The potential of integrated soil fertility management for closing the yield gap in Ethiopia

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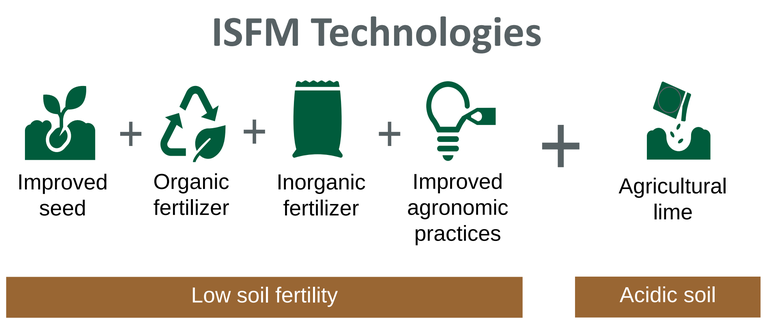
1. Introduction

- Land degradation and declining soil fertility are constraining crop yields in the Ethiopian Highlands
- > 3.5 million ha of cultivated lands are acidic with a pH of < 5.5 causing fertilizer inefficiency and lower yields
- Limited access to agricultural inputs (e.g. lime, improved seed, fertilizer, …)
- Integrated Soil Fertility Management (ISFM), a combination of technologies can alleviate some constraints
  → reduce the yield gap



Picture 1: Farmer showcasing the effect of ISFM on the pod size of faba beans

2. Material & Methods

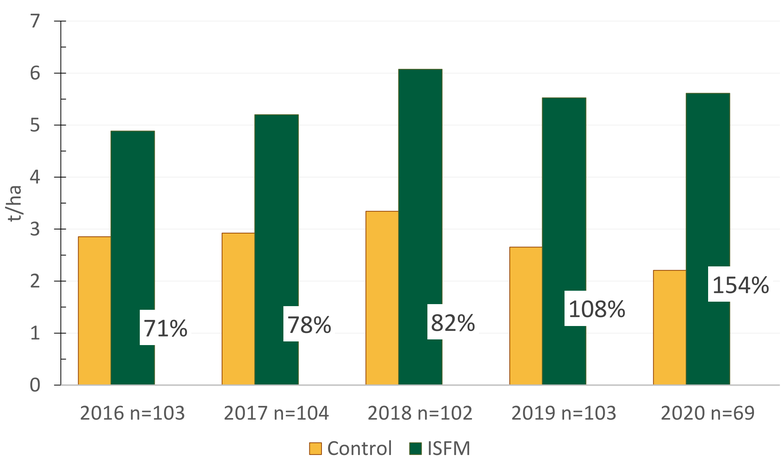
- Farmer-led demonstration plots between 2016 and 2020 (~600 m²)
  - 1878 short-term (one season) demonstrations
  - 103 long-term (five consecutive seasons) demonstrations
- ISFM (treatment) versus farmers` conventional practice (control)
- Mean grain yields across all crops (mainly wheat, maize, teff, barley, sorghum and faba bean)
- ISFM:
  - Application of ≥ 3 ISFM technologies
  - Lime if soil pH < 5.5
- Comparison of means also with national statistics data
- Significance level at p > 0.05

Picture 2: Farmer between his two demonstration plots shortly before harvest. On the left the ISFM and on the right side the control plot

3. Results & Discussion

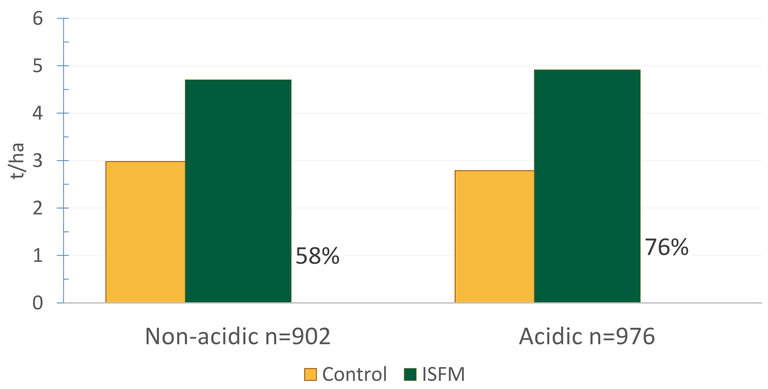
- Significant 67% mean grain yield difference (short-term) across all crops (control 2.88 t/ha, ISFM 4.81 t/ha)
- Long-term control plot grain yields declined to 2.21 t/ha while ISFM plot yields increased to 5.61 t/ha (+154%)

Graph 1: Mean long-term grain yields over time (2016 to 2020) **2020 without Tigray*



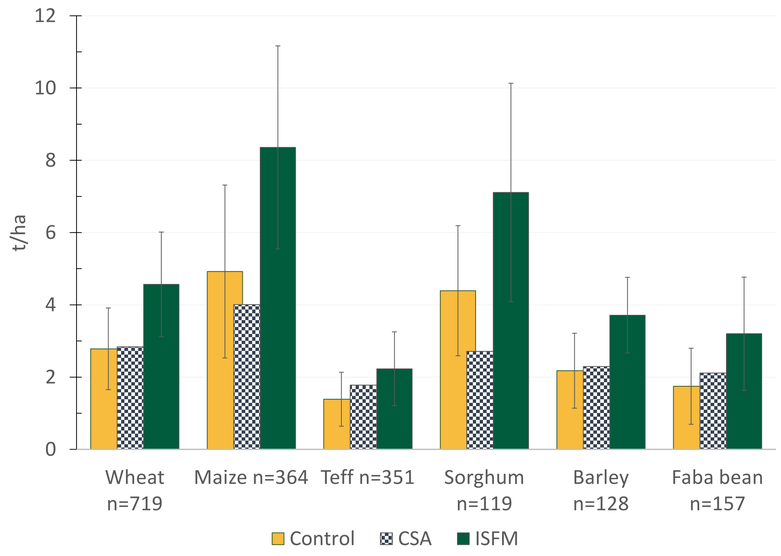
- Soil fertility is building up over the years and further increased yields (Graph 1)

Graph 2: Mean short-term grain yields on acidic and non-acidic soils (n=1878, 2016 to 2020)



- Short-term control grain yields on acidic soil were significantly lower than on non-acidic soil (Graph 2) while the controls didn't differ in the long-term
- Long-term ISFM grain yield on limed soil was significantly higher than on plots which didn`t receive lime (non-acidic)
- Acidity restrains crop yields but can be counteracted by lime. Which could also benefit not yet highly acidified soil

Graph 3: Short-term grain yields compared to the Ethiopian Central Statistics Agency (CSA) data from 2016 to 2020



- Control yields of major crops are comparable to yields reported by the national statistics agency while ISFM greatly exceeds them (Graph 3)
- Dataset is good as controls are realistic (with differences in maize and sorghum caused by lower yields in the lowlands)

4. Conclusion

- ISFM has great potential to narrow the yield gap and contribute to food security and limited imports
- Establishing a functional lime supply chain (amongst other agricultural inputs) should be prioritized
- ISFM can play a role in agroecological transformation by reducing dependency and increasing efficiency

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