

## Species richness affects grassland yield and yield stability across seasons, sites and years

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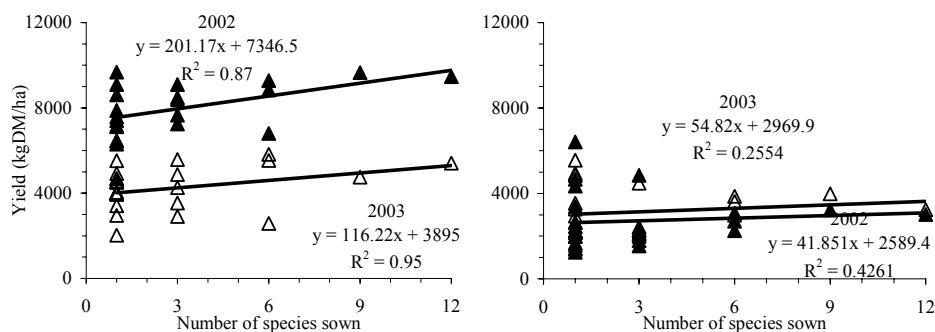
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**Introduction** The benefits of biodiversity (specifically species richness) are proposed to include both greater yield and greater stability of yield in a variable environment (Sanderson *et al.*, 2004). Experimental evidence showing yield benefits is inconsistent (White *et al.*, 2004). There is relatively little experimental data showing the effects of species richness on yield stability. The objective of this study was to measure the yield from mixtures with up to 12 species, and to measure the variability of yield between 2 sites, between spring and summer, and in 2 successive years.

**Materials and methods** Twelve grassland species were planted in 22 treatments comprising one (12 monocultures), three (5 mixtures), six (3 mixtures), nine (1 mixture) or 12 species (1 mixture). All treatments were planted in 10 m x 2.5 m plots in May 2001 at 1000 viable seed/m<sup>2</sup> at 2 sites (Columbus and Utica, Ohio). Herbage mass was measured for 2 years using a calibrated rising plate meter, pre- and post-grazing, for 4 grazing events in each of 2002 and 2003. For the analysis in this paper, spring yield was the total of the first 2 grazing events, and summer/autumn yield was the total of the third and fourth grazing events.

**Results** The number of species sown per plot was positively related to mean yield in spring, but was poorly related to yield in summer (Figure 1). In spring, the 12-species mixture never exceeded the best yielding monoculture, however, the identity of that monoculture varied between season, site and year. Plot error (i.e. standard error of the 3 replicates, within site, year and season) was greatest for the monocultures (mean = 566 kg DM/ha) but was similar for the 3-, 6-, 9- & 12-species mixtures (mean = 448 kg DM/ha). Treatment yield was standardized by dividing by the overall mean (proportion of average). The standard deviation of standardized yield between years for the monocultures (0.71) was nearly twice that for the 12-species mixture (0.48), with the other treatments intermediate (0.55). The standard deviation of standardized yield between sites for the monocultures (0.86) was more than twice that for the 12-species mixture (0.34), with the other treatments intermediate (0.58). The standard deviation of standardized yield between seasons for the monocultures (1.17) was almost 5-times that for the 12-species mixture (0.24), with the other treatments intermediate (0.44).



**Figure 1** Relationship between species richness and yield in spring (left) and summer/autumn (right) for 2 years. Data are for Columbus only, similar responses were found at Utica. Symbols are the mean of 3 replicates.

**Conclusions** Yield responses to species richness were only found during spring, and not during summer/autumn. Yield stability across seasons, sites and years increased with species richness for almost every comparison tested.

### References

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