Genetic evaluations for heat tolerance in meat animal species

Heather L. Bradford, B. O. Fragomeni,

S. Tsuruta, J. K. Bertrand, K. A. Gray,

Y. Huang, D. A. L. Lourenco, and I. Misztal





Background

- Annual economic losses from heat stress
 - \$87 million for beef cows
 - \$282 million for finishing cattle
 - \$113 million for sows
 - \$203 million for finishing swine
- Affects pregnancy, milk production, feed intake, and weight gain

Measuring Heat Stress

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

Measuring Heat Stress

January 2018

Feb	ruary	20)1	8
			_	_

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

Modelling Heat Stress

- Degrees of THI above a threshold
 - 21.1°C (70°F) or 23.9°C (75°F) for beef cattle
 - 21.1°C (70°F) for swine
- Reaction norm
- Random regressions (slope and intercept) for THI

Data

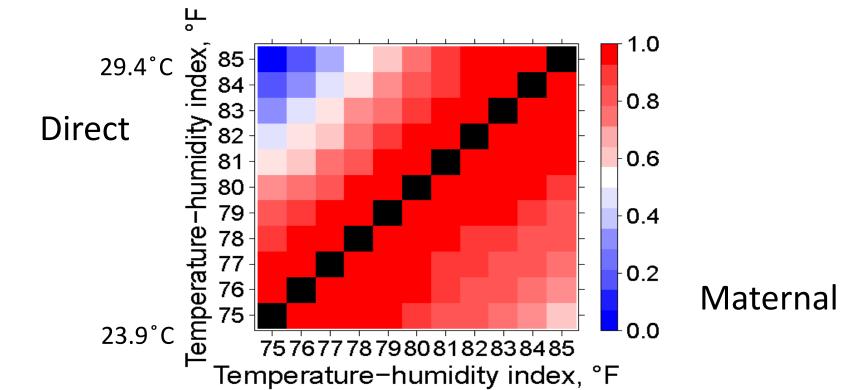
- American Angus Association (St. Joseph, MO)
 - Weaning weight (205 d; n=82,669)
 - Yearling weight (365 d; n=69,040)



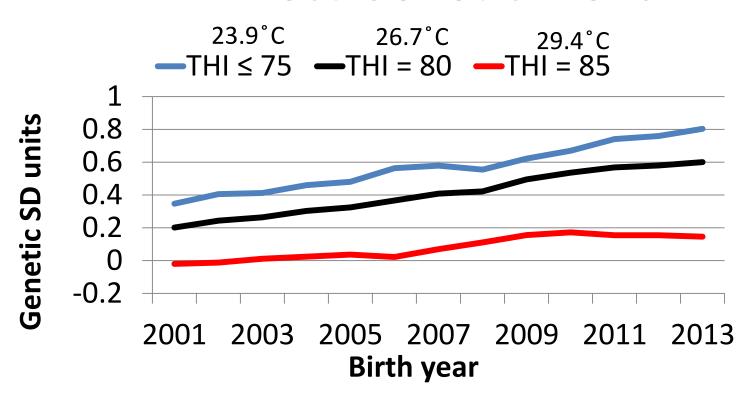
- Smithfield Premium Genetics (Rose Hill, NC)
 - 170-d weight on Durocs (n=207,233)
 - Hot carcass weight on crossbreds (n=228,191)



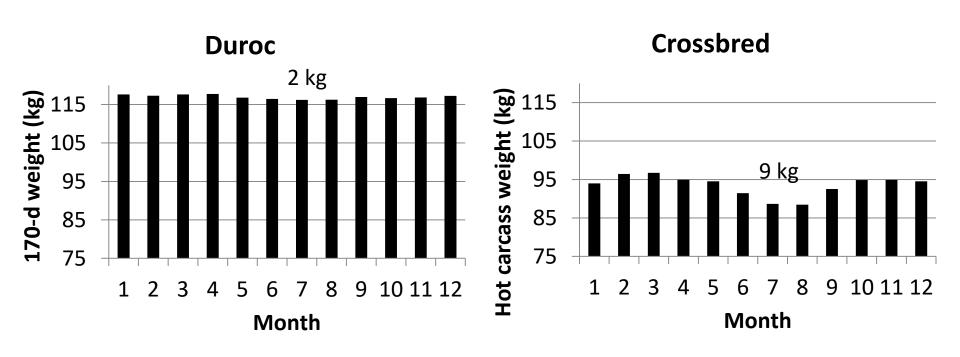
Angus Weaning Weight



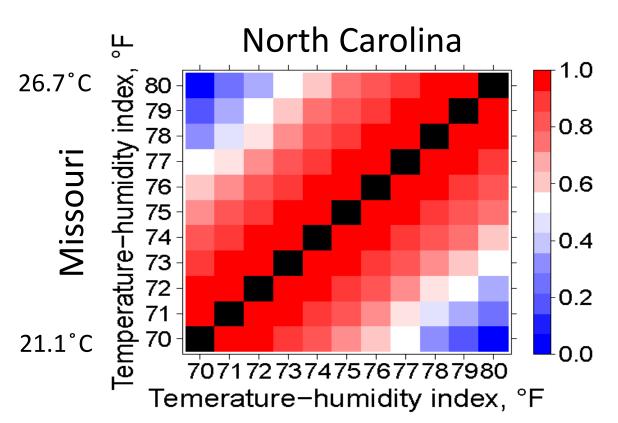
WW Direct Genetic Trend



Effect of Heat Stress in Swine



Crossbred Swine



No Genotype x Environment

- Angus
 - Yearling weight
 - Most genetic correlations > 0.80 for direct
 - All genetic correlations > 0.95 for maternal
- Purebred swine
 - 170-d weight
 - All genetic correlations > 0.95

Conclusions

- GxE for direct but not maternal effects in beef cattle
- GxE for crossbred but not purebred swine
- Heat tolerance could be incorporated in selection schemes

Journal of Animal Science publications

Beef Swine

Bradford et al., 2016 Fragomeni et al., 2016