Genetic evaluations for heat tolerance in meat animal species

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Background

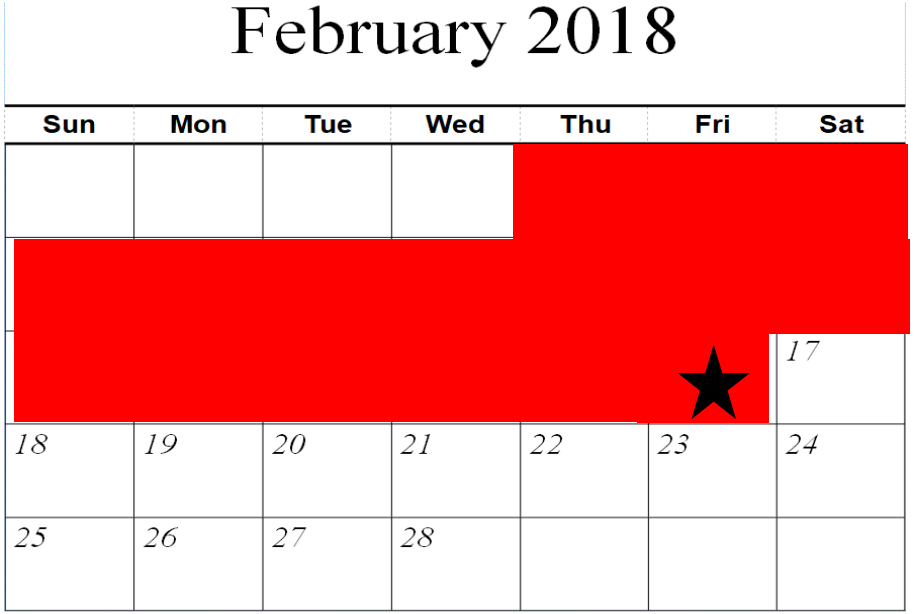
- Annual economic losses from heat stress
  - $87 million for beef cows
  - $282 million for finishing cattle
  - $113 million for sows
  - $203 million for finishing swine
- Affects pregnancy, milk production, feed intake, and weight gain

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



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)

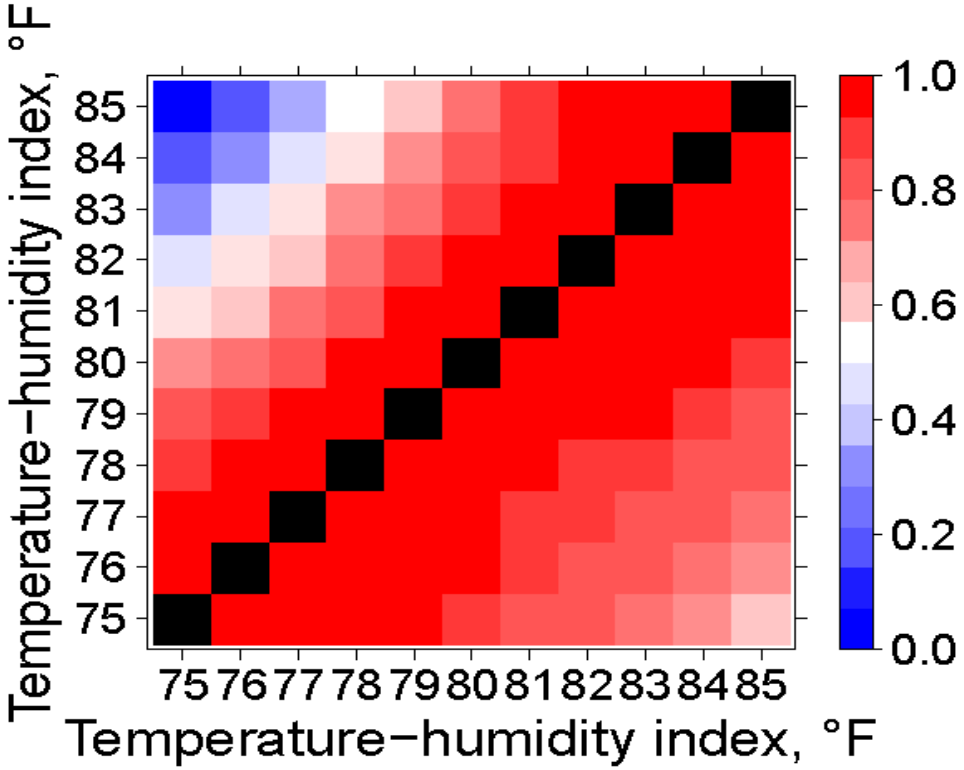
- Smithfield Premium Genetics (Rose Hill, NC)
  - 170-d weight on Durocs (n=207,233)
  - Hot carcass weight on crossbreds (n=228,191)

Smithfield™
Premium Genetics Group

Angus Weaning Weight

29.4˚C

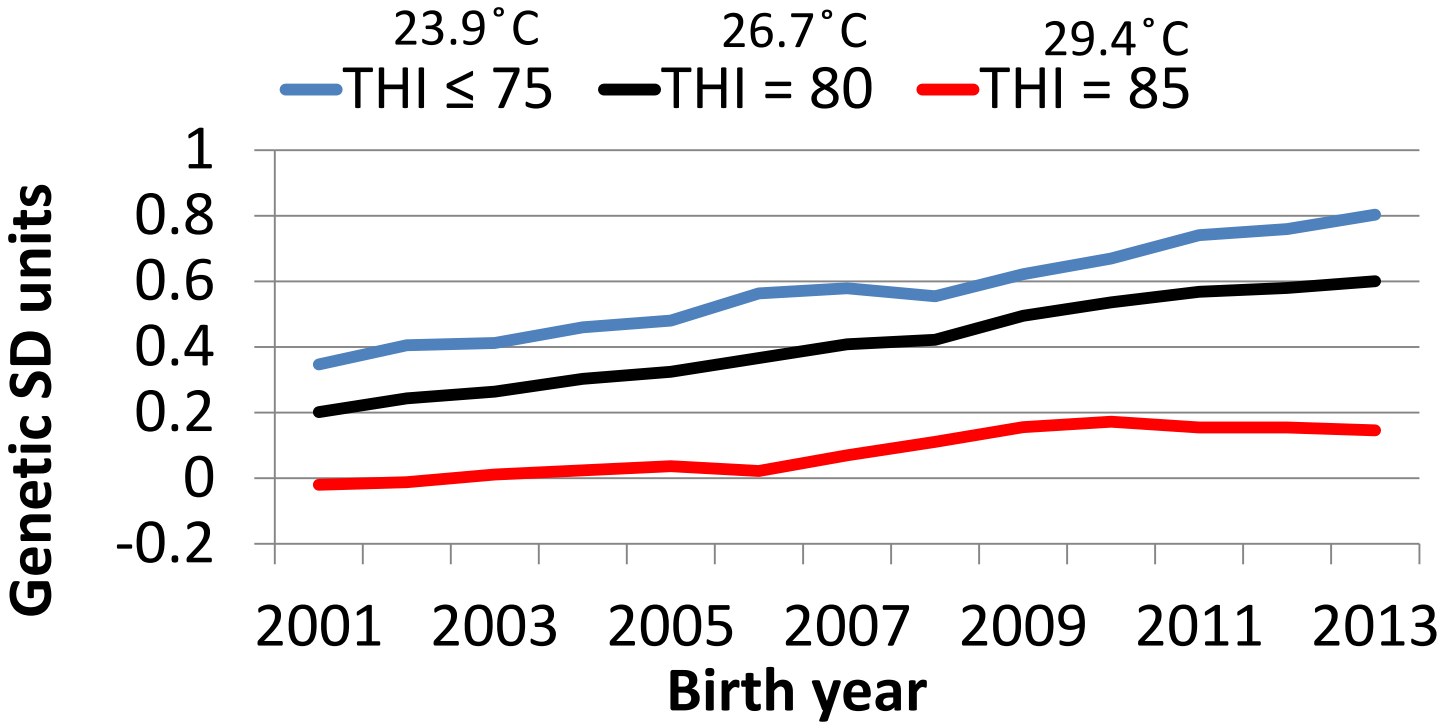
Direct



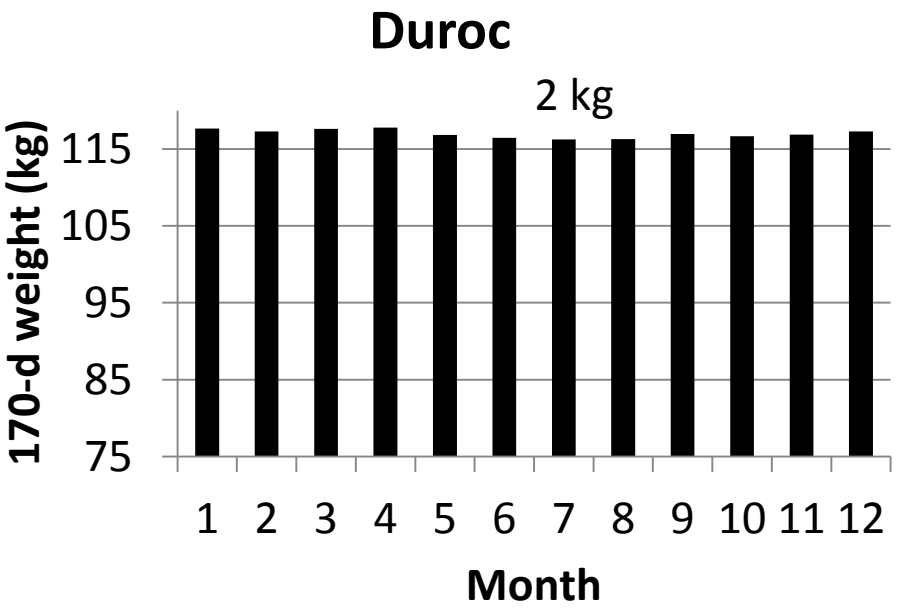
23.9˚C

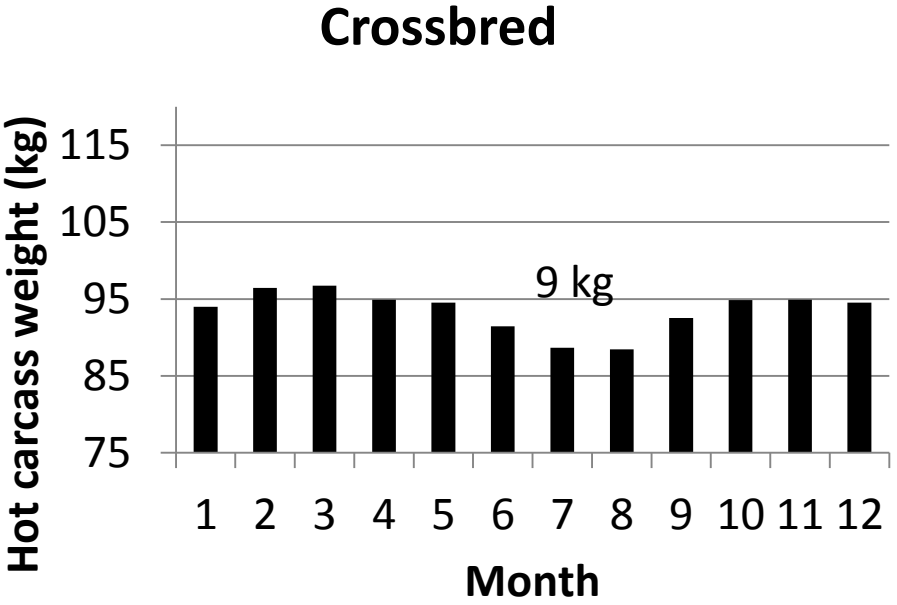
Maternal

WW Direct Genetic Trend

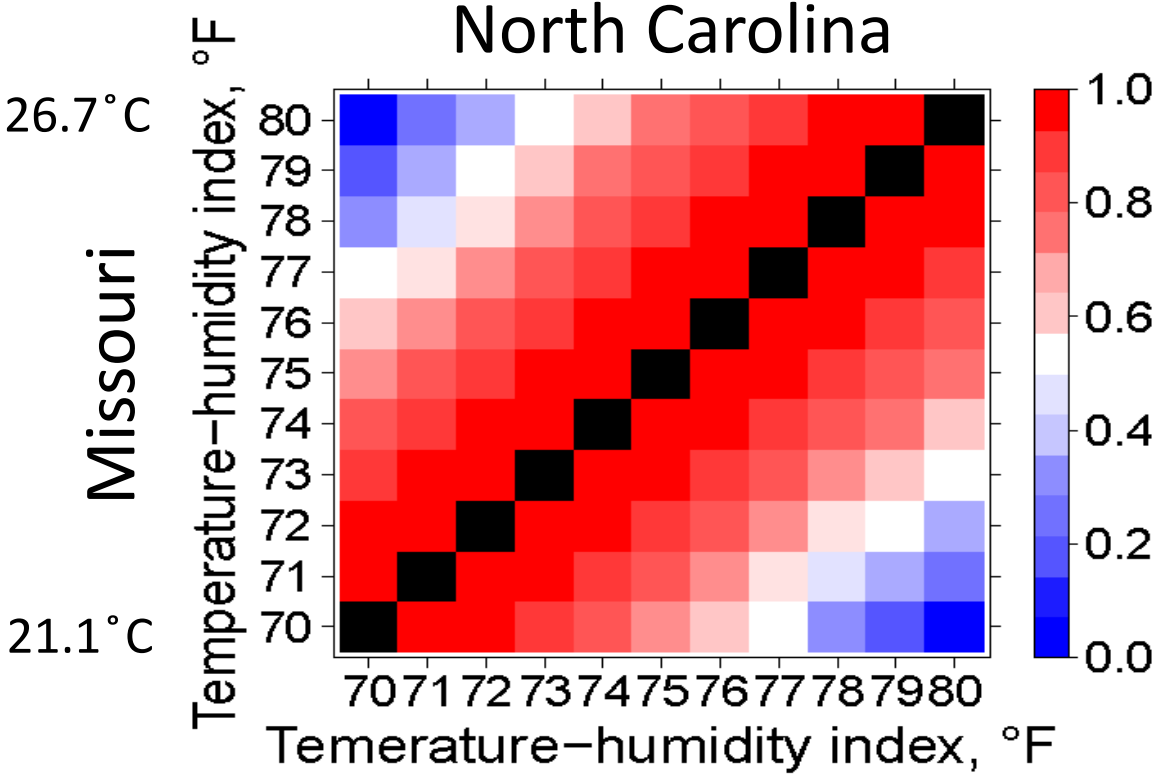


Effect of Heat Stress in Swine





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
Bradford et al., 2016

Swine
Fragomeni et al., 2016