

Diversity and stability in experimental grassland communities

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Introduction

Stability is a main goal in grasslands management. Here we use the plant breeding concept of yield stability over a range of environments (Finlay and Wilkinson, 1963), to explore three relevant dimensions of yield stability.

Hypotheses

- Diverse grasslands are more stable than monocultures.
- Stability dimensions increase linearly with sp. richness.

Methods

Experiment

Plant communities: 50 combinations ("entries") of 8 species, in a replacement design, with all monocultures, and mixtures of two (19), three (13), four (7), and six (3) sp.
Plot design: 4x3 m plots, 3 reps in randomised complete blocks.
Environments: 12 combinations of: 2 locations (Iowa, USA), 2 managements (multiple and single harvest) and 3 years.

Stability analyses

For each entry, the means of the three replications in each environment were regressed against the mean yield across all entries in each environment ('environment mean'). Linear regression coefficients (b_1) and root mean squared errors of the regression (RMSE) were calculated for each regression (examples in Figure 1). Confidence intervals were constructed for each b_1 (not shown).

The b_1 represents the amount of yield change along the environmental gradient.

RMSE represents the variability of yields and the fit to the linear model.

Stability dimensions

- 'constancy' ($b_1 = 0$): yields are the same in all environments;
- 'consistency' ($b_1 = 1$): yields are parallel to the mean of the environments; measured as: $ST_{II} = |b_1 - 1|$.
- 'reliability' lower RMSE.

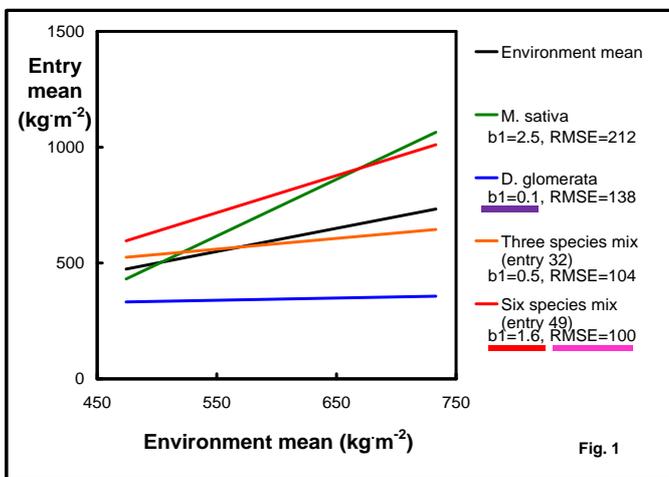


Fig. 1

Conclusions

Consistency and reliability are useful dimensions of yield stability for production situations, and were positively and linearly correlated with richness in our experiment.

Figure 2. The means of ST_{II} (consistency) and RMSE (reliability) across richness levels were regressed against species richness. $P < 0.001$ for both regressions.

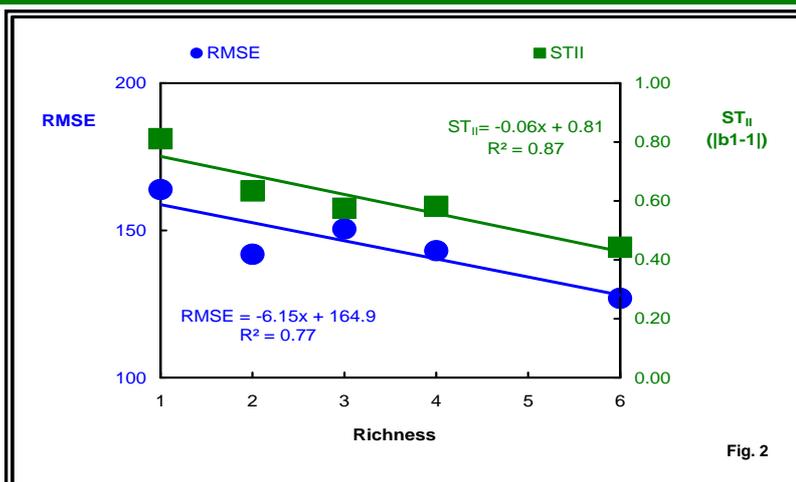


Fig. 2