GENOTYPE BY FERTILITY SEASON INTERACTION FOR FARROWING RATE AT FIRST INSEMINATION

A.M.G Bunz[1,2], K.L. Bunter[2], R.S. Morrison[1], B.G. Luxford[1] and S. Hermesch[2]

[1] Rivalea Australia (Pty Ltd), Corowa, NSW, 2646

[2] Animal Genetics & Breeding Unit, a joint venture of NSW Department of Primary Industries and the University of New England, Armidale, NSW, 2350 Australia

BACKGROUND

- Seasonal infertility in pigs is the reduction of reproduction performance during summer and autumn [1]
- Affected by photoperiod and heat stress[2]
- Management strategies do not eliminate all heat stress and photoperiod effects.

PURPOSE

- Seasonal variation in reproductive traits does not reflect traditional calendar seasons
- Selection for reduced seasonal infertility in pigs should be explored
- Objective was to develop methodology:
  - That defines biologically meaningful fertility seasons relevant to farrowing rate in sows
  - Investigate genotype by fertility season interactions for farrowing rate traits

Data

Farrowing Rate at first insemination in each mating cycle (FR): 0=fail, 1=pregnant

- 39,677 FR records from 13,345 sows (2012-2017) across three breeding lines, from a single farm in Australia (hot summers, cool winters and low humidity)
- Pedigree contained 16,935 animals including 7,440 dams and 1,068 sires over 16 generations
- Daily maximum ambient temperature (TMAX) obtained from a near by weather station
- Change in daylight length (DL) obtained using R package geosphere [4]

Statistical analysis

- The four fertility seasons were created using:
  a) A generalized linear model with a logit link to identify the most informative days (p-value<0.05) for FR regarding TMAX and DL from 35 days prior to and 35 days post mating date
  b) A cluster approach based on partitioning around medoids[5] method was then used to group temperature and photoperiod patterns for every mating date according to their similarity
- The four clusters created represent four fertility seasons (f-seasons) for FR.
- Genetic parameters were estimated using a series of univariate and bivariate linear animal models using ASREML v4.1[6]

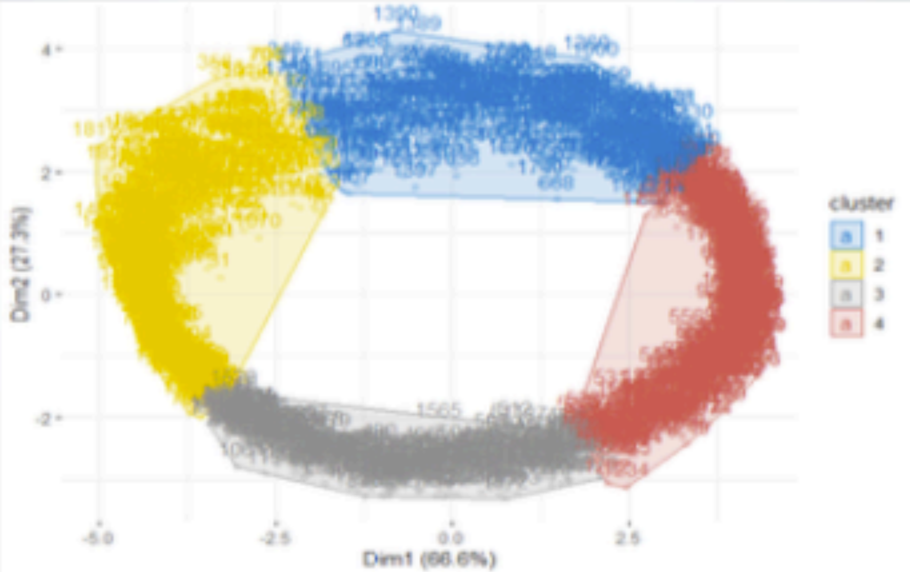

Figure 1: Plot of the four fertility seasons based on the first two dimension of the principle components analysis of the maximum temperature and change in daylight length variables from the most informative days of FR for each mating date

RESULTS

- The phenotypic and genetic variances for FR were largest in the most stressful f-seasons 2
- F-season 2 had the lowest FR (74%) and was characterized by high mean TMAX (>29° C) prior to the mating event and high negative mean DL (-1.63 until -2.09 minutes per day) around the mating event
- Heritabilities were low for all FR traits (0.01-0.04)
- Genotype by f-season interaction was found (0.22±0.31) between the two f-seasons (2&4), which differed most in regard to the TMAX and DL characteristics around mating date

CONCLUSIONS

- Cluster analysis was successfully used to define fertility seasons according to photoperiod and temperature, which can be applied to other traits.
- Although an interaction was found, FR is a lowly heritable trait and therefore other traits should be explored to reduce seasonal infertility in pigs

REFERENCES

1. Love RJ, 1978. The Veterinary Record. 103, 443-446.
2. Auvigne V, Leneveu P, Jehannin C, Peltoniemi O and Salle E, 2010. Theriogenology. 74, 60-66.
3. Lewis CR and Bunter KL, 2011. Animal Production Science. 51, 615-626
4. Hijmans RJ, Williams E, Vennes C and Hijmans MRJ, 2017. Spherical trigonometry. 1, 7
5. Kaufman L and Rousseeuw PJ, 1990. Finding groups in data: an introduction to cluster analysis John Wiley & Sons
6. Gilmour AR, Gogel BJ, Cullis BR, Welham SJ and Thompson R, 2015. Hemel hempstead: VSN international ltd