

## **Genotype-by-environment interaction analysis of dry matter yield of perennial ryegrass cultivars across south-eastern australia using factor analytic models**

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Perennial ryegrass (*Lolium perenne* L.) is a high-quality grass species and plays a mainstay role in the Australian dairy industry. Over 60 perennial ryegrass cultivars are currently available on the Australian market; however, their performance in dry matter yields (DMY) varies across complex dairy farming environments in south-eastern Australia. A rating system that could account for the genotype-by-environment interaction (G×E) effects will be crucial to obtaining an accurate DMY prediction when assisting Australian dairy farmers in selecting productive cultivars according to different environmental conditions. In the present study, we fitted several two-way separate factor analytic models that considered genotypic, environmental, temporal, spatial effects, and G×E effects using linear mixed models to explore the heterogeneous genotypic variances of 126 ryegrass cultivars across 18 pasture environments in south-eastern Australia. We identified three mega-environments where the cultivars presented statistical differences in DMY performances, as well as several high-yield cultivars specific to each of the three mega-environments. This study highlights the significance of accounting for G×E effects when obtaining accurate DMY predictions and the robustness of utilizing the factor analytic model. Future studies will explore the genomic relationship of available ryegrass cultivars and potential additive genetic effects regarding DMY.