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Mixed application of compost and inorganic fertilizers increases maize (*Zea mays* L.) yields, grain minerals, and nutrient use efficiency and mitigates greenhouse gas emissions in Southwestern Ethiopia

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SOILS: WHERE FOOD BEGINS

Global Symposium on Soils for Nutrition | 26-29 July 2022

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Introduction

- Sustainable crop intensification is required without affecting the soil production capacity for the next generation

- Appropriate soil nutrient management can be a strategy to balance crop production and environmental pollution

- The current nutrient management practice in Ethiopia:
  - ✓ Low amount with limited types……>>> due to this fact…..>>>
  - ✓ Low productivity, low quality and GHG emissions

- Ethiopia aimed to increase the use of mineral fertilizer to 247 kg ha^{-1} in 2030

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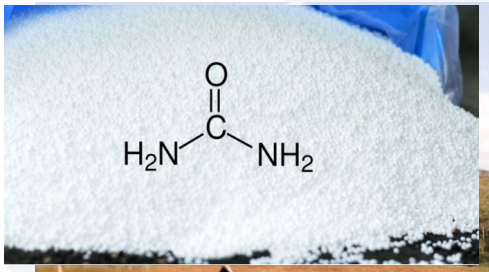
Materials and Methods



- Based on a total N supply of about 100 kg N ha^{-1}, comp and min
- 100% min, 80% min, 60% min, 50% min, 30% min, 100% comp and cont
- Lab & field experiment

- Maize data for two years
- GHG data
- Nutrient use efficiency data
- Grain mineral concentrations data

Results and Discussions

Table 3. Maize yield in two years field experiments (N= 4) (Mean ± standard error).

Treatments	1st year grain yield (Mg ha^{-1})	2nd year grain yield (Mg ha^{-1})	Average grain yield (Mg ha^{-1})
Cont.	8.5 ± 0.3^{a}	7.5 ± 0.2^{a}	8.0 ± 0.1^{a}
100 min	9.0 ± 0.1^{ab}	7.6 ± 0.2^{a}	8.3 ± 0.2^{ab}
80 min	9.0 ± 0.1^{ab}	8.1 ± 0.3^{ab}	8.6 ± 0.3^{abc}
60 min	10.4 ± 0.7^{c}	9.2 ± 0.7^{c}	9.8 ± 0.1^{d}
50 min	10.1 ± 0.2^{bc}	8.6 ± 0.2^{bc}	9.2 ± 0.3^{cd}
30 min	9.1 ± 0.2^{ab}	9.2 ± 0.3^{c}	9.3 ± 0.3^{cd}
100 comp	9.5 ± 0.4^{b}	7.6 ± 0.2^{a}	8.5 ± 0.3^{abc}

- Combined fertilizer enhance maize yield 12 to 18% in combined fertilizer compared to inorganic fertilizer application alone

Results.....

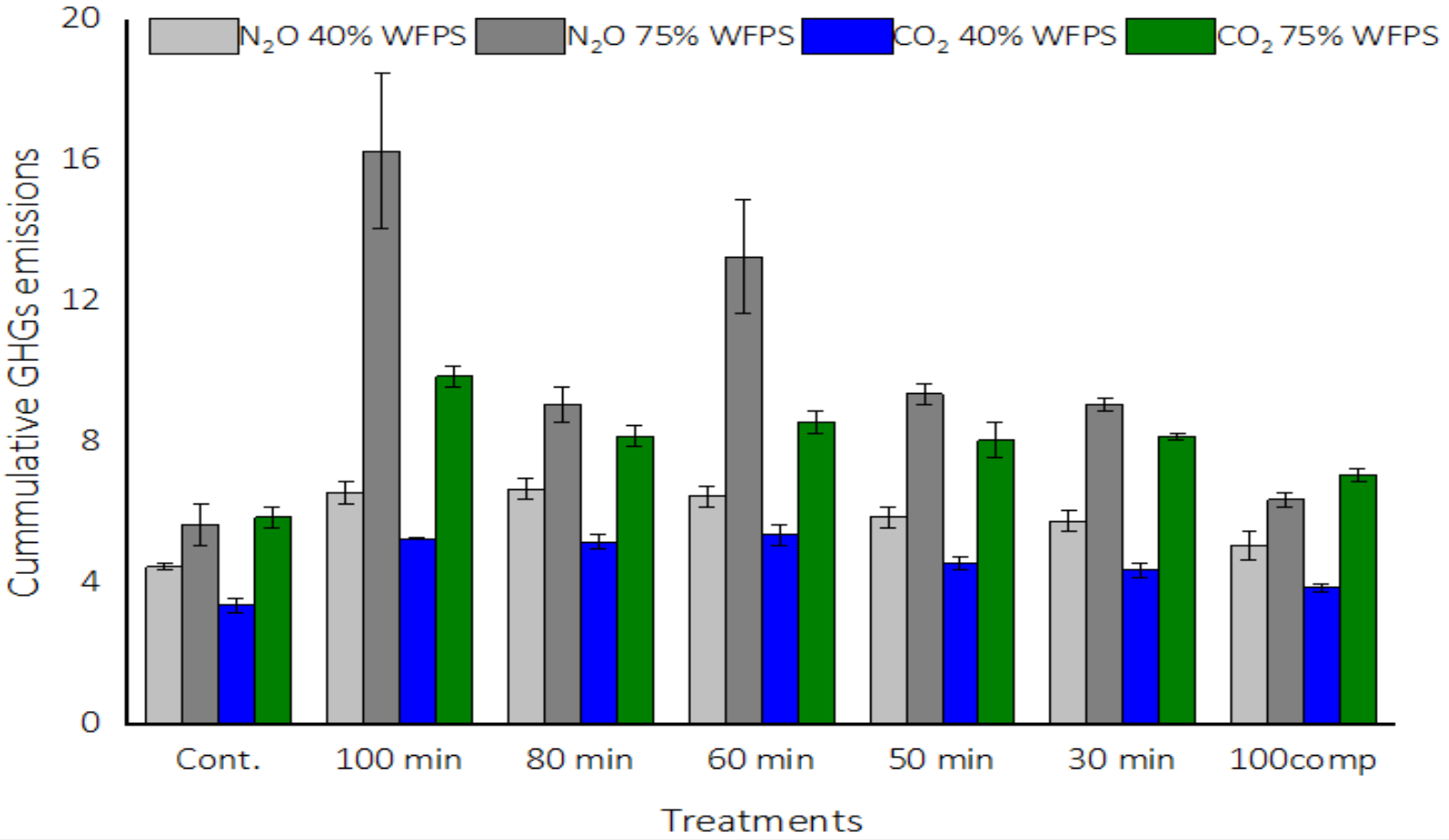
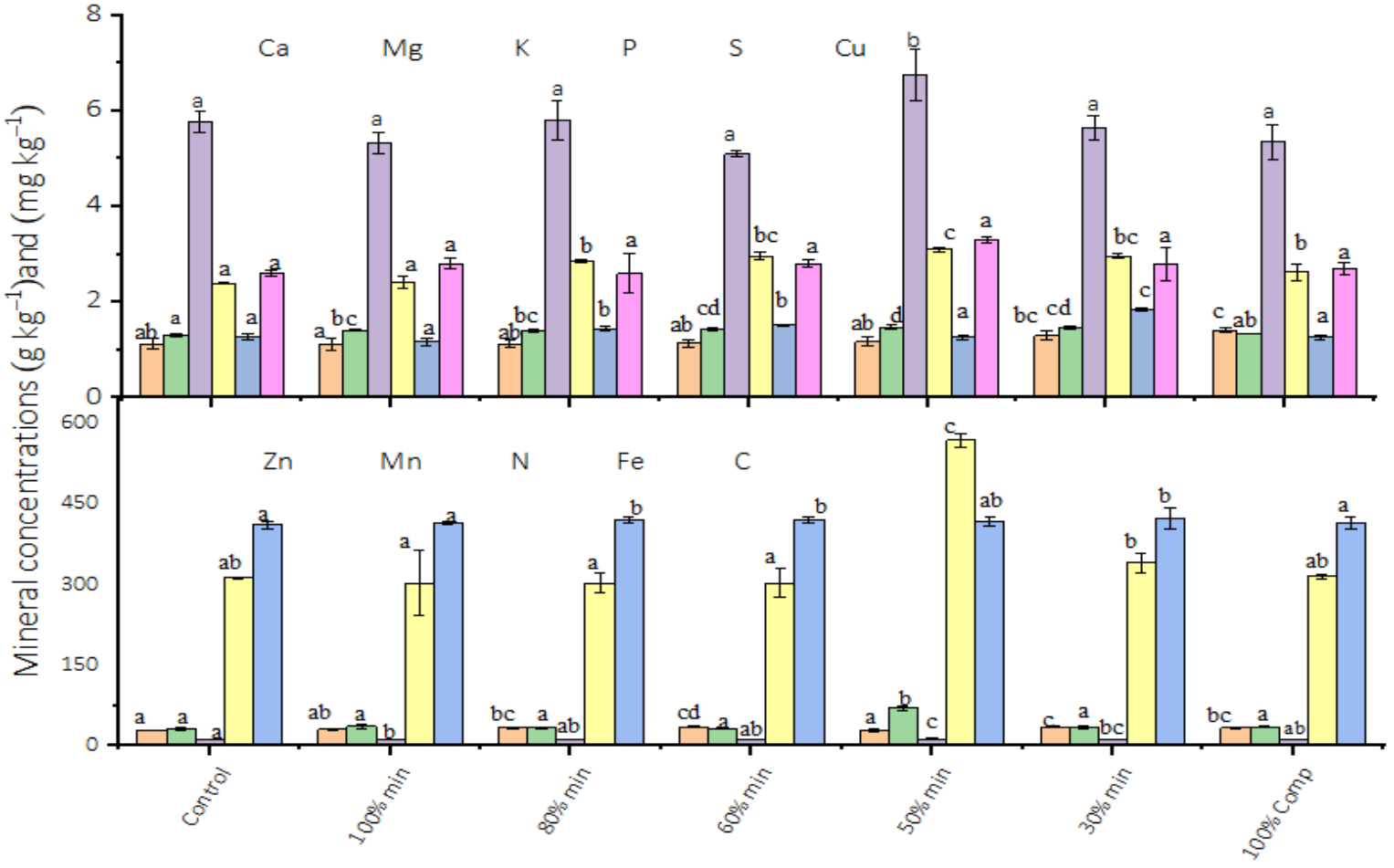


Figure: Cumulative GHGs and global warming potential

Combined application of compost and inorganic fertilizer significantly ($p < 0.05$) reduced

- emission of N_2O 22%–79.5% and
- global warming potential (GWP) by 27%–34% in comparison to inorganic fertilizer in wet soil

Results.....



Most pronounced elevations in comparison to 100% min were measured in the combined treatment. For example,

- Fe (304 vs. 570 mg kg^{-1})
- Mn (36.3 vs. 70.1 mg kg^{-1})
- Zn (32.5 vs. 40.5 mg kg^{-1})

Results.....

Treatment	NUE (%)	PUE (%)	SUE (%)
Control	–	–	–
100% min	9.6 ± 1.2^{a}	15 ± 0.7^{a}	0.2 ± 0.01^{a}
80% min	9.6 ± 0.9^{a}	20.7 ± 1.9^{a}	12.8 ± 1.2^{b}
60% min	14.4 ± 0.8^{b}	45 ± 2.6^{b}	17.2 ± 1.5^{bc}
50% min	20.3 ± 1.4^{c}	38.6 ± 2.4^{b}	21.1 ± 2.7^{c}
30% min	18.9 ± 1.1^{c}	42.4 ± 2.3^{b}	38.4 ± 2.5^{d}
100% COMP	9.3 ± 0.7^{a}	121.4 ± 3.6^{c}	0.7 ± 0.01^{a}

Combined application increased:

- >>NUE by 10% than 100% min.
- 100% comp resulted in about 106% higher PUE than 100% min.
- 10-40% higher SUE compared to 100% min.

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Conclution

- 30 kg N or 50 kg N in combination with compost of 4.9 and 3.5 t ha^{-1} would be a promising option in Nitisol:
  - ✓to reduce GHG emission without altering maize crop yield and
  - ✓increasing nutritional quality and NUE of maize in smallholder farming system

Acknowledgments

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Thank you !

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