significant opportunities to reduce the GHG footprint of crude palm oil (CPO) through improved landscape management and avoidance of high carbon stock areas(14, 15).

Drivers of Variability in Greenhouse Gas Footprints of Crop Production

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1. Description of study

WHY

- GHG emissions of open-field crop production are characterized by large variability[1,2]
- Understanding the variability of GHG footprints is important to:

→ **Benchmark performance**

→ **Guide strategies for GHG mitigation**

WHAT

- **Quantify farm-specific GHG footprints of 26 crops** based on a dataset of 4,565 farm observations spanning 36 countries and covering the years 2013-2016.
- **Understand the major drivers influencing** the variability of GHG footprints

HOW

- Quantify the GHG footprints based on emissions from:
  - (i) electricity use
  - (ii) fossil fuel (petrol and diesel) use
  - (iii) crop and pruning residue application
  - (iv) fertilizer use
- Examine for each crop, **using linear regression models**, the relationship between farm-specific GHG footprints and yield, area and year of production.

2. Results

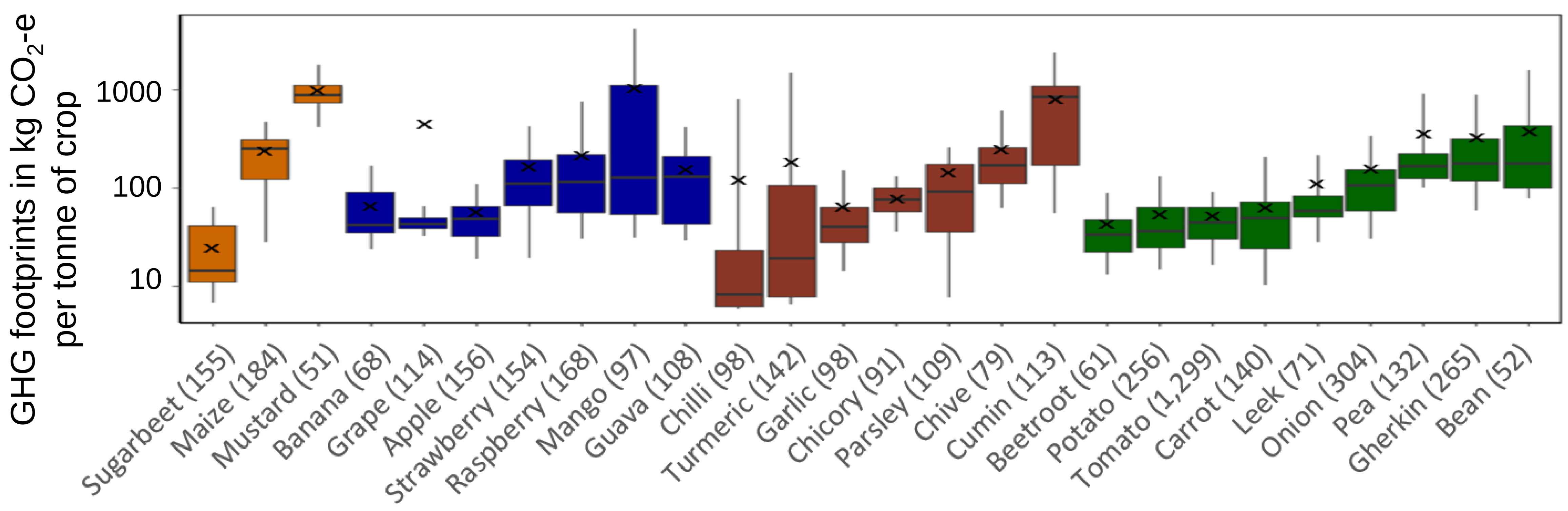

Figure 1. GHG footprints in kg CO_2 eq per tonne of crop. The number in the brackets refers to the number of observations per crop. The variability diagrams show the 5th percentile, first quartile, median, third quartile, and 95th percentile of the footprints. The crosses represent the arithmetic mean GHG footprints.

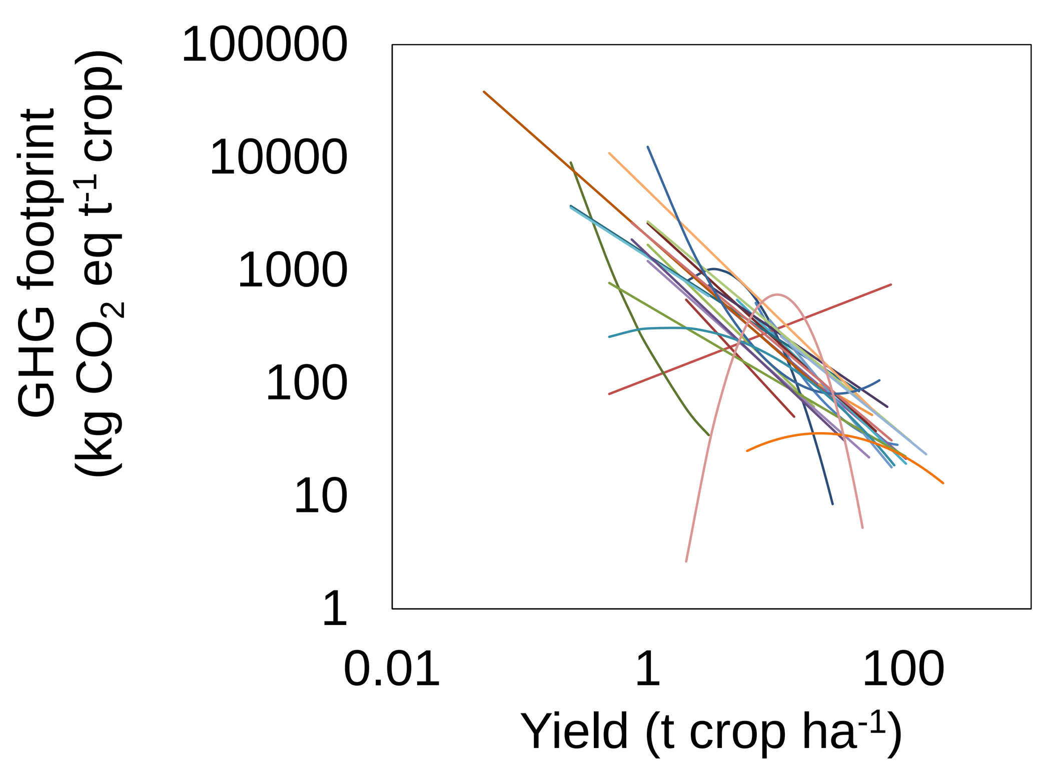

Figure 2: Modeled relationships between GHG footprints and yield holding other factors at their median values. The lines represent the fitted values using the fixed part of the models for each crop.

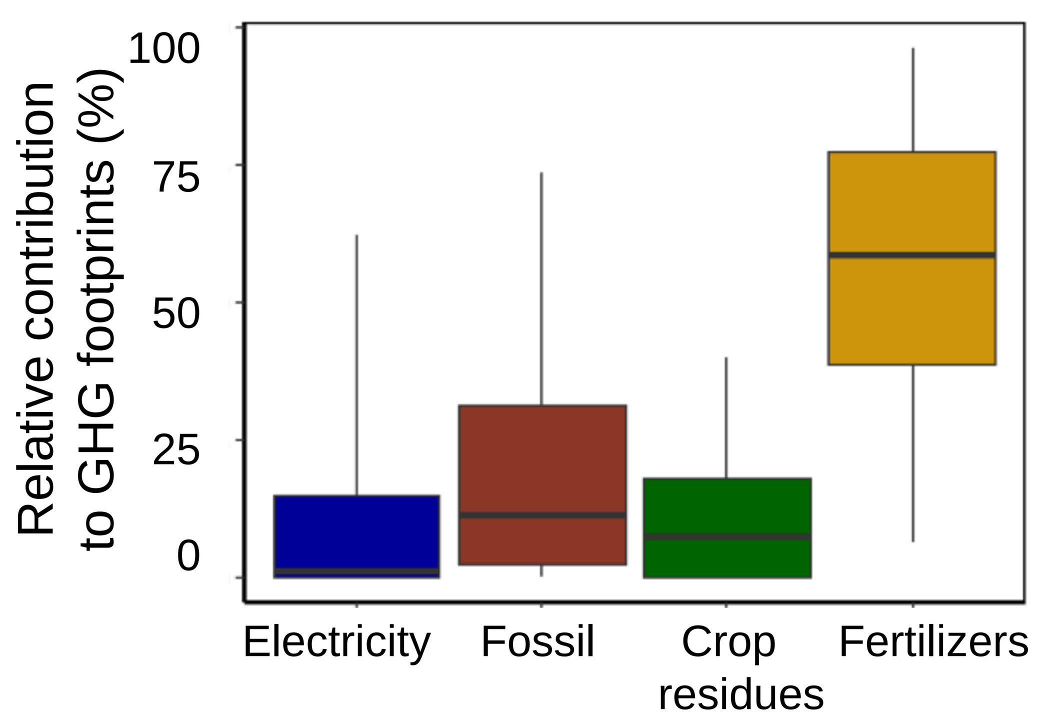

Figure 3: Relative contribution in percentage by each type of emission to the magnitude of GHG footprints across all crops. The variability diagrams show the 5th percentile, first quartile, median, third quartile, and 95th percentile

3. Take home messages

Variability in GHG footprints is larger within than between crops, i.e. 55% vs 45% of explained variance.

- Need to investigate which country- and farm- specific variables could be driving this variability

GHG footprints decrease with increasing yields for 24 out of 26 crops.

- This implies that farmers can increase yields without corresponding increase in GHG footprints through efficiency improvements
- Trends were less clear for area and year of production.

Fertilizer use contributes most, on average, to the GHG footprints of 23 out of 26 crops.

- Precision farming techniques may help to optimize amounts, types, methods and timing of fertilizer application.

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