

A Method To Define Environmental Groupings For UK Sheep Farms To Allow The Assessment of Genotype x Environment (GxE) Effects

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Introduction

- The UK sheep industry covers an assorted range of farming systems and environments. Each flock has its own unique and diverse set of resources and management styles.
- Genotype x Environment Interactions (GxE) can arise when different genes, contributing to the performance of an animal and their offspring, are active in different environments.
- Can have a negative impact on the economic performance of a flock.

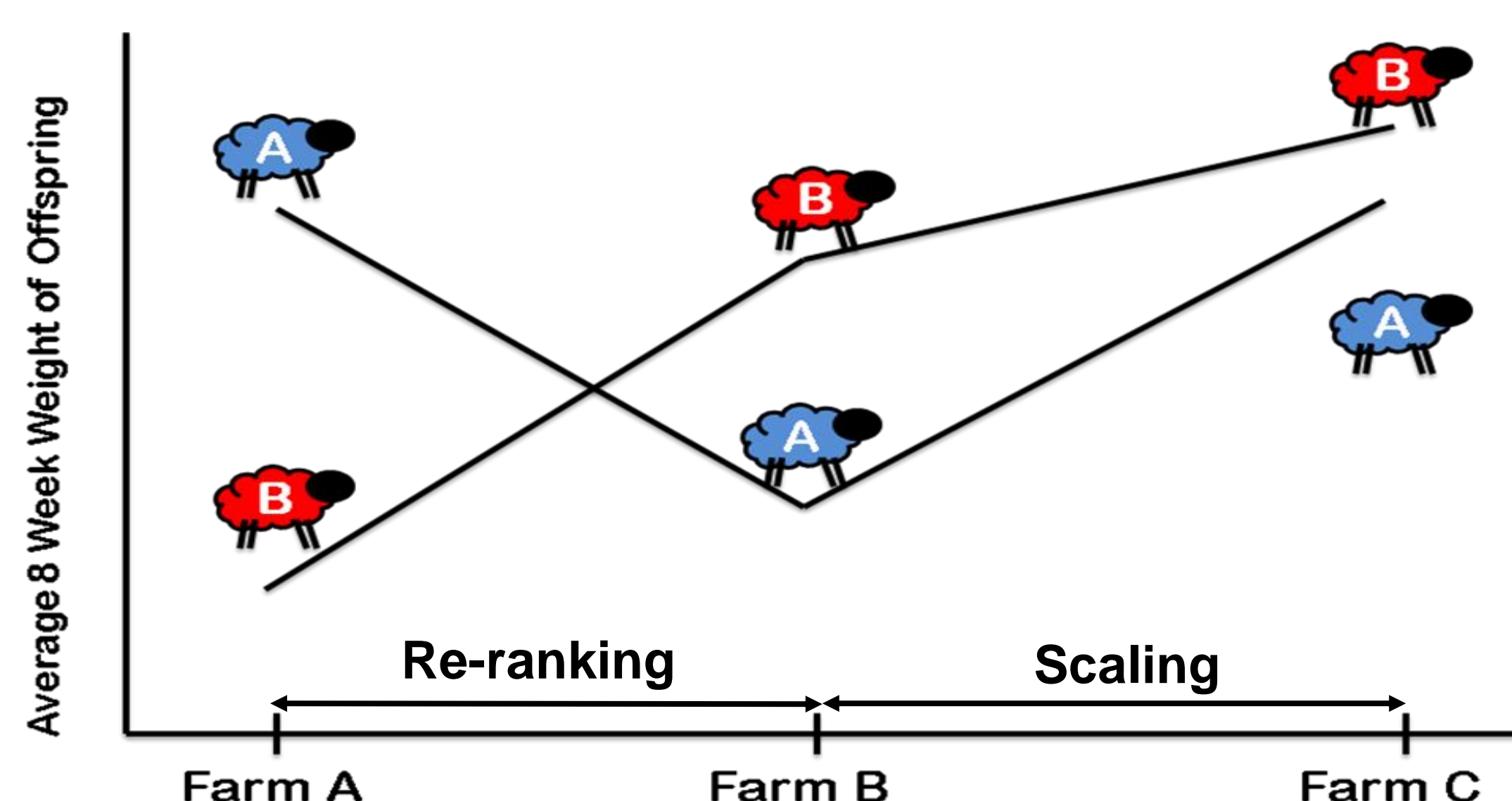


Figure 1. Offspring Performance of Two Rams Across Three Farms.

- Main concern is that animals may rank differently across environments (Figure 1). The best performing ram on Farm A is not the best performing ram on Farm B.

Methods

- Data gathered using a questionnaire covering land type; sheep numbers and breed; management of flock throughout the year; health treatments and labour.
- Combined with farm location details, lambing dates and regional weather between 2005-2009.
- Data from 79 terminal sire flocks were used in this study. (21 Charollais, 18 Suffolk and 40 Texel flocks).
- Analysed using Multivariate Analyses - Principal Coordinate (PCO) and Cluster Analyses.

Results – PCO & Cluster Analysis

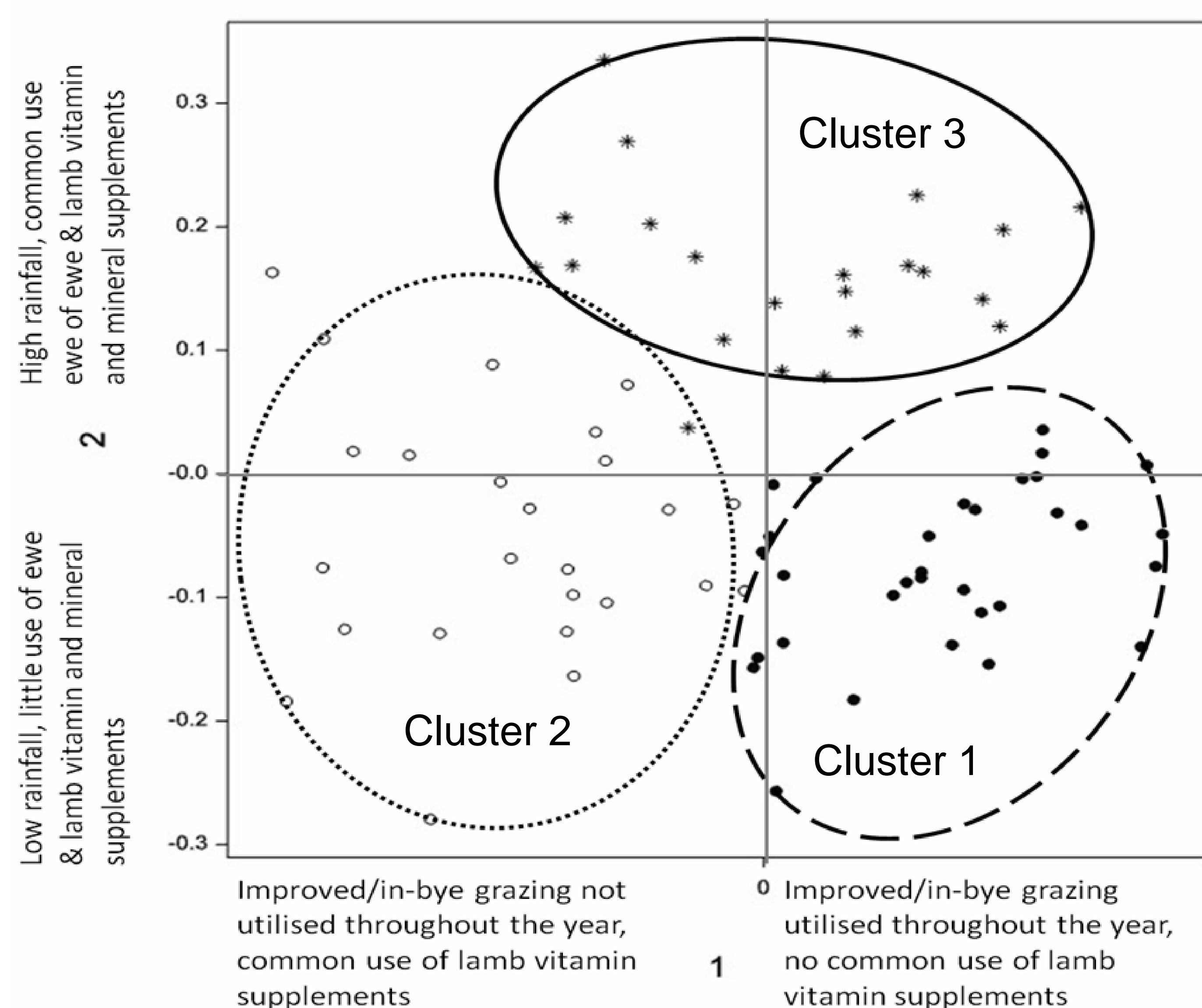


Figure 2. PCO Dimension 1 versus PCO Dimension 2.



Courtesy of the Charollais Sheep Society. (www.charollais-sheep.com)

- 3 homogenous clusters of farm environments identified. (Figure 2)
- Grazing type, climatic conditions and the use of vitamin and mineral supplements most important factors in the clustering of flocks.

Results - GxE Analysis

- Investigated using performance data from 12,181 Charollais lambs, born between 1990 – 2010.
- Traits: 21 week old weight (**21WT**), ultrasound back-fat (**UFD**) and muscle (**UMD**).
- Majority of common sires used across cluster 1 and cluster 2.
- Genetic correlations estimated between cluster 1 and 2, for each trait (Table 1). Correlations less than 1 = GxE present.
- In addition to a number of sires performing consistently across clusters, evidence of re-ranking and scaling observed, for all traits.

Table 1. Genetic Correlations for 21WT, UMD and UFD between Cluster 1 and 2.

	21WT Cluster 1	UMD Cluster 1	UFD Cluster 1
21WT Cluster 2	0.29 (± 0.16)		
UMD Cluster 2		0.67 (± 0.14)	
UFD Cluster 2			0.16 (± 0.19)

Conclusions

- By grouping flocks into similar environment types, the study has found evidence of GxE in a sample of UK Charollais flocks when the response of genotypes to different environments was assessed.
- If the cluster groups were a true representation of UK Terminal Sire farm systems, future genetic evaluations may benefit by taking into account the GxE observed.
- The identification of genotypes best suited to certain environments, or alternatively genotypes that perform consistently across environments, will allow producers to use GxE to their advantage, thus reducing inefficiency in performance.

Acknowledgements

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