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Interactive comment on “Biodiversity for multifunctional grasslands: equal productivity in high-diversity low-input and low-diversity high-input systems” by A. Weigelt et al.

Anonymous Referee #3

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This study compares the effects of plant diversity and management applications (mowing and fertilizing) on grassland productivity. The effects of diversity on productivity and the role of legumes in the same experiment have been published already in other papers. The interesting addition in this manuscript is that the authors added mowing and fertilization regimes to their field experiment. I find the results interesting, but I have some comments about the experimental design and the interpretation of the results.

Experimental design

In the Jena experiment diversity levels are maintained by weeding out all species that were not sown originally. Clearly there are scientific advantages when doing this. How-

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ever, this paper approaches the diversity issue from a management perspective. Managed grasslands are not weeded. Although the authors emphasize the implications and applications of their work, I find it questionable how reliable/usable the results are of this study for managed grasslands.

Moreover, although the authors show clear relationships between diversity and productivity, this is based on the biomass of sown species only (page 3194). It is well documented in the literature, eg (among many other studies) Roscher et al. *Acta Oecologica* 2009, that low diversity plots have much higher colonization rates than high diversity plots. These colonizing species are typically fast growing and would cause significant increases in biomass. Again, from a fundamental scientific point of view it is interesting to show these diversity productivity relationships but they are of limited value from a management perspective. Fertilizing would benefit the fast growing plant species even more, resulting in more biomass in low diverse communities that are fertilized. Because these communities were weeded, the statement that high diverse communities are more productive than low diverse intensively managed communities is therefore misplaced.

For of the treatments, the main plots were much about 100 x larger than the subplots, and more subsamples were taken from this treatment (M2F0). A more correct design would have been to select a subplot in the main plot of identical size, and treat it the same way the other subplots have been treated. Moreover, the other four subplots were fertilized at the start of the experiment (page 3193) (treatment 1, 3,4,5) but treatment 2, the main plots not. This is also strange because treatment M1F0 is an unfertilized treatment. Plotsize and initial fertilization can clearly influence the results and in my opinion this part of the design is not correct. Moreover, the data for treatment 2 are based on four random samples within the large plots and the other treatments on one random sample per harvest.

Interpretation

BGD

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The authors focus on quantity of biomass, however, quality is at least as important. In the experiment tall herbs, grasses, small herbs and legumes were sown, page 3192. Tall herbs will produce large quantities of biomass, and these plants probably don't do too well with frequent mowing regimes. This is most likely why biomass is highest in the intermediate mowing regime, and I suggest that the authors discuss this issue. However, intensively managed grasslands don't typically have high abundance of tall herbs, if any at all. More production in high diverse communities due to tall herbs would therefore probably not be a very good management strategy.

Specific comments

At places it is difficult to find the information needed to correctly interpret the data. I could not find information on the reference grasslands, (they are white in my version in figure 1 and not black as mentioned in the legend). What was the species diversity, how were they managed etc. Do we have to compare them to M4F200?. They are certainly higher, particularly if species richness was not high which is what I assume.

Fertilization treatments are not well described, for example, I could not find how much was applied each time?

Interactive comment on Biogeosciences Discuss., 6, 3187, 2009.

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