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Biogeosciences Discussions

Interactive comment on "Remote sensing of plant trait responses to field-based plant-soil feedback using UAV-based optical sensors" *by* Bob van der Meij et al.

Bob van der Meij et al.

gerlinde.dedeyn@wur.nl

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M. Tuohy (Referee) Referee #2 M.Tuohy@massey.ac.nz Received and published: 19 December 2016

The authors have carried out a detailed study and presented a well written report on the outcome. Previous research has been thoroughly reviewed and the methods used have been well described. Reply: We thank the referee for these positive comments on our manuscript.

The conclusion that UAV-mounted hyperspectral sensors can adequately quantify plant traits may be a leap of faith considering that the best R2 values for fresh biomass and

N content were only 0.56 and 0.68 respectively. Reply: We thank the referee for the critical comment. However, we did not use the specific wording as suggested by the referee stating 'adequately quantify', we do state that the methodology offers great potential as we were able to discriminate between the treatments and obtained surface level information of a number of plant traits, in contrast to the point observation data of the in situ measurements which limit the spatial resolution.

The PSF results could have been explained better; it is not clear what a good F6,21 value is and the range varies from around 11 to almost 27. Reply: The results of the PSF comprise the outcomes of the statistical tests in which we performed analysis of variance of the different plant traits in relation to the different treatments we imposed in the field by means of growing different species and species combinations of cover crops before growing oat. The significance of the F values is indicated by the p values that are mentioned with it, with a p value < 0.05 indicating that the cover crop treatments resulted in different values of the plant trait of focus in the following oat crop. We expanded our description of the PSF effects in the results in order to clarify the findings.

It could be argued that reflectance is not a good proxy for plant height and will never be, but it might well be expected to provide some measure of nutrient concentration. With the obvious importance of the NIR wavelengths, perhaps more attention should be paid to this region of the spectrum rather than waste processing time on PLS analysis of all the bands. Reply: The UAV based camera system used in this research includes both a hyperspectral and RGB sensor. The Structure-from-Motion method enables the derivation of a digital surface model (DSM) from the RGB images and from that to derive the plant height. The hyperspectral reflectance data were indeed used for deriving indices for plant chemical composition. As our work was in part explorative we included a range of PLS analyses, these however did not take up much processing time as we could run the analyses in a semi-automated way.

Grammatical corrections. 3/32 replace good with well; delete remote based Reply: Changed 4/12 of the field's Reply: Included 'the' 4/36 weighing not weighting Reply:

Changed 4/37 change to once in each plot. Reply: Changed 5/1 ground not grinded; change to weighed in tin cups and then. . . Reply: Changed 5/17 found to be inadequate Reply: Changed 5/32 replace conflicting with conflict Reply: Changed 6/31 replace was with were; change 'and using' to and a non-parametric. . . Reply: Changed 9/6 replace till with to Reply: Changed 11/23 use a more extensive. . . Reply: We included 'a'.

Colours in figs 5 and 6 should match those of the spectra in fig 4 Reply: We adjusted the colour scheme for the different treatments in Figure 5 in order for it to match with the colour scheme of the treatments in figure 4. In figure 6 the colours we used relate to the different plant traits that we are addressing in the different panels, the colours hence do not relate to the different treatments as these are indicated in the x-axis of each panel.

Fig 6: small letters above each bar are not explained. Reply: We had included the meaning of the small letters in the second sentence of our figure legend but the formulation may not have been clear enough. We therefore reworded this sentence into: 'Bars with different letters above them indicate that the treatments are significantly different at p< 0.05 for the respective plant trait.'

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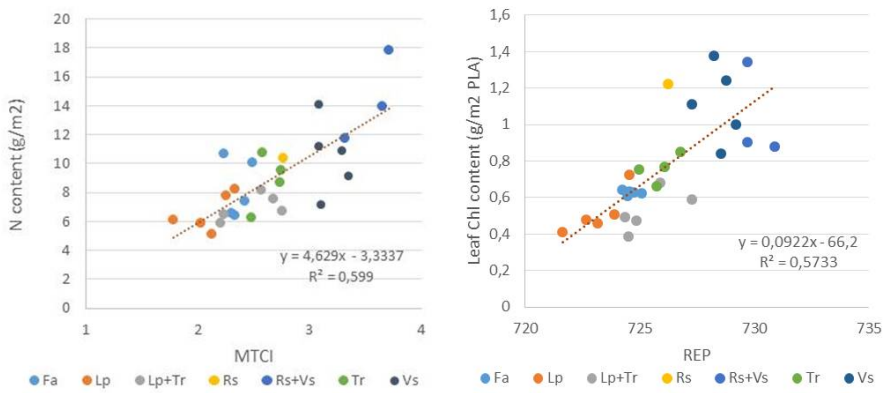

Fig. 1. new Fig. 5 with adjusted colour scheme