Narrowing maize yield gaps across smallholder farming systems in Zambia: What interventions, where, and for whom?

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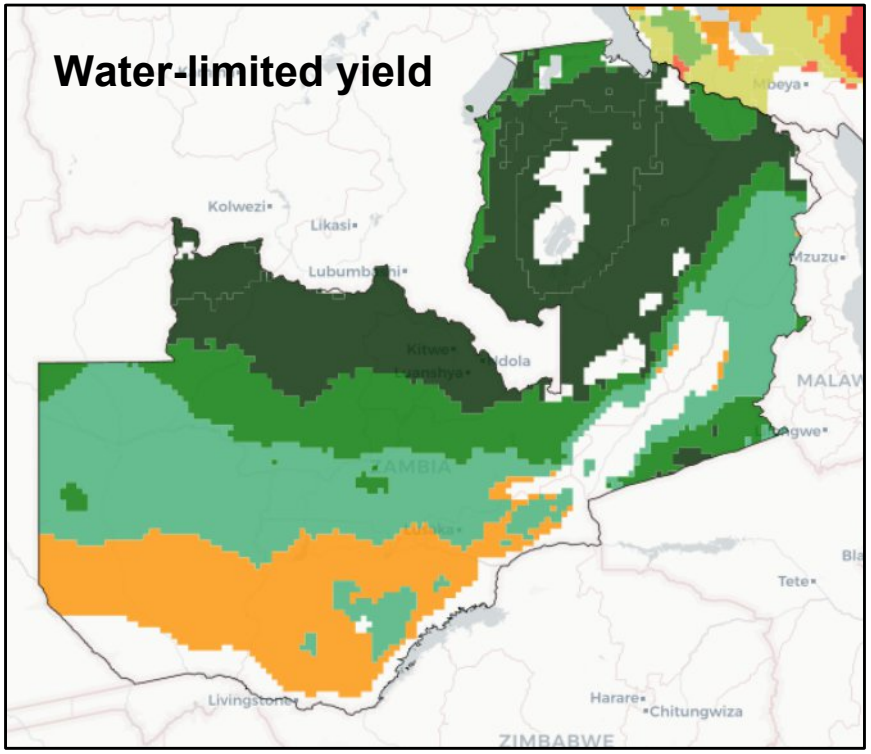
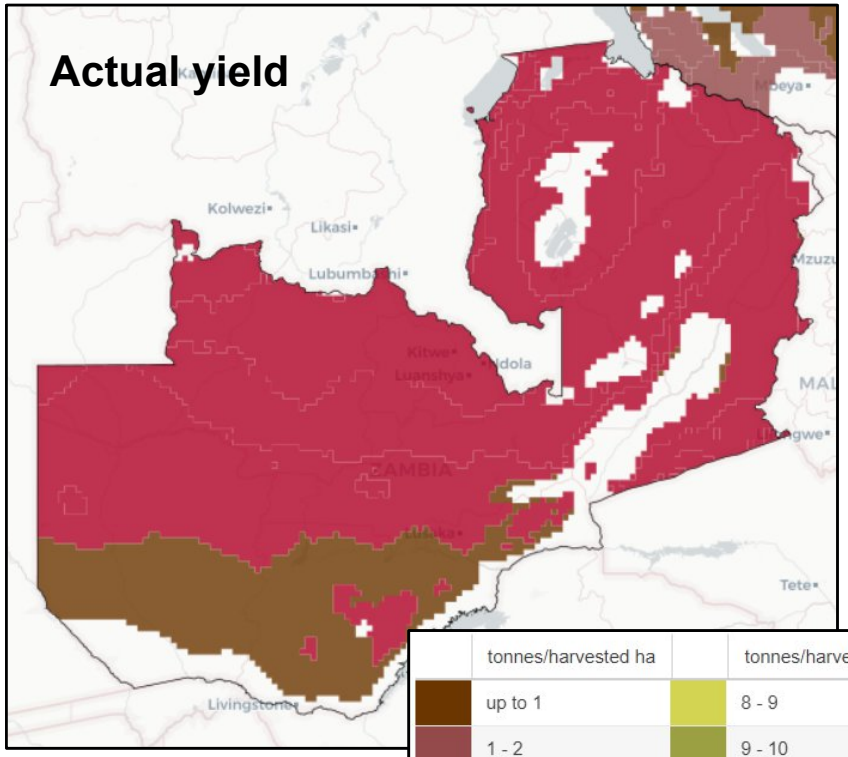
Introduction

- Maize cultivated in ca. **1 million ha** across Zambia, with 75% of the production taking place in smallholder farming systems.
- **1.6 million farmers** considered small-scale with 70% having farm sizes below 2 ha of land. Market-oriented farms coexist with subsistence farms.
- **Low maize productivity** across Zambia, but unclear causes due to diverse agro-ecological conditions across the country.
- Few studies explored the causes of yield gaps for **farm types** with different production orientations and resource constraints (e.g., Berre et al., 2017).
- **Objectives**: (1) characterize farm diversity across Zambia in relation to maize production, and (2) identify the limiting factors to maize production in the country.

Maize yields in Zambia

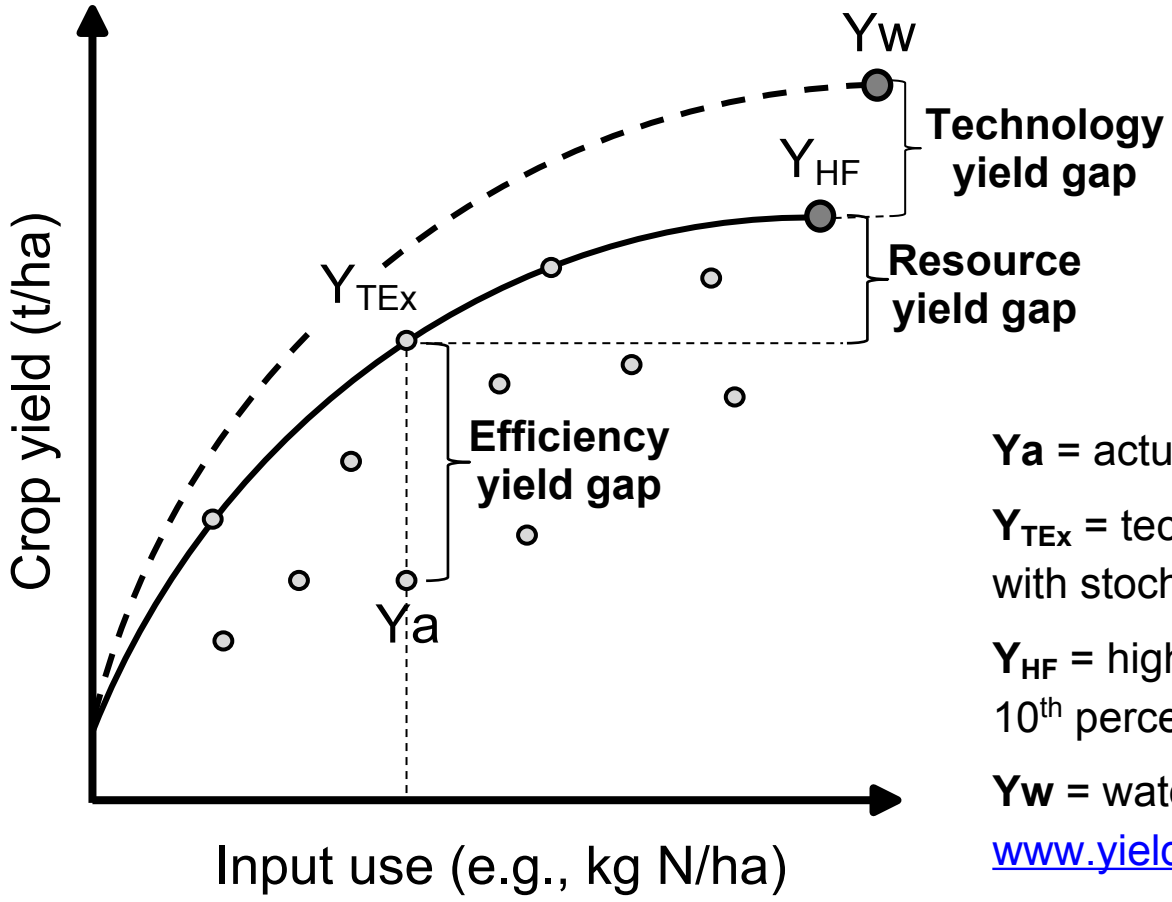




tonnes/harvested ha	tonnes/harvested ha
up to 1	8 - 9
1 - 2	9 - 10
2 - 3	10 - 11
3 - 4	11 - 12
4 - 5	12 - 13
5 - 6	13 - 14
6 - 7	14 - 15
7 - 8	more than 15

www.yieldgap.org

Yield gap decomposition



Ya = actual farmers' yields from surveys

Y_{TEx} = technical efficient yields estimated with stochastic frontier analysis

Y_{HF} = highest farmers' yields as the top 10^{th} percentile of Ya

Yw = water-limited potential yield from www.yieldgap.org

Silva et al. (2017) ***Eur. J. Agronomy***

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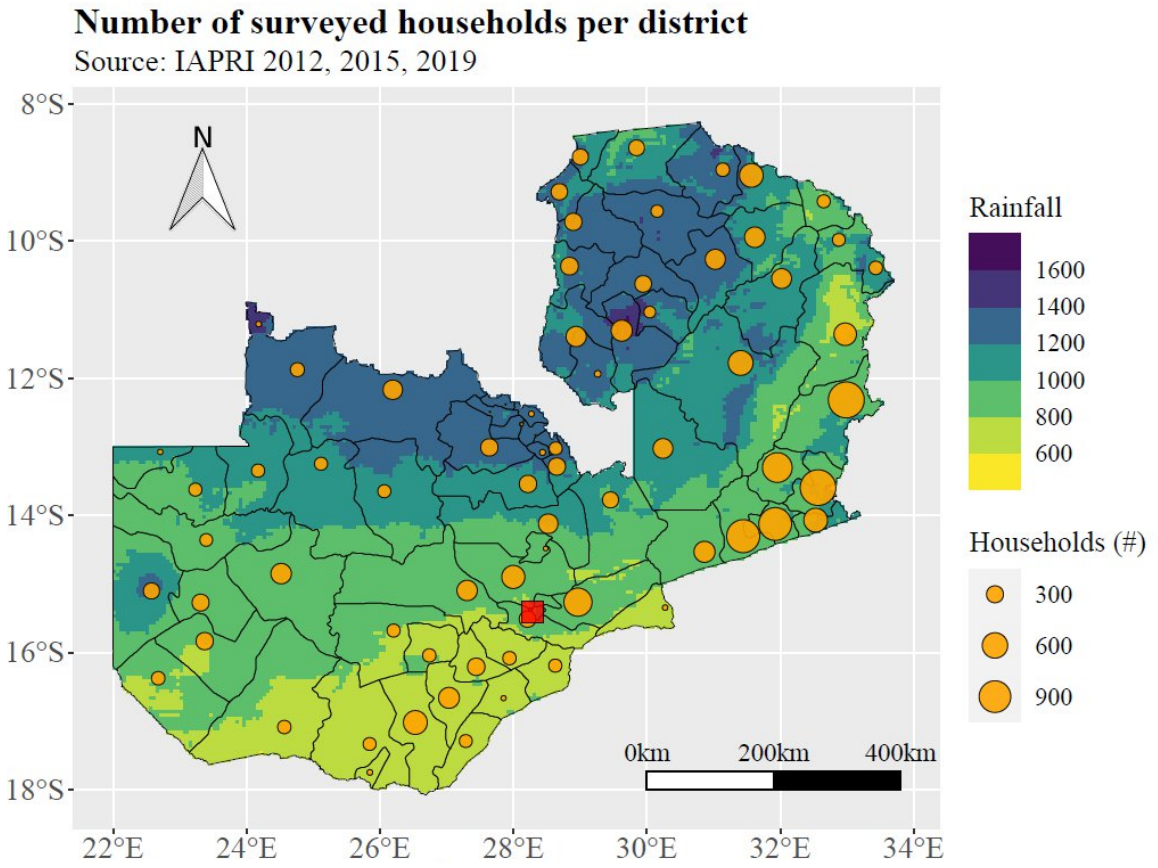
Rural Agricultural Livelihoods Survey

- Three-wave panel survey: 2012, 2015, and 2019.
- Focus on small- and medium-scale farming sector.
- >7000 households per wave.
- 6500 households interviewed in the three waves.
- Representative at province and national levels.



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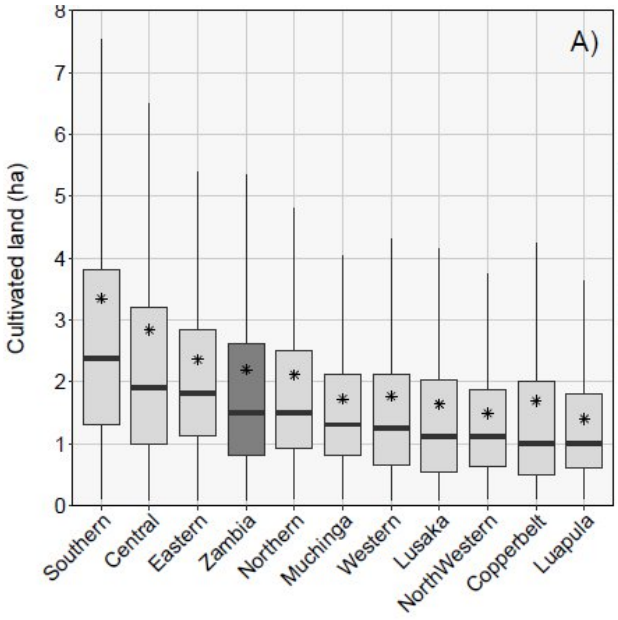
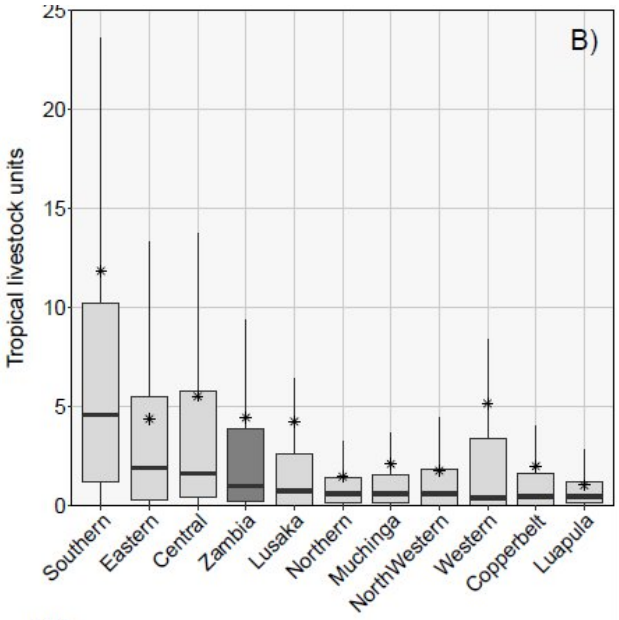
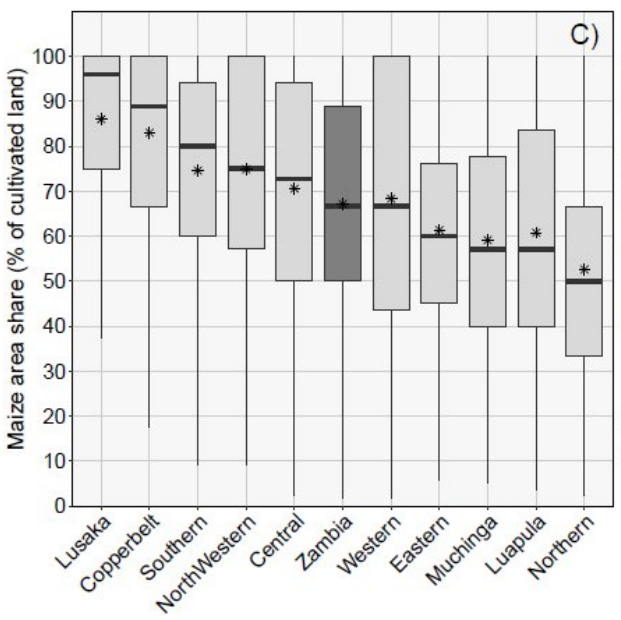
Diversity of farming systems



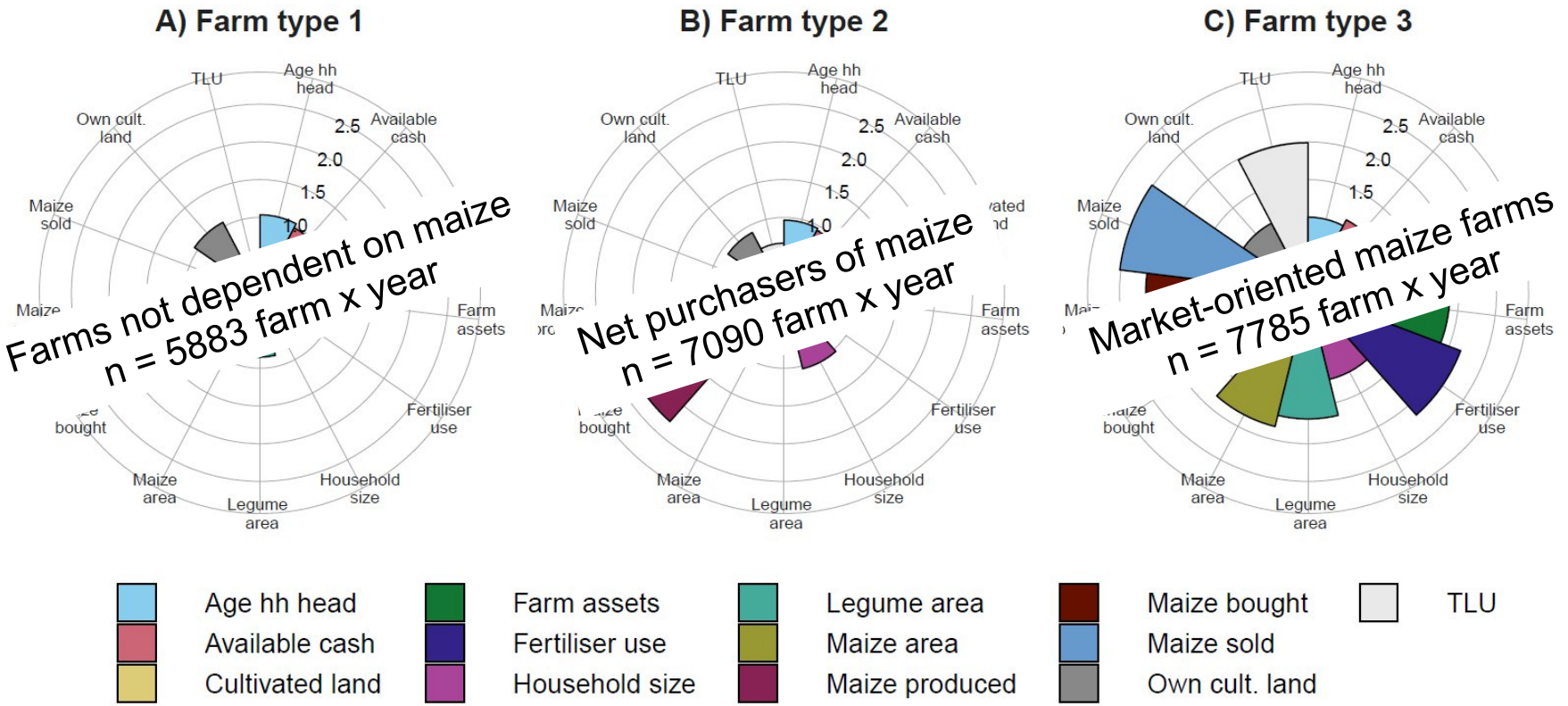




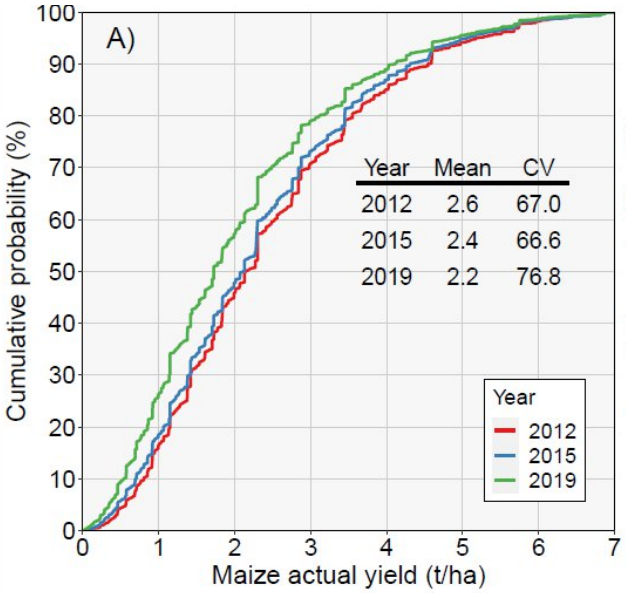
Farm types and the role of maize

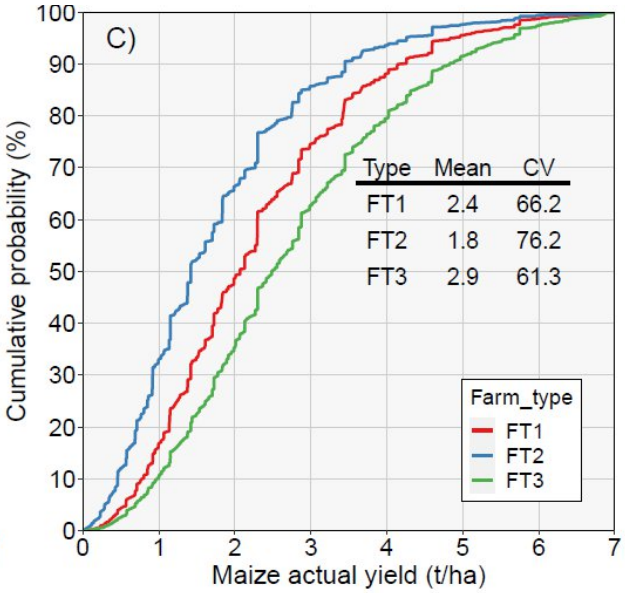
Methods: Principal component analysis + Hierarchical clustering for pooled data.

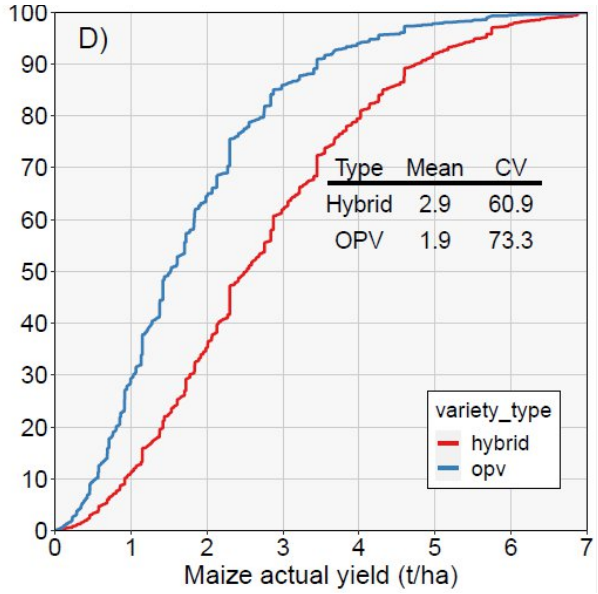
Variables: Structural variables + Functional variables characterizing maize production.



Actual yield in farmers' fields







1. Huge maize yield variability from nil up to 7 t/ha.
2. Yield variability consistent over the three time periods.
3. Striking yield differences between farm types and variety types used.

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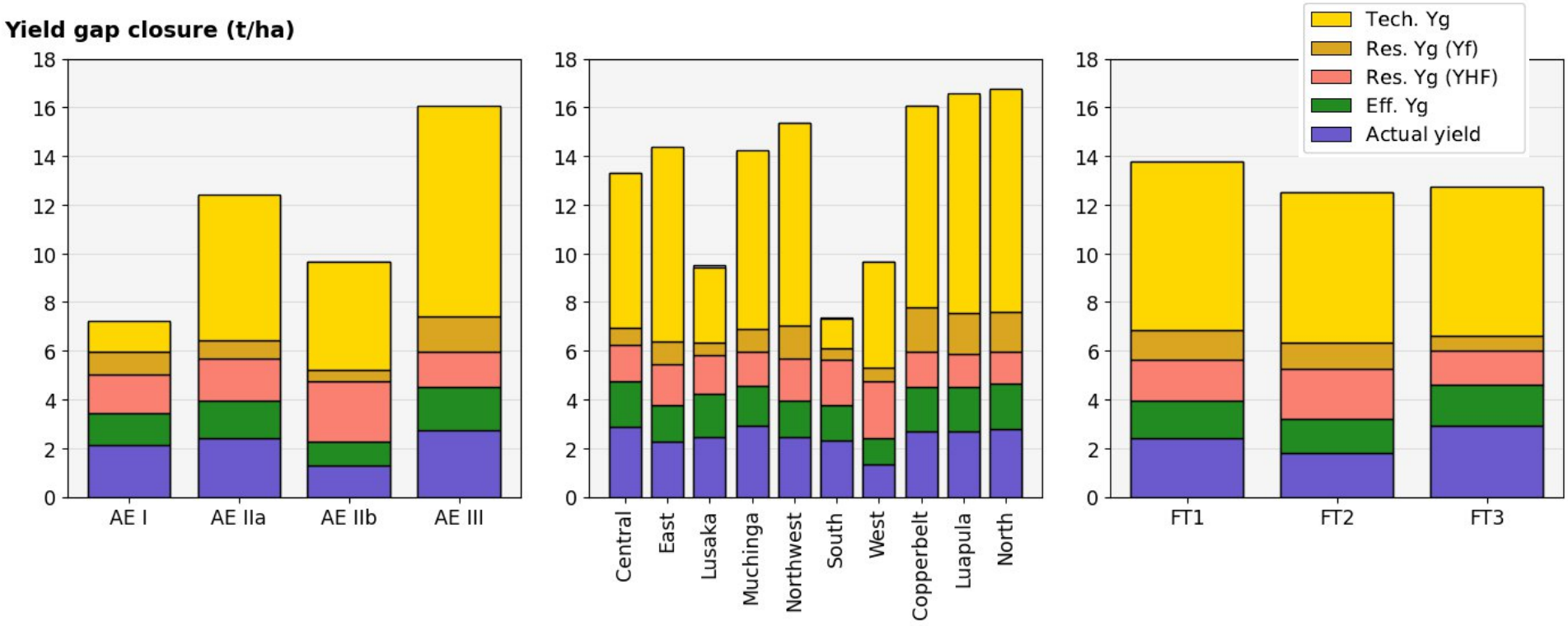
Maize yield gaps



1. Technology Yg > 50% of Yw: current best practices below agronomic potential.
2. Narrowing efficiency and resource Yg can more than double current yields.

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Determinants of yield gaps

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Take-home messages

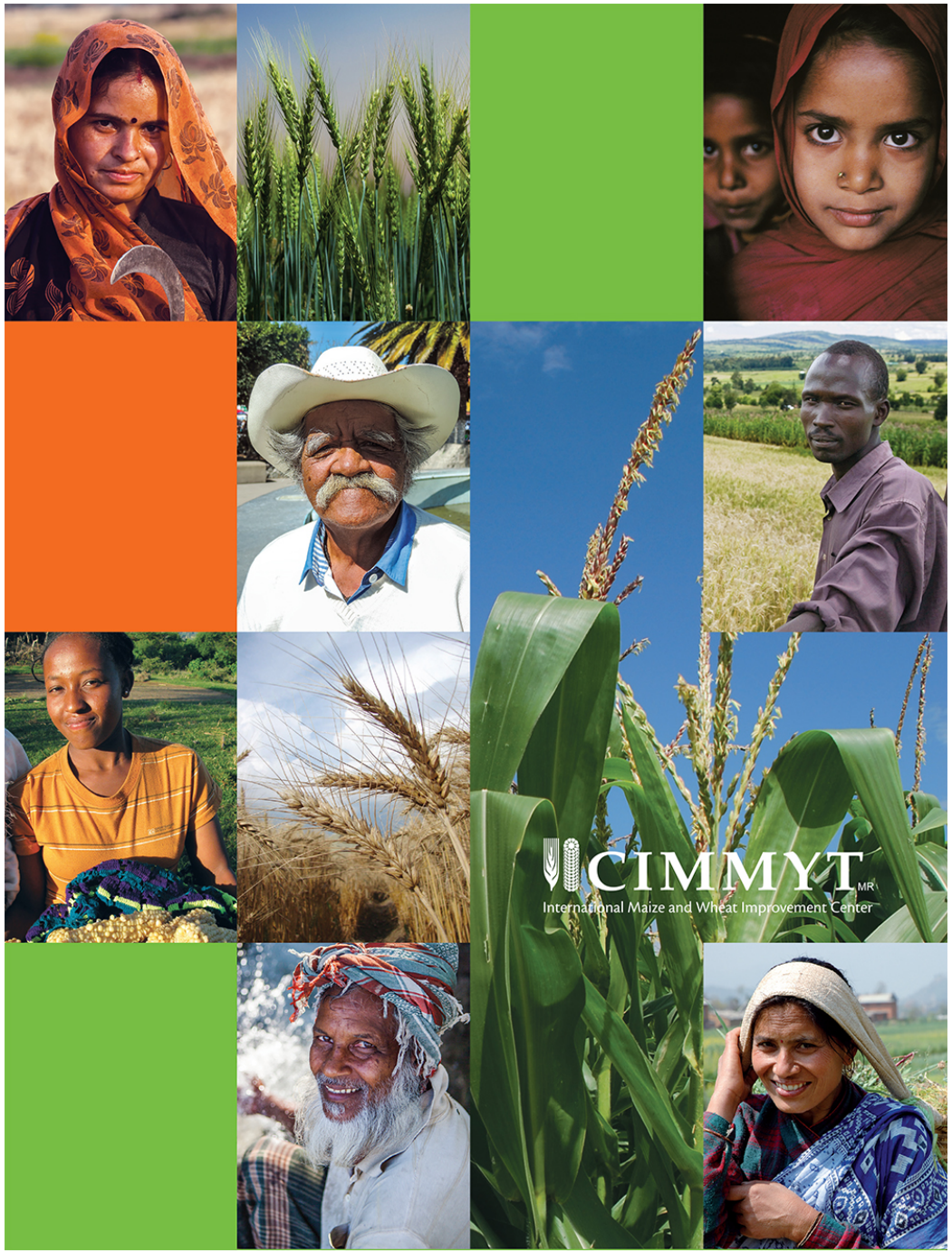
1. Three main farm types across Zambia: 1) market-oriented maize producers, 2) maize consumers and 3) other ‘non-maize’ oriented.

2. The magnitude of yield gaps slightly differs per farm type, but the causes are largely similar for all farm types.

3. Technology yield gaps explain most of the yield gap, indicating current practices do not reach their full agronomic potential.

4. Narrowing efficiency and resource yield gaps through fine-tuning current practices can more than double current yields.

5. Variety choice, low input use (particularly fertilizer), and untimely operations are the main causes of maize yield gaps in Zambia.



Thank you for your interest!

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