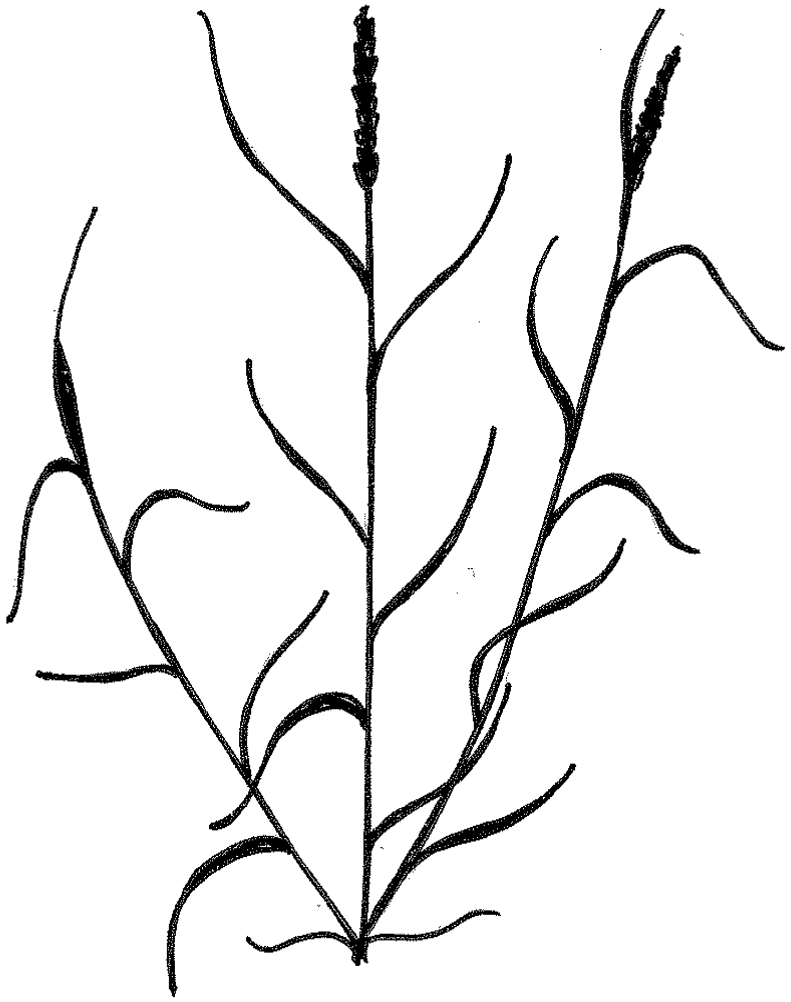
Hypothesis: Increased diversity within a crop will increase resilience to climate change events

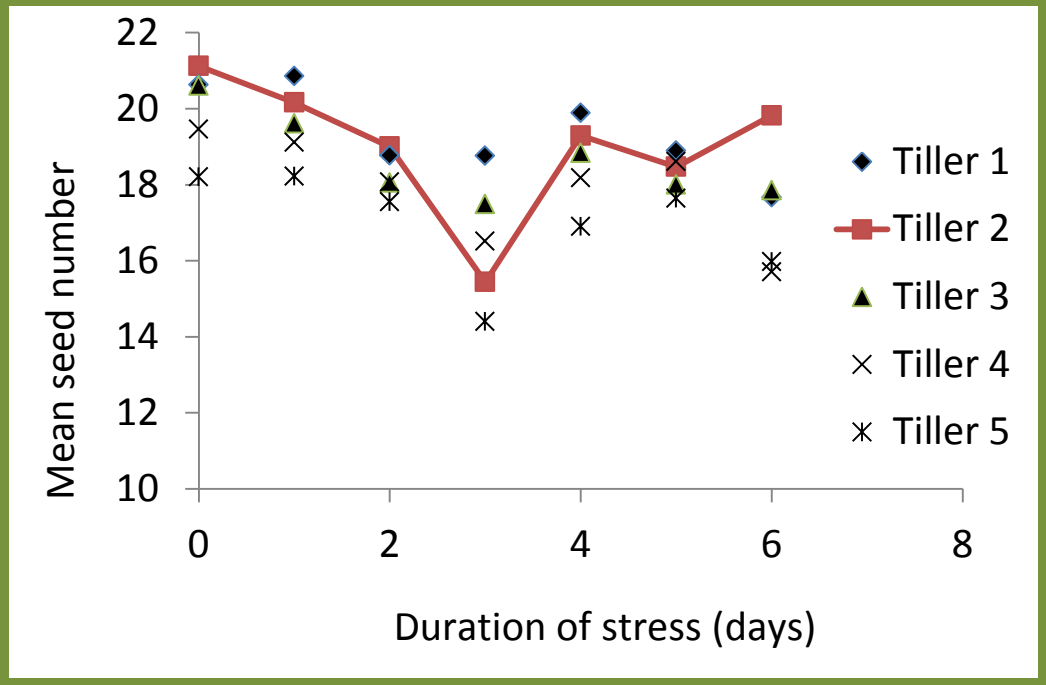




Heat stress affects seed number and seed weight

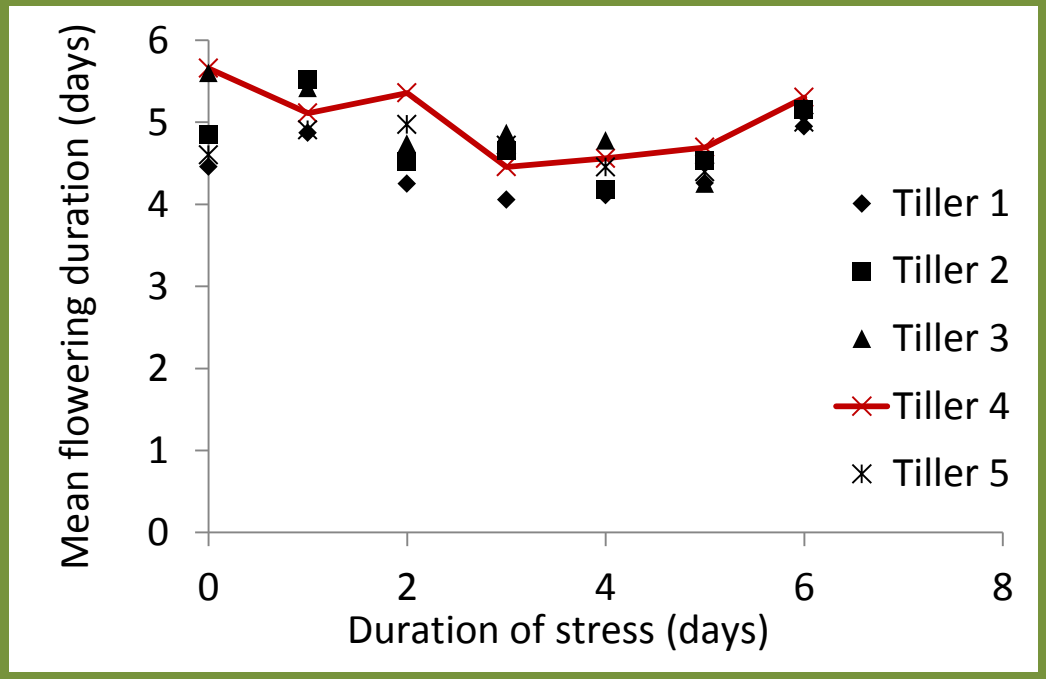
- Average over 5 tillers
- 4 replicate plants (1 per pot)
- Just 2012 data
- 12 lines
- Stress at 35C for 3 hours per day between 11.30 and 14.30 returning to ambient *circa* 17 - 20C





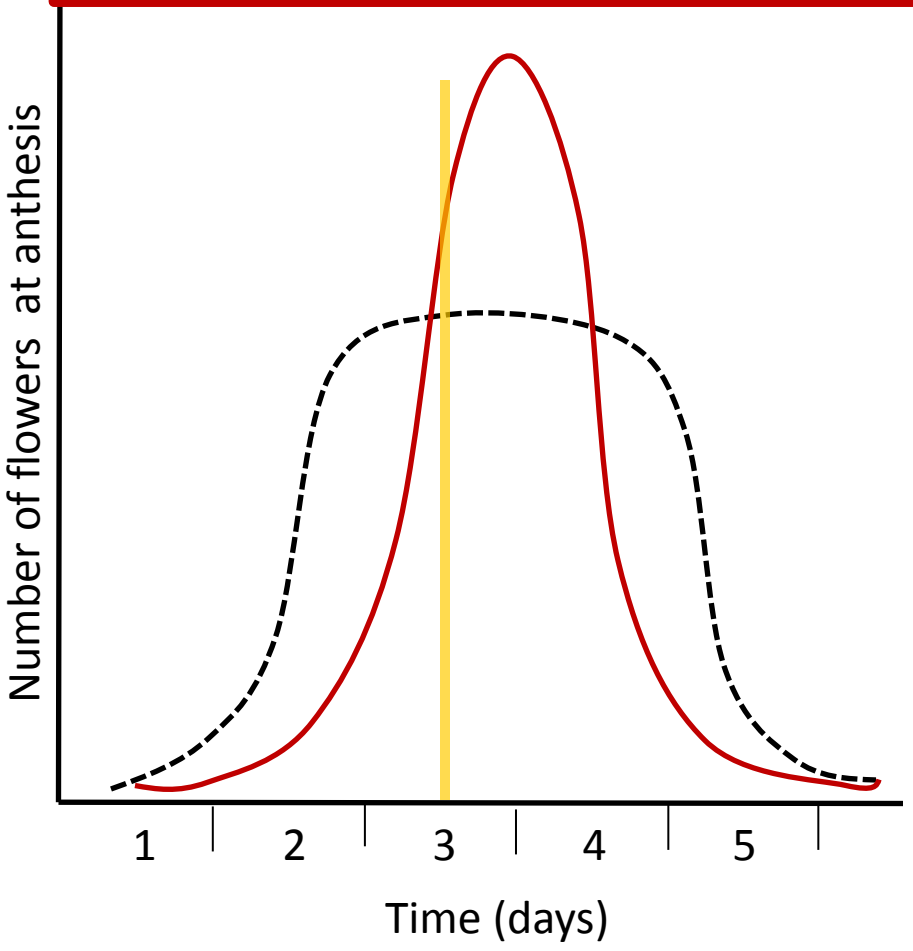
Heat stress affects tillers differentially

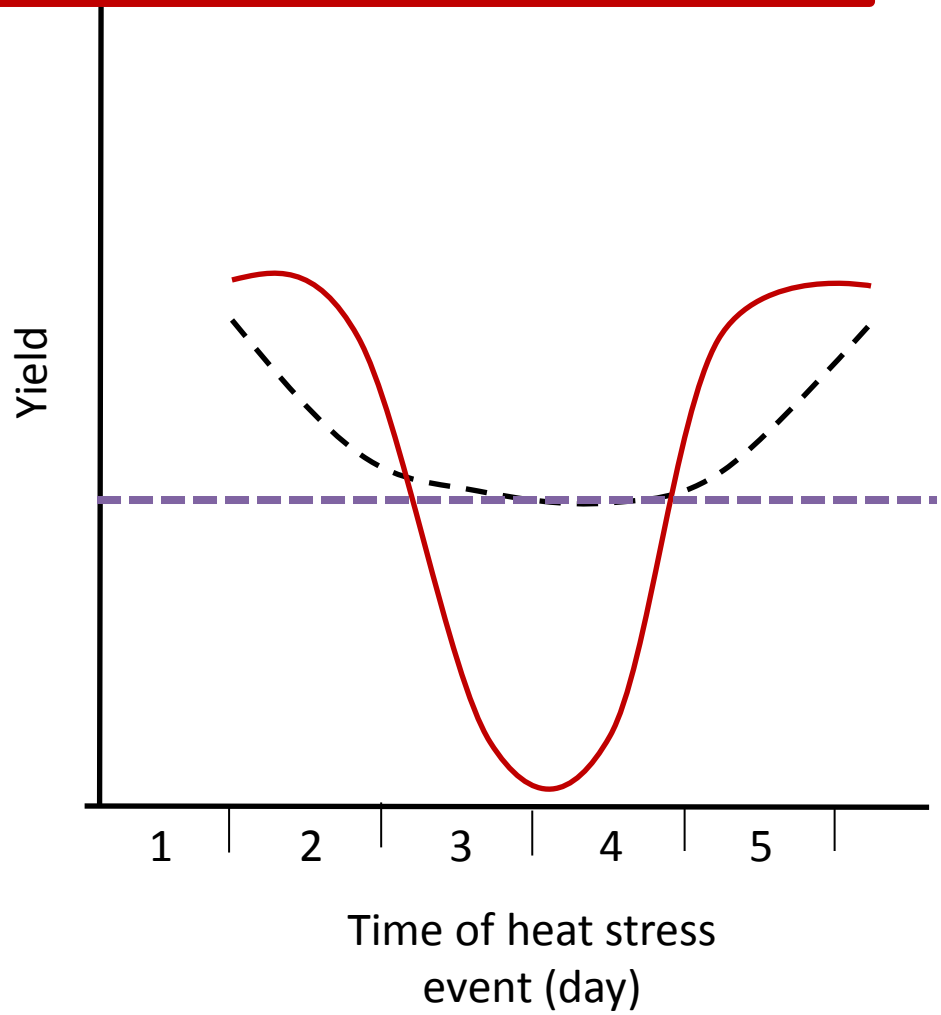
	P	s.e.d.
Tiller 1	0.256	1.426
Tiller 2	0.002	1.330
Tiller 3	0.097	1.162
Tiller 4	0.024	1.205
Tiller 5	0.068	1.331

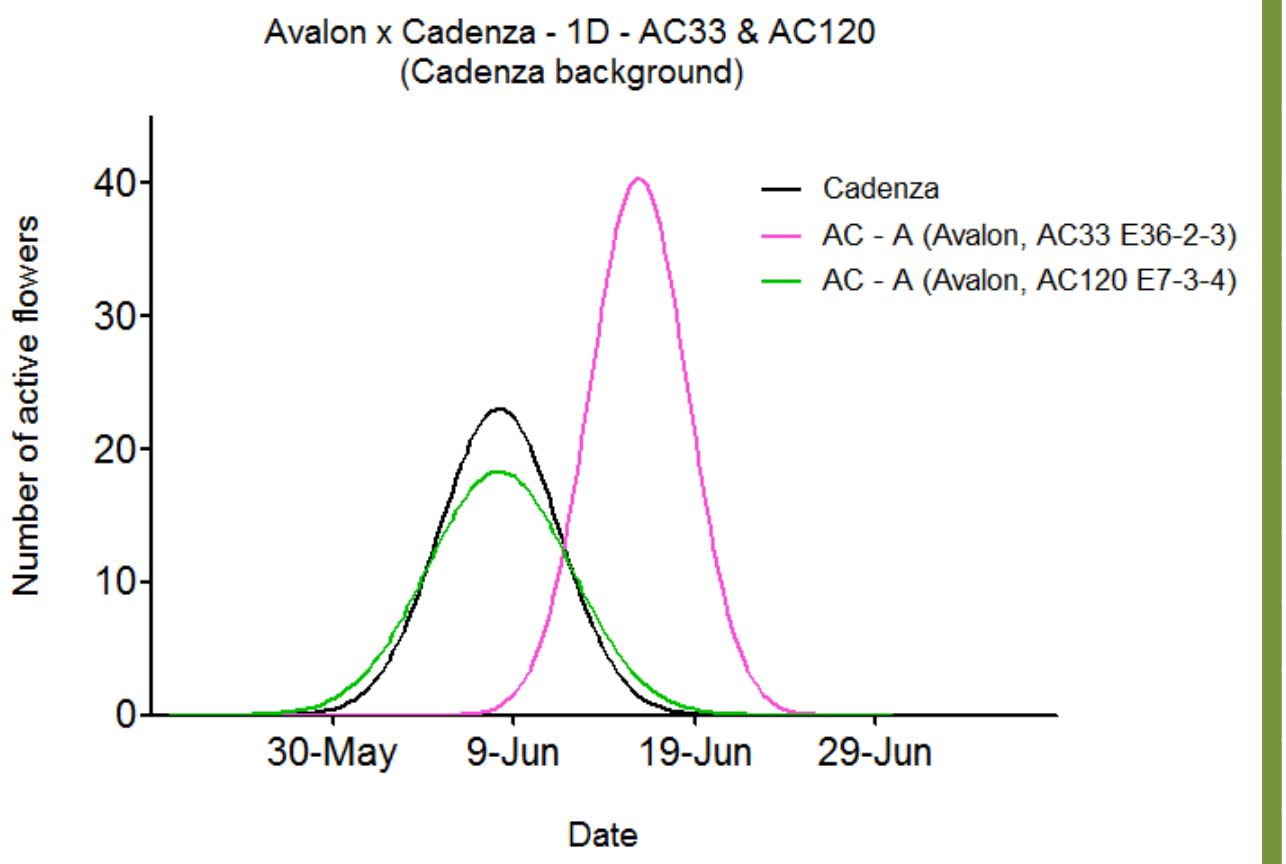


	P	s.e.d.
Tiller 1	0.339	0.477
Tiller 2	0.071	0.455
Tiller 3	0.066	0.452
Tiller 4	0.036	0.423
Tiller 5	0.538	0.85

Is there potential to manipulate the duration of flowering to separate tillers (or plants within a population) to reduce the impact of a single extreme event ?



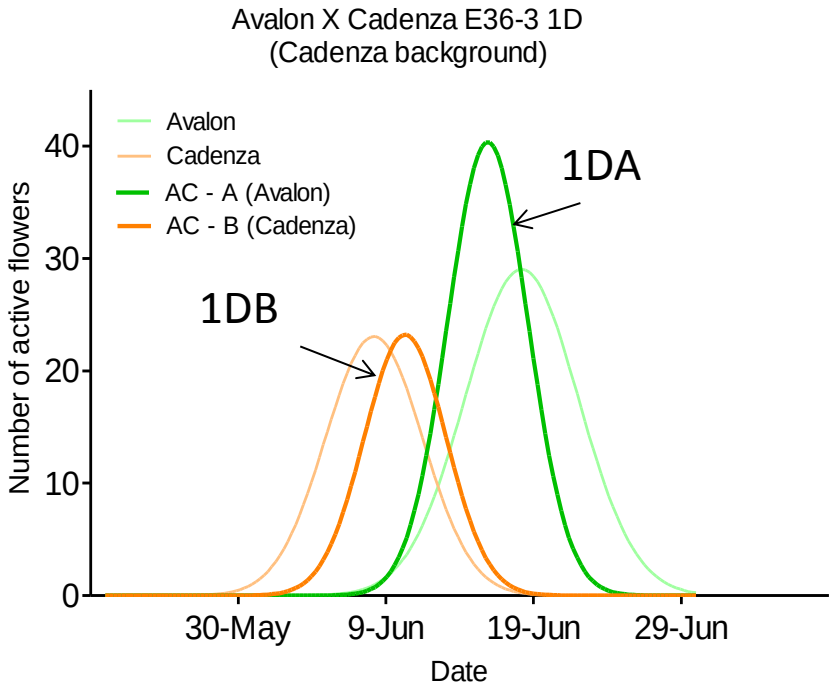




Fitted mean E36-2-3: 26.90 (7.6 days later than peak flowering in Cadenza)

Fitted mean E7-3-4: 19.20 (identical flowering time as Cadenza)

1B	Avalon Cadenza
1D	Avalon Cadenza
1D	Avalon Cadenza
1D	Spark-Rialto
1D	Spark-Rialto
2A	Paragon - GS100
2B	Paragon -CS
2B	Paragon-Son64
2D	Paragon-Son64
2D	Paragon - Opata
3A	Avalon Cadenza
3A	Spark-Rialto
3B	Charger-Badger
3B	Spark-Rialto
6A	Avalon Cadenza
6B	Avalon Cadenza



	stress time	
	booting	Flowering
1DA	22nd May	10th June
1DB	22nd May	12th June

1DB was at a later more vulnerable stage than 1DA at the time of the booting stress?

BUT when lines are stressed at the same time at flowering there is no significant difference in seed number across tillers

	control		booting		flowering		s.e.d	P value	
	1DA	1DB	1DA	1DB	1DA	1DB	(max - min)	Region	Region x stress
Tiller 1	41.3	41	32.8	20.5	37	36.5	4.33	0.027	<0.001
Tiller 2	35.8	38.8	34.2	18	34.3	37.5	4.77	0.491	0.003
Tiller 3	37.3	37	31.8	23.3	26	31.7	4.92	0.892	0.051
Tiller 4	32	33.5	27.2	32.5	36	26.7	5.92	0.902	0.407
Tiller 5	36	33.8	32.2	30	23	29	6.09	0.796	0.289

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1. Is diversity within a single genotype great enough to achieve the resilience required?

➢ based on lines analysed so far, unlikely

2. Can great enough diversity be achieved with a NILs mixture as proof of concept?

➢ Final year of experimentation using field based heat stress

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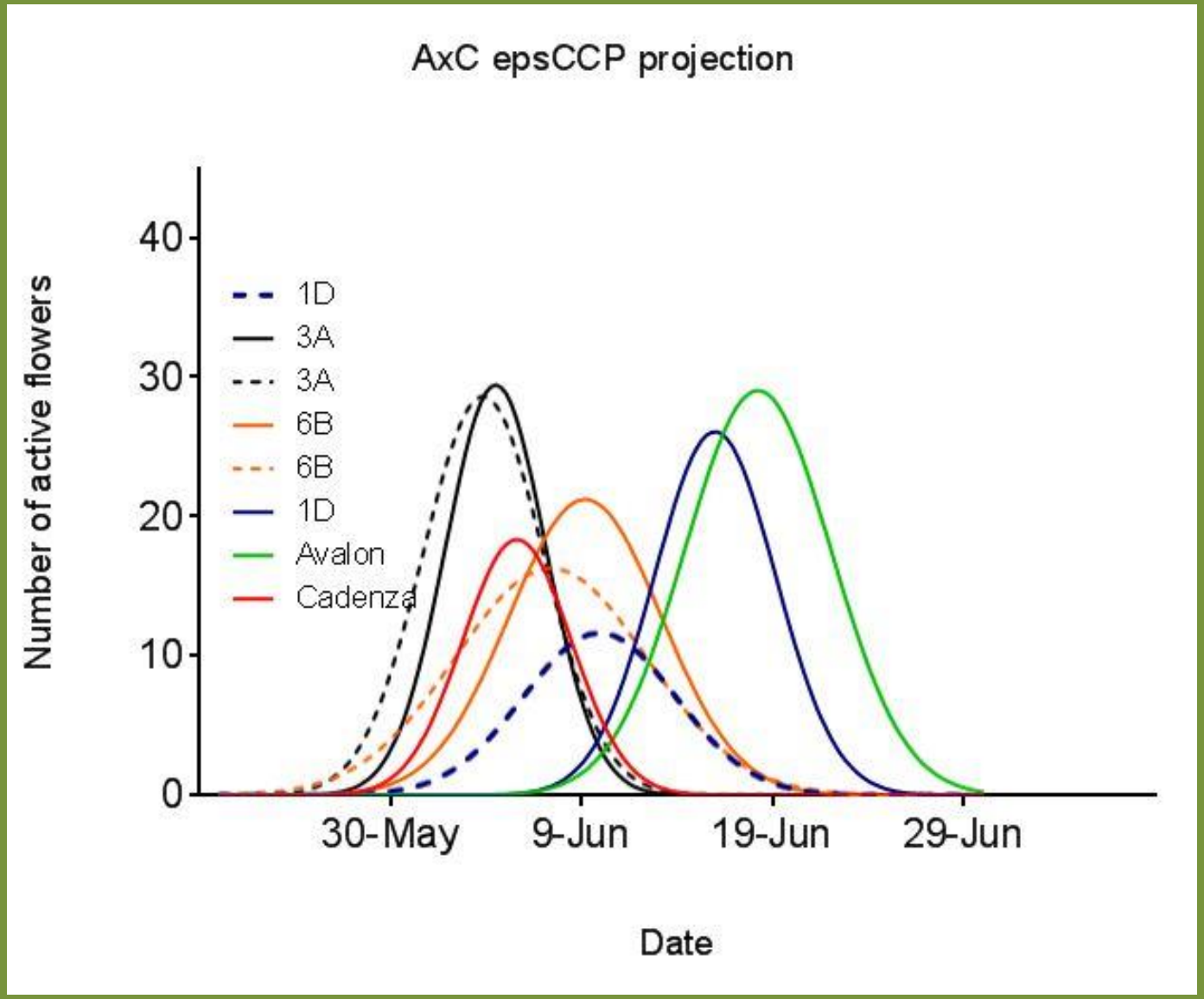

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Aim of experiment:

1. Establish the potential of flowering diversity alone (eps mixture) to escape heat stress around anthesis

2. Compare performance of eps mixture against flowering diversity within a wide genetic background (YQCCP) to escape heat stress around anthesis

3. Establish interaction of drought and heat stress on yield performance of both CCP's

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Summary

- Flowering time, and the relative time of flowering of individual tillers influences vulnerability to abiotic stress events
- Determination of the optimum flowering duration for a *specific* duration of heat stress event may be possible
- Duration of flowering relative to *predicted* heat stress duration may reduce the risk of loss of yield due to a changing climate

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