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Avec le soutien de la Wallonie

Sustainability in Wheat Farming: A Critical Examination of Fungicide Practices in Belgium Through Life Cycle Assessment

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Introduction

Fungal diseases

- Fusarium
- Septoria
- Yellow rust

Belgian wheat farming

Fungicide treatments

- Mitigation of resistance
- Frequent turnover of authorized substances
- Demand for more sustainable alternatives

Life Cycle Assessment (LCA)

- Lack of LCA studies on fungicides
- Limitations of current LCI databases (field emissions modeling)
- Missing characterization factors (CF)

Human health

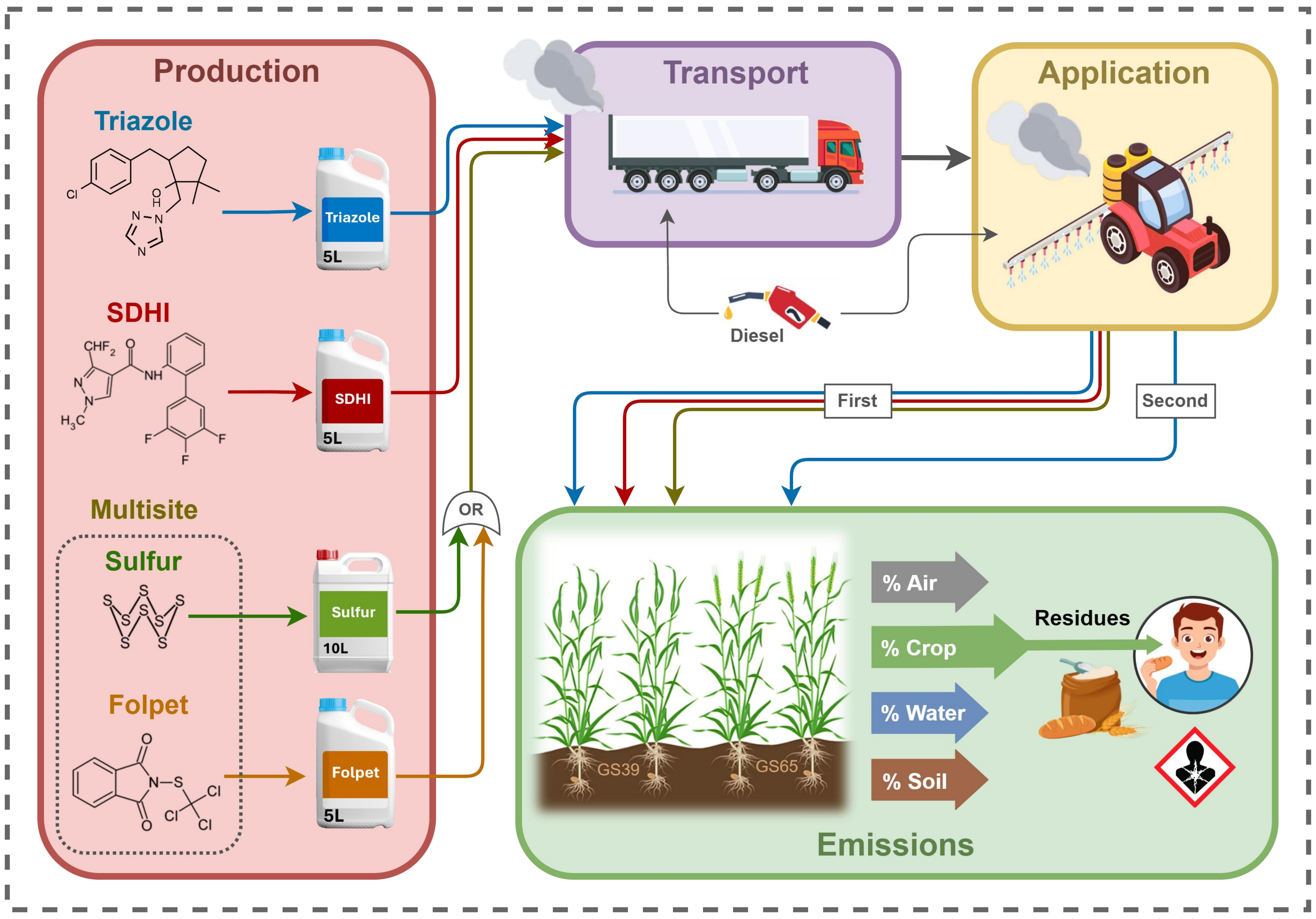
- Mycotoxins risks
- Potential toxic effects from ingestion of fungicides residues

Materials & Methods: Life Cycle Assessment

- **ISO standards 14040:2006** and **14044:2006**
- **OLCA-Pest framework** [1]

Goal & Scope

- Environmental impact of a conventional fungicide program in Belgian wheat farming for bread making.
- **Functional unit** (FU): treatment of **1 ha** of soft winter wheat culture. **System boundaries**:



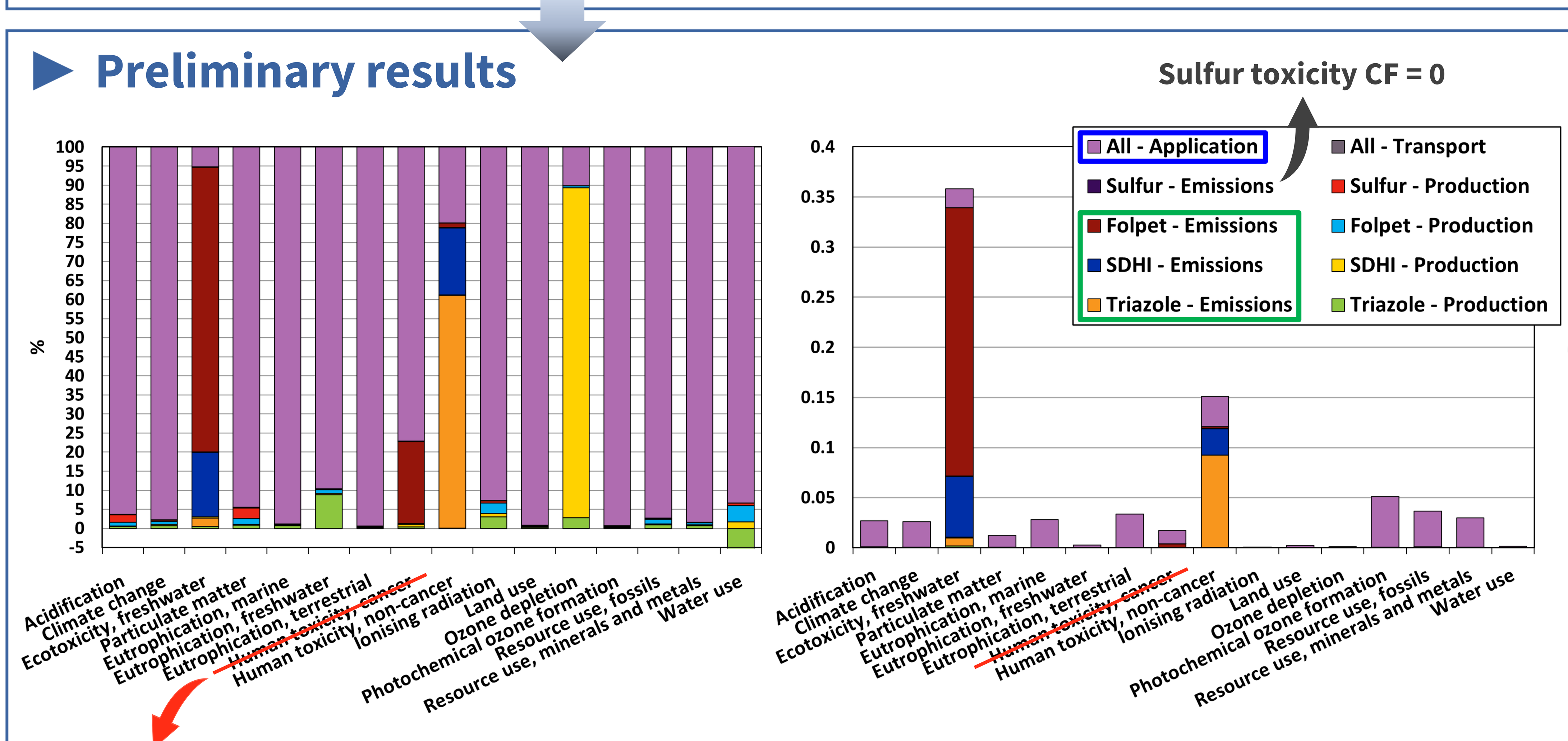
Inventory

- **Ecoinvent 3.9.1** edited (new *Crop* compartment)
- SDHI production proxy: Pyrazole production
- **PestLCI consensus** [2]: initial emission fractions

Impact Assessment

- **Environmental Footprint** (EF) 3.1 edited (added CF)
- Human toxicity characterization factors (CF) from [3]
- Simapro 9.5.0.0 software

Preliminary results



Missing CF for all substances except Folpet

Fig 1. *Characterization (on the left) and normalization (on the right) of the potential environmental impacts of 1 FU*

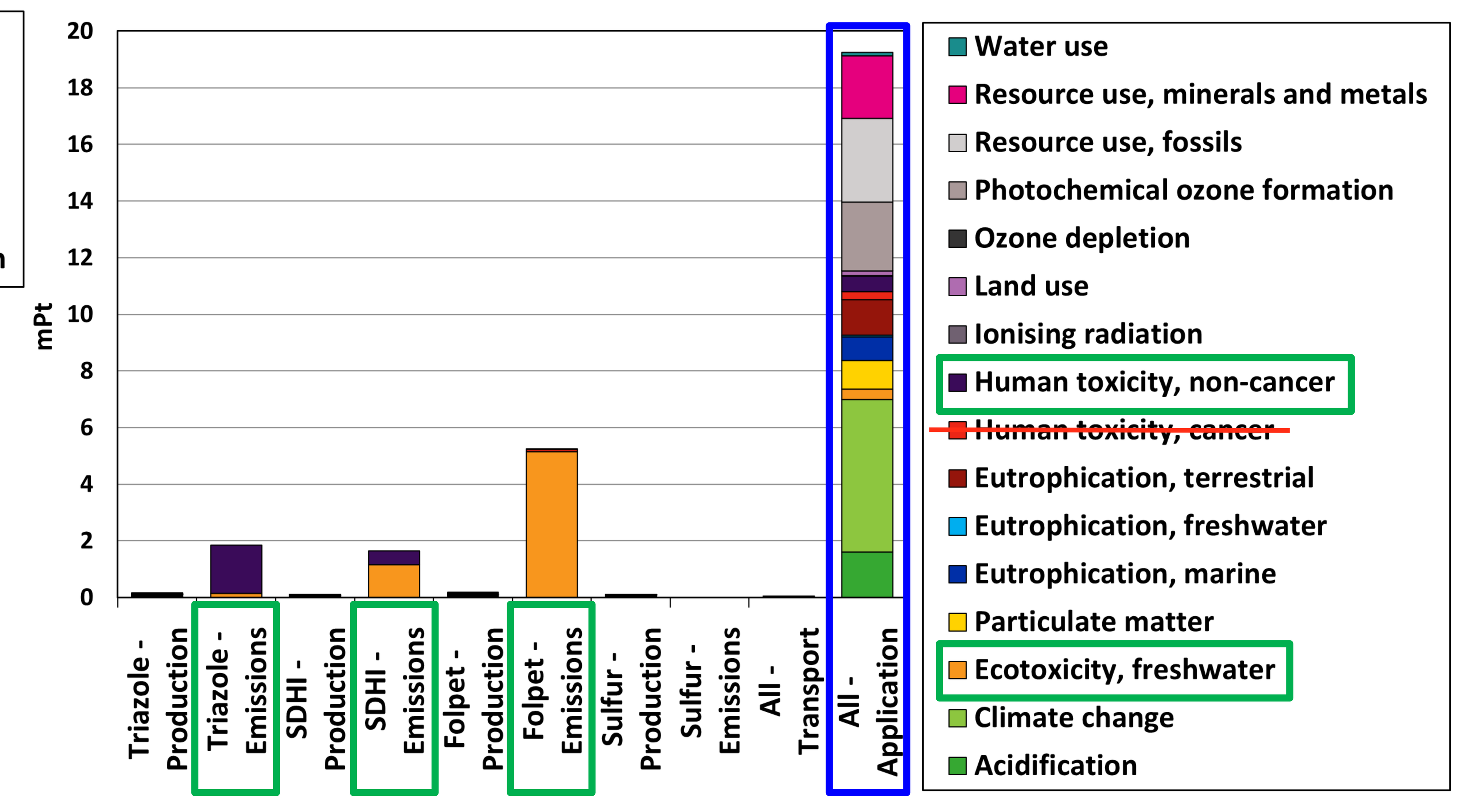


Fig 2. *Single score of 1 FU (weighting coefficients of EF 3.1)*

Conclusions

- **Lack of data** to assess the carcinogenic toxicity of most substances.
- **Field emissions** post-application have a predominant impact, primarily on human toxicity and ecotoxicity (except for sulfur, considered non-toxic).
- **Application step** contributes significantly to most impact categories, while production and transportation generally present negligible contributions.

Perspectives

- These results will serve as a **benchmark for the LCA of alternative fungicide programs**, including innovative sustainable solutions currently under development within the **ELITHE project**, funded by Belgian public authorities.
- **Integrating LCA into local decision support tools** holds promise for refining fungicides use strategies, ultimately contributing to a more sustainable and resilient agricultural sector in Belgium.

[1] Nemecek, T., Antón, A., Basset-Mens, C. et al. (2022). Operationalising emission and toxicity modelling of pesticides in LCA: the OLCA-Pest project contribution. Int J Life Cycle Assess 27, 527–542.
[2] Fantke P., Antón A., Grant T., Hayashi K. (2017). Pesticide emission quantification for life cycle assessment: a global consensus building process. J LCA Japan, 13:245–251.
[3] Fantke, P., & Jolliet, O. (2016). Life cycle human health impacts of 875 pesticides. International Journal of Life Cycle Assessment, 21(5), 722–733.