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Christel, Renaud-Gentié ; Dijkman, Teunis Johannes; Bjørn, Anders; Birkved, Morten

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Modeling pesticides emissions for Grapevine LCA: adaptation of Pest-LCI model to viticulture

Renaud-Gentié Christel[1)], Dijkman Teunis J.[2)], Bjorn Anders[2)], Birkved Morten[2)]

1) *Groupe ESA, UPSP GRAPPE, UMT VINITERA 55, rue Rabelais, BP30748, F-49007 Angers, Cedex 01, France*

2) *Technical University of Denmark, DTU Management Engineering, Produktionstorvet Building 424, DK - 2800 Kgs. Lyngby, Denmark*Corresponding author: c.renaud@groupe-esa.com

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ABSTRACT

Viticulture is an important economic and cultural sector in Europe, but is also one of the larger pesticides consuming sector per ha with 20kg pesticides/ha/year (of which app. 15 kg/ha is elemental sulfur) at the European Union scale (endure 2010).

Pesticides emissions are therefore also a key topic to be addressed when performing wine and/or grape production LCAs. However, due to the lack of specific inventory models for pesticide emission quantification, most of the published wine LCA studies either neglect pesticide emissions or simply assume that 100% is emitted to the soil.

PestLCI (Birkved and Hauschild, 2006; Dijkman *et al.*, 2012) is currently the most advanced LCI model for pesticides emissions on agricultural field (van Zelm *et al.*). Despite the fact that the model has been applied in wine/grape production LCAs , it still does not take into account certain specificities (e.g. double cropping system, vertical spraying etc.) of viticulture.

This paper presents a customized PestLCI 2 version adapted to include viticulture specificities. The application of the model is illustrated through case studies on 5 vineyard management types (Renaud *et al.*, 2012).The customization of the PestLCI 2 model includes:

- Addition of 29 new active substances commonly used in viticulture
- Addtion of 10 new viticulture type specific spraying equipment including drift-reducing tunnels.
- Introduction of double cropping systems yielding a mixed canopy (vine /grass cover) and sequential pesticide interception
- Addition of “direct spraying” of specific plant parts

- Account of number of rows treated at once

The specificities of viticulture, compared to arable crops had, due to the customization complexity, to be addressed individually in order to find the best possible customization approach.

In order to enable the inclusion of improved emission quantities of pesticides from viticulture, USEtox characterization factors were calculated for the missing (viticulture specific) pesticides. Emission quantifications were calculated for 5 vineyard management types. The results on these 5 management types were compared with the ones obtained with other approaches: 100% emitted to the soil ((Nemecek and Schnetzer, 2011) 75% soil and 25%air ((Neto *et al.*, 2012)).

The results of calculations on the cases show that pest-LCI results in much lower emissions and consequently, lower toxicity impacts that the other apporaches.

It also appears that some substances dominate the overall toxicity.

The question of inorganic substances accounting is discussed.

Some questions couldn't be addressed due to lack of data: effect of canopy form on air boundary layer, effect of high percentage of stones in the soils on pesticides leaching.

The included parameters are adapted to vertical trained vineyards which is the most common in Europe and in the new world. For application to other conformations and to orchards few adjustments would be necessary.

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