Genetic evaluation for heat tolerance in growing Angus cattle

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Background

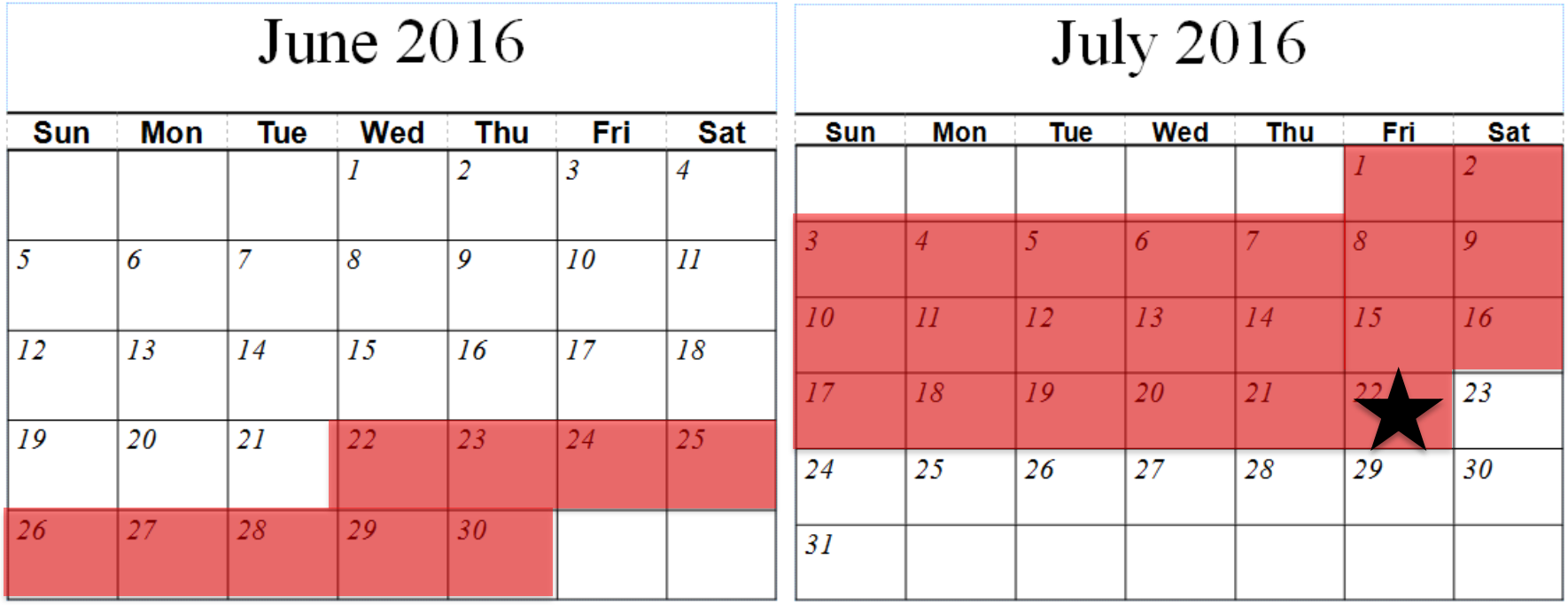
- Annual economic losses from heat stress
  - $87 million for beef cows
  - $282 million for finishing cattle
- Affects pregnancy, milk production, feed intake, and weight gain

St-Pierre et al., 2003

Measuring Heat Stress

- Temperature-humidity index (THI)
- $\mathrm{THI} = \mathrm{t} - (0.55 - (0.0055 * \mathrm{rh}))*(\mathrm{t} - 58)$
  - t = temperature (F)
  - rh = relative humidity (%)
- Airport weather stations

Measuring Heat Stress

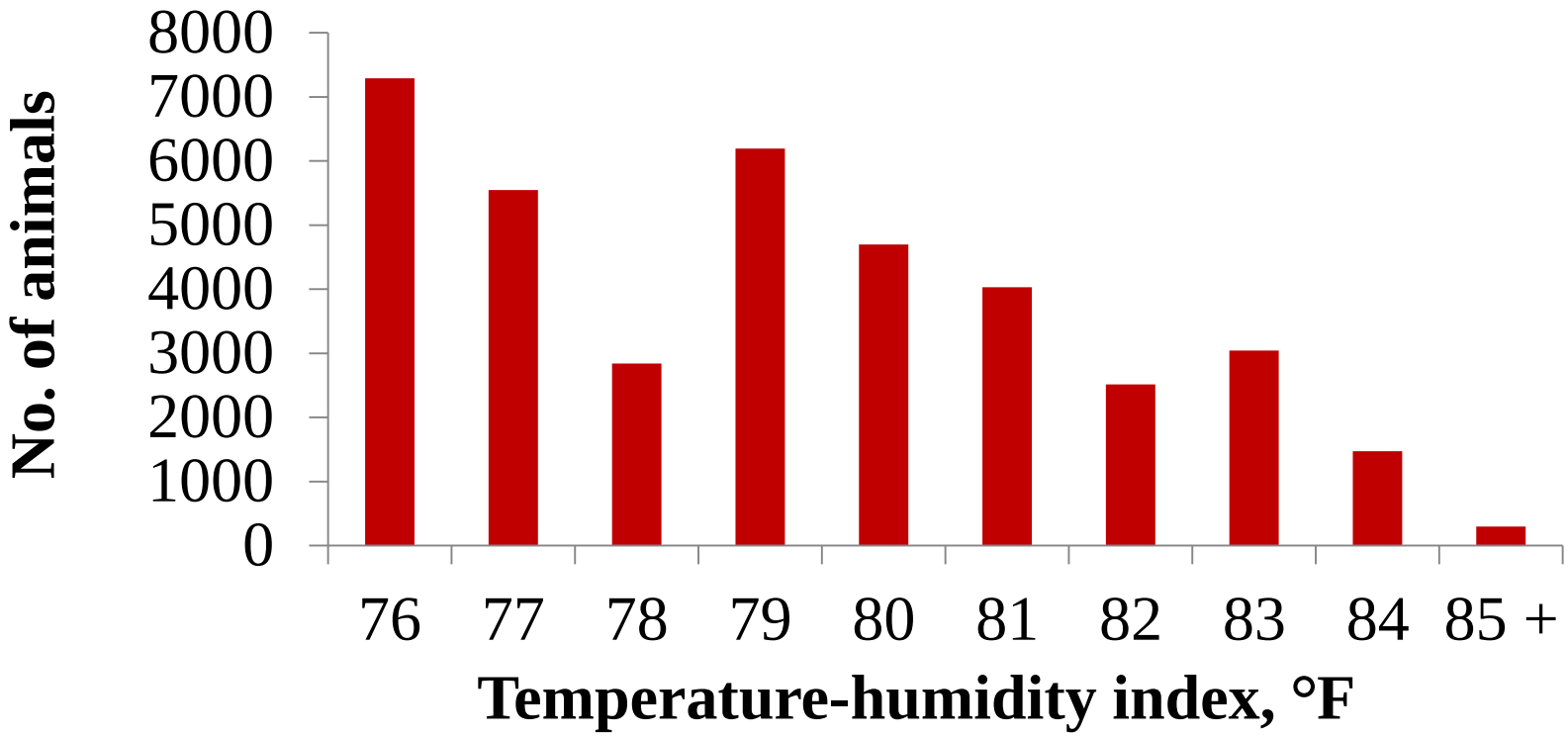


Average temperature-humidity index = 84

Weaning Weight Data Description

Item	Value
Mean (kg)	255
SD (kg)	48
Animals	82,669
Heat stress	37,922
No heat stress	44,747
Pedigree animals	169,291

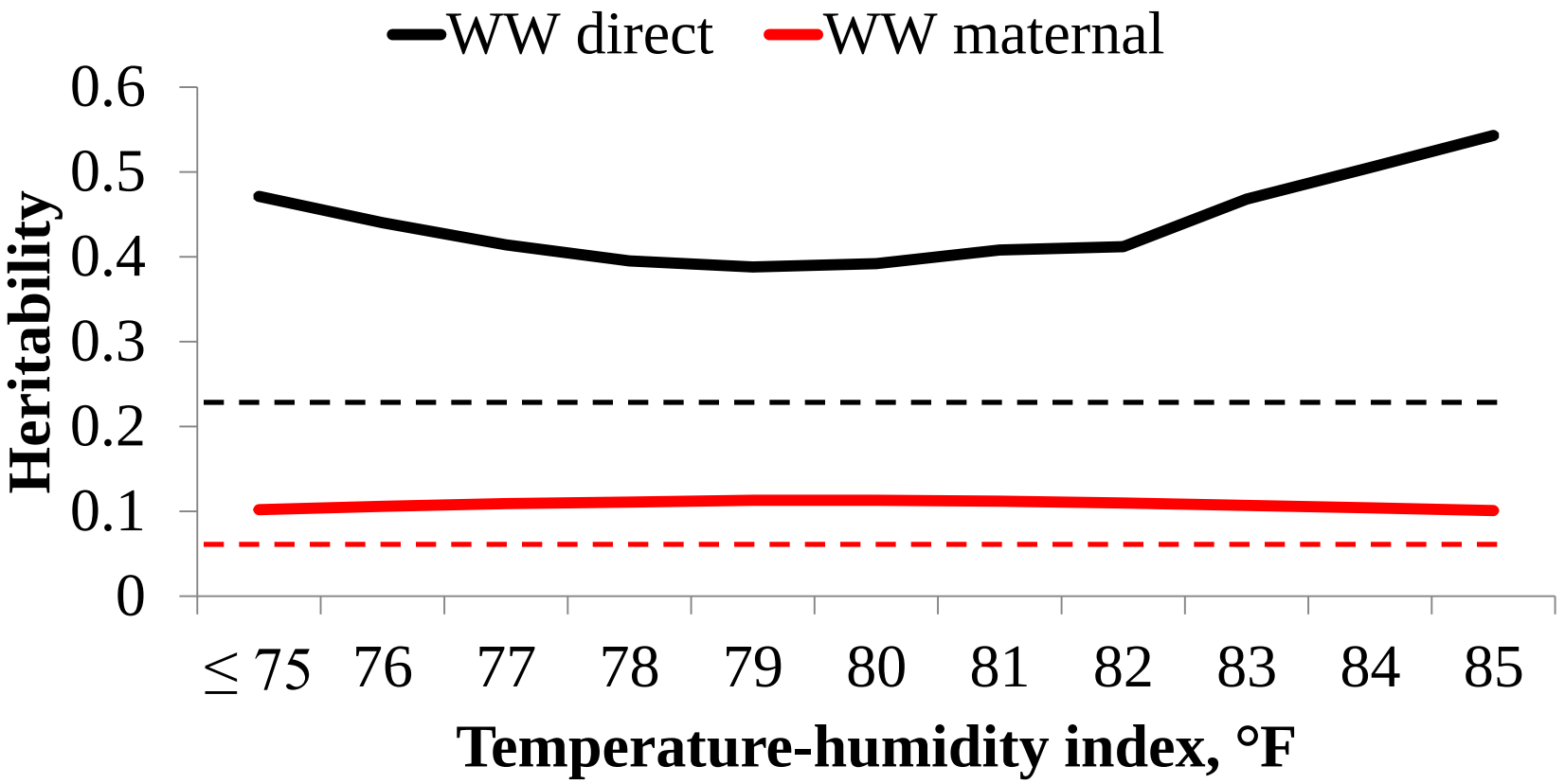
Weaning Heat Stress



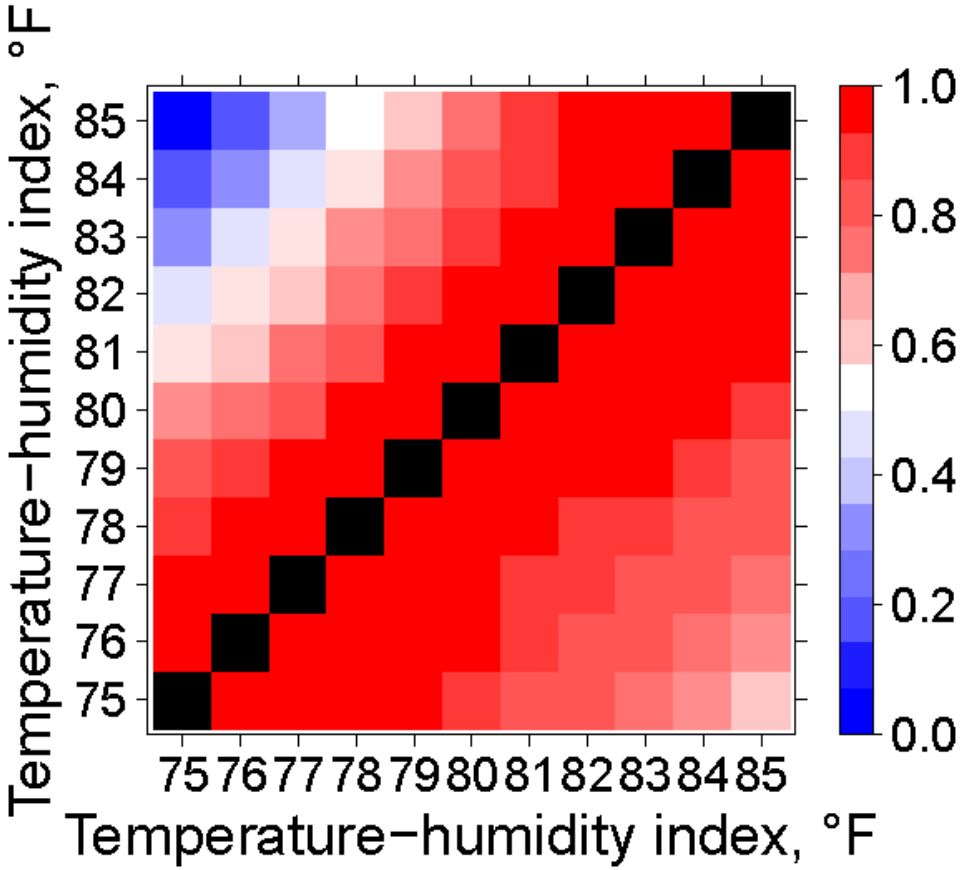
Models

- Univariate
  - Age, age of dam, contemporary group
- Reaction norm
  - Age, age of dam, sex, herd, year
  - Direct, maternal genetic, and maternal permanent environment random regressions on linear heat stress

Heritabilities



Genetic Correlations



Direct above diagonal

Maternal below diagonal

Rank Correlations

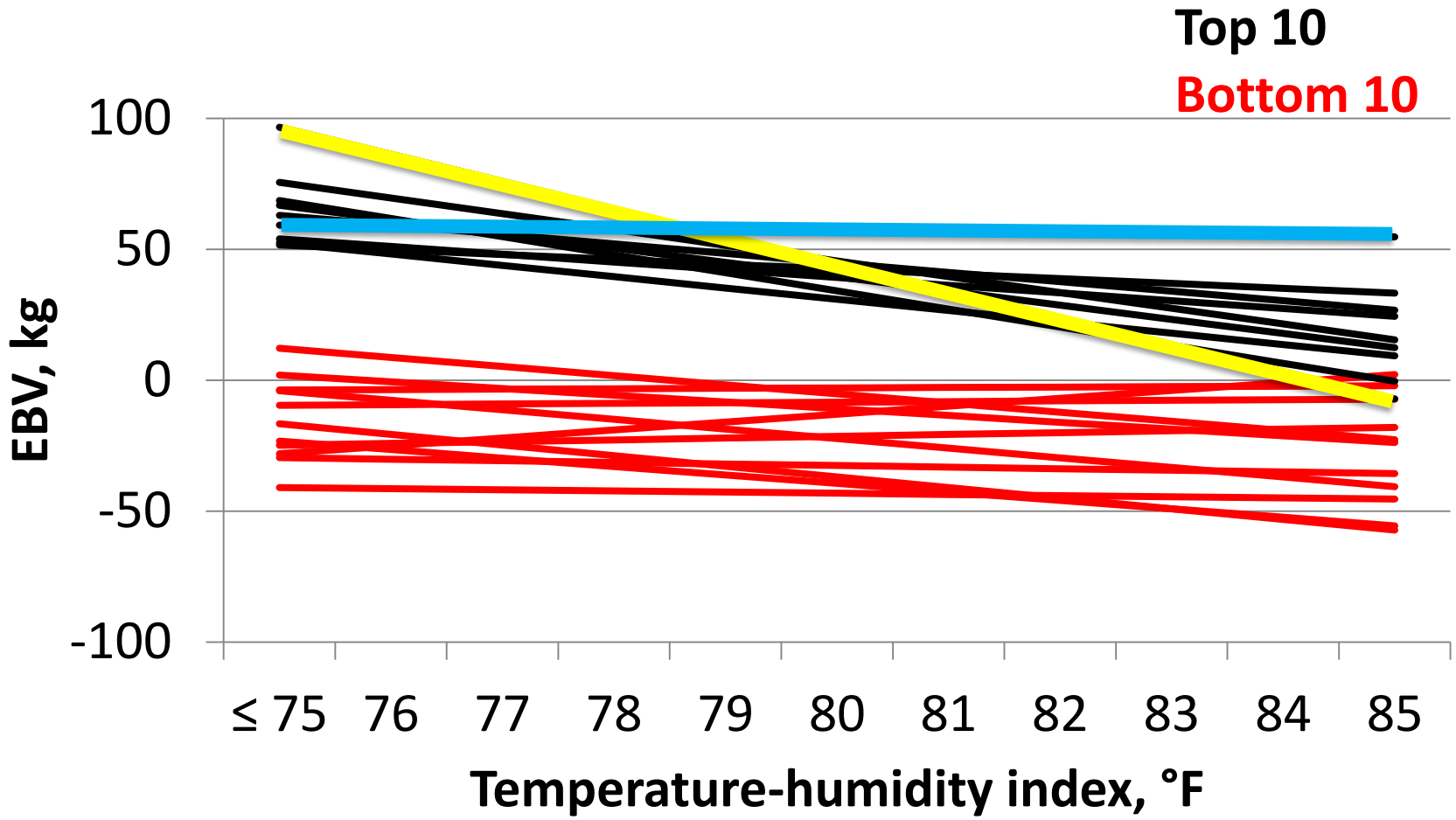
Model	Univariate	Reaction norm		
		THI ≤ 75	THI = 80	THI = 85
Univariate		0.65	0.63	0.37
THI ≤ 75	0.77		0.80	0.30
THI = 80	0.77	0.96		0.78
THI = 85	0.70	0.82	0.94	

n = 1,048 proven sires

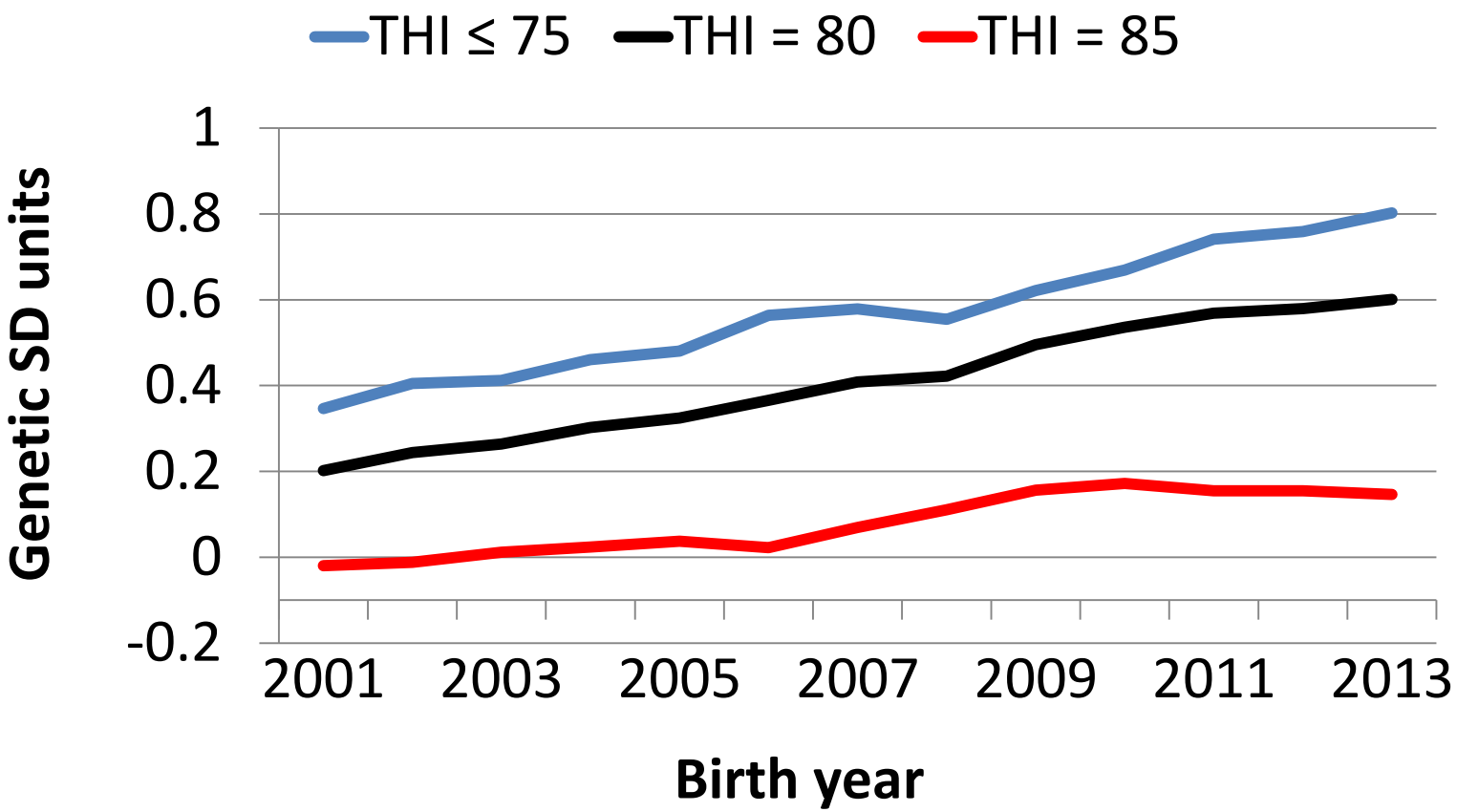
Direct above diagonal

Maternal below diagonal

WW Direct Reaction Norms



WW Direct Genetic Trend



Conclusions

- Evidence of genotype x environment interaction for direct but not maternal genetic effects
- Heat tolerance could be incorporated in selection schemes

Acknowledgment

- American Angus Association