

Interactive comment on “Quantifying nitrogen losses in oil palm plantations: models and challenges” by Lénaïc Pardon et al.

M. van Noordwijk (Referee)

M.vanNoordwijk@cgiar.org

Received and published: 24 June 2016

Comments on bg-2016-177: Quantifying nitrogen losses in oil palm plantations: models and challenges by L. Pardon et al.

With the rapid expansion of oil palm the environmental consequences beyond initial conversion need to be quantified. The manuscript describes a comprehensive comparison of existing models that can be used to predict N losses from oil palm, both at qualitative and quantitative level. The tables of which processes are included (or not) can help in further model development, borrowing ideas within the modelling community, retaining what seems to work best. As there is no established empirical data set that can serve as comparison, it is not easy to see which models over- or underestimate the overall loss, beyond what the discussion indicates. The manuscript will

C1

hopefully trigger further critical analysis, and is worth publication in Biogeosciences. The manuscript takes the various models at 'face value', without comparing the underlying equations. As leaching is identified as the dominant process of N loss across the models, it will be good to provide further detail on why the various models provide different estimates. I assume that the basic equation for leaching losses as the net vertical water transport multiplied by average concentration of mineral N in soil solution holds true across all models. Variation in results could then be based on differences in ET (with vertical water transport equal to rainfall -ET) or concentration. The latter will vary with N form (fraction of mineal N as ammonium vs nitrate), sorption of ammonium and nitrate to the soil, or any preferential flow that allows water to bypass mineral N. Please add a paragraph or two to the dicussion that takes this debate a bit further. Identification oc clay content as key variable points to interactions via sorption and/or microbial dynamics – again, a bitfurther discussion of the underlying mechanisms that are included in the model is of interest. One would expect pH to play a substantial role, as it influences nitrification as a process – is that included in any of the models? It may be good to include some further words of caution to use of the 'portfolio of models' rather than a single one – in the absence of further empirical studies. There is no specific reason to believe that the average is closer to the truth than any of the values in the range of results obtained...

Overall I recommend the manyscript to be published with some minor revisions.

Comments that may be taken into account in a final version: Around line 45 it may be good to give some a priori reasons why porcess models adjusted to temprate conditions might not work, without adjustment, to tropical conditions: faster decomposition, different dominant clay minerology, different soil microflora and fauna, ... reference could be made to: Richards, M., Metzel, R., Chirinda, N., Ly, P., Nyamadzawo, G., Vu, Q.D., de Neergaard, A., Oelofse, M., Wollenberg, E., Keller, E. and Malin, D., 2016. Limits of agricultural greenhouse gas calculators to predict soil N₂O and CH₄ fluxes in tropical agriculture. Scientific reports, 6.

C2

Around line 48 a distinction may be made between models that are primarily used for 'response to management' type studies, and those that are supposed to provide an accurate mean

Line 74 reference for Morris please

Line 240 Please clarify which reason applied. Aren't all models 'open source'? to which model

Line 245 a range from 10 to 190% of initial estimate may get one into pretty extreme conditions on the low side, and pretty mild one on the high side, as many effects are multiplicative rather than additive... This may require some text in the discussion.

Line 267 Please provide the calculated yield levels and average annual external N inputs that correspond with this result, along with rainfall and ET

Line 336 Was application of EFB only considered at planting time?

Line 375 Any differentiation by clay minerology in any of the models?

Line 446 If fertilizer is added close to the trunk in a zone with average of above-average water infiltration, a high leaching loss is to be expected, unless there are contravening processes of preferential water uptake in this zone...

Line 490 The Richards reference cited above suggests that there are real knowledge gaps on the N₂O emissions for any current model

Typo's Line 429 Some words missing?

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-177, 2016.