

A modelling approach to understanding environmental modification of seed dormancy in annual ryegrass (*Lolium rigidum*)

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Summary Seed dormancy in mature seeds of annual ryegrass (*Lolium rigidum* Gaud.), and its loss over summer, influence patterns of ryegrass germination and persistence of its seeds in the seed bank. Dormancy characteristics vary between annual ryegrass seed populations collected from different locations, but it has previously been unclear whether variation is caused by genetic differentiation between the seed populations, variation in the local environment during seed maturation, or both.

We used a modelling approach to investigate environmental factors likely to influence dormancy development and loss. Dormancy loss during dry after-ripening was observed for annual ryegrass seeds collected from eight sites in one to three years (10 site × year combinations), and incubated under four or five temperature regimes. Logistic curves were fitted to the dormancy loss data and correlations were sought between the curve parameters and various climatic variables. September temperature in the year of observation was closely correlated with time to 50% of maximum germination, indicating that temperature during seed

maturation influences the duration of dormancy loss. Long-term average autumn temperature and rainfall values were correlated with the proportion of the seed lot remaining non-germinable (and likely to be carried over into the next season), suggesting that ecotypic differentiation has occurred on the basis of effective autumn rainfall. We interpret this as an indicator of opportunity for seeds to germinate successfully the following autumn. The specific rate of dormancy loss did not vary over a large range, and may be considered constant across all collections. This model indicates that both genetic adaptation to the local environment and environmental conditions during seed maturation affect the dormancy characteristics of annual ryegrass populations. It will therefore be important to consider long-term weather as well as temperature in the year of seed development when assessing the likely emergence pattern of annual ryegrass in any given locality.

Keywords Dormancy development, dormancy loss, dry after-ripening, ecotypic differentiation, seed maturation environment.