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Interactive comment on "Herbicide weed control increases nutrient leaching as compared to mechanical weeding in a large-scale oil palm plantation" *by* Greta Formaglio et al.

Anonymous Referee #2

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General comments This manuscript provides important results for the management of oil palm plantations, showing that mechanical weeding reduces leaching losses compared to conventional practices using herbicides. This study is one of the first to take into account the great spatial heterogeneity of oil palm plantations to estimate nutrient leaching. Although the experimental design of the factorial management experiment is strong with big plots and 4 blocks, there are some weaknesses in the methodology: only one year of soil solution sampling, only one depth of soil solution collection, water transfer model parameterized using data in the literature (LAI, fine root densities, soil hydraulic parameters). However, studies that accurately measure nutrient leaching over several years are rare in the tropics and the data set presented here is original

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and timely. Moreover, the discussion section shows that the magnitude of the drainage fluxes is consistent with evapotranspiration rates estimated in oil palm plantations from various methodologies. The manuscript is generally well written. Only minor revisions are recommended prior to publication.

Specific comments

Abstract: It would be interesting to indicate some values of nutrient losses in plots with conventional management practices. L32: “Our findings signified that mechanical weeding. . .” should be replaced by “Our findings suggested that mechanical weeding. . .” because you cannot generalize to Indonesia your results at a single site.

Introduction: The Introduction section is clear and informative. L71-73: Not always the case, see for example eucalypt plantations.

Material and methods The lysimetry design was suitable for the quantification of leaching losses. You might indicate that, even though the time period for soil stabilization was short in your study (only two months from the installation of the ceramic cups to the start of the soil solution collection and four months from the implementation of the factorial management experiment to the collection of the soil solutions), this period was sufficient because the biological processes are rapid in tropical soils.

You may be interested in two articles that accurately describe the spatial development of roots in oil palm plantations: Plant and Soil 189: 33-48, 1997 and Plant and Soil 190: 235-246, 1997.

More information should be given on the water drainage model. How have you dealt with run off from one management zone to another? The parameterization of the model is rough, without measurements of root profiles and soil hydraulic parameters in each treatment and management zones. Moreover, the validation from soil water potentials is also rough with only two depths (it would have been interesting to include the depth of 1.5 m where soil solutions are collected) and punctual measurements in only

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two treatments (only 12 tensiometers). It is important to provide a table (in appendix) showing the values given to all the parameters used in the Expert-N water sub-model for each management zone.

Statistical analyses are clearly presented.

Results No specific recommendation, this section is well written.

Discussion You might be interested by a recent paper providing values for N leaching in oil palm plantations. The three management zones were sampled in the field to validate this model and the order of magnitude is consistent with your results: DOI: 10.1002/agj2.20109 The comparison with other perennial tropical plantations is interesting (Table A2). Could you add forest plantations to this appendix (pines, eucalypts, acacias) and rubber plantations if you find data in the literature?

L515-517: not sure that the amounts of Na taken up by soil macrofauna could be sufficient to explain the differences. It has been demonstrated that oil palm can take up Na in addition/substitution to K (Bonneau, X., Boutin, D., Bourgoing, R., Sugarianto, J., 1997. Le chlorure de sodium, fertilisant idéal du cocotier en Indonésie. Plantations, Recherche, Développement 4 (5), 336–346), as also shown recently in eucalypt plantations.

Tables, Figures and appendices The 4 tables, 5 figures and 3 appendices shown are clear and relevant.

Technical corrections

L329: than in the inter-row L332: dissolved organic N or total dissolved N? L453: higher?

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