Residue fact sheets for energetic and material use of agricultural crop residues in Ethiopia

Fabian-Constantin Sittaro[1], Sophia Bothe[2], Jonas Hoffmann[3], Max Hörügel[3], Friederike Naegeli de Torres[1]

ETH-SOIL

Introduction

- Agricultural challenges in southwest Ethiopia: Deteriorating soil fertility, erratic rainfall, soil erosion
- Project aims to utilize residual biomass in pyrolysis, biogas, and composting plants to produce organic fertilizer
- Potential for energy and material usage from agricultural crop residues, concurrent use as animal feed or fuel
- Comprehensive data on residue availability and its energetic and material potential is lacking
- Development of residue fact sheets for 13 major crops
- Equips policymakers, researchers and local businesses

Figure 1 and 2: Above: Harvest of Sorghum cobs, Below: Bundled teff straw

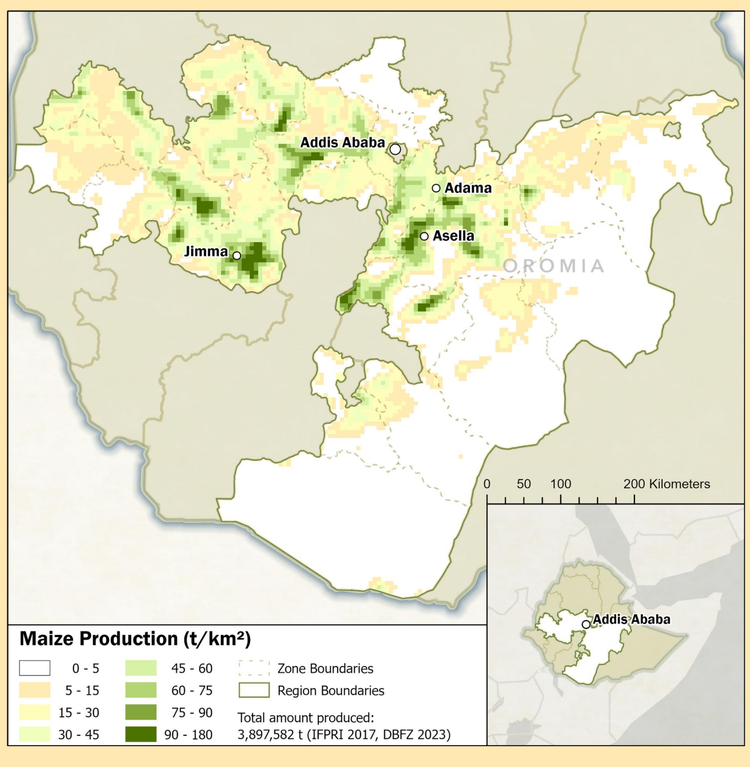
Methods

- Quantification of crop yields using IFPRI's spatial production allocation model (resolution: 5 arcsec)
- Utilizing a global harvested area extent dataset (resolution: 3 arcsec) from 2023 to ensure a more recent representation of crop distribution
- Bilinear resampling to harmonize the resolution of yield and harvested area data
- Multiplying aligned raster datasets to quantify annual crop production
- Production data multiplied with crop-specific residue-to-crop ratios indicates the estimated quantities of residues during harvest

Maize Crop *Zea mays*

harvest time	from september
residues	straw, cobs, husks
amount of production	3,897,582 t

Maize is a widespread crop in Ethiopia. Its high biomass production and versatile residues make it attractive for cultivation. Maize also plays a central role in Ethiopia's food security and is the most commonly grown cereal alongside wheat and teff.



Straw Maize

Quantity[1]	Residue Factor
3,707,990	0.7 - 1
Dry Matter (%)	**Methane Potential[2]**
86	0.345
Heat Value[3]	**C/N**
16.10	80/1
Energetic Use	**Material Use**
biogas from anaerobic digestion	soil structure improvement, fertilizer, animal feed, soil cover

1=(metric tones/a); 2=(m^3CH4/kg TS); 3=MJ/Kg

Cobs Maize

Quantity[1]	Residue Factor
4,456,620	0.2 - 0.86
Dry Matter (%)	**Methane Potential[2]**
74	0.348
Heat Value[3]	**C/N**
17.13	93/1
Energetic Use	**Material Use**
heating pellets, biogas from anaerobic digestion	construction material, inert grits as blasting media in the metalworking sector

1=(metric tones/a); 2=(m^3CH4/kg TS); 3=MJ/Kg

Husks Maize

Quantity[1]	Residue Factor
1,010,770	0.2 - 0.3
Dry Matter (%)	**Methane Potential[2]**
64	0.238
Heat Value[3]	**C/N**
16.39	59/1
Energetic Use	**Material Use**
pyrolysis, pellets for heating, feedstock	biofuel, fertilizer, infestation protection, food and plates

1=(metric tones/a); 2=(m^3CH4/kg TS); 3=MJ/Kg

Figure 3: Front and back side of maize crop residue fact sheet

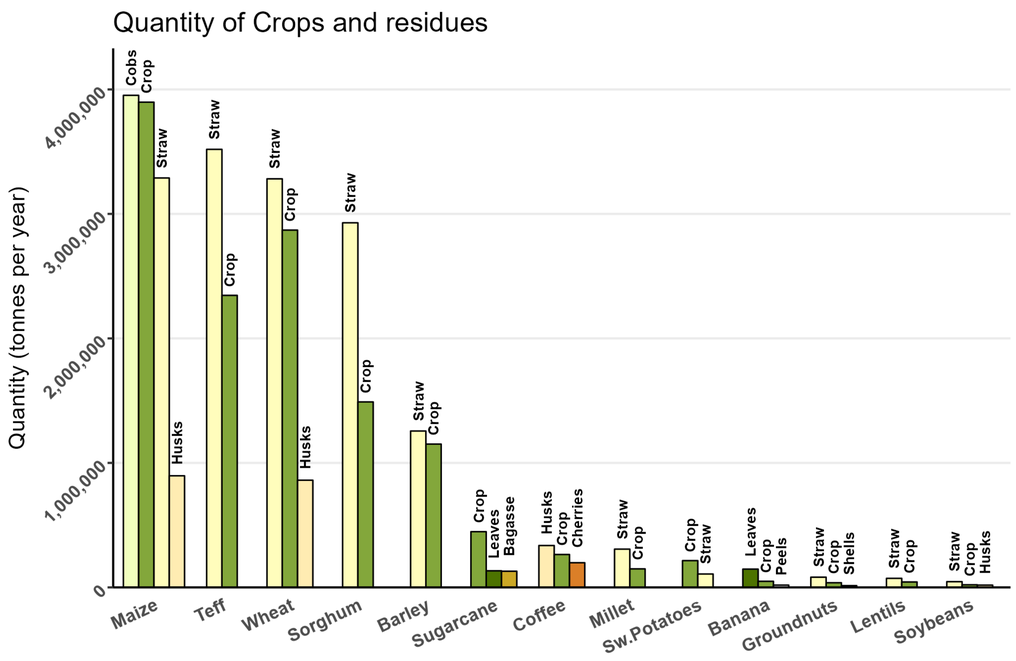


Figure 4: Quantity of crops and residues (in tonnes per year) in Oromia, Ethiopia.

Highlights

- 25 agricultural residues of 13 plants are mapped
- Residues can contribute to a variety of material and energetic use cases
- Spatial and temporal availability of residues is highly crop-specific
- Estimation of biochemical parameters is sufficient for assessment of energy yields
- Price fluctuations still pose challenges for business developments in bioenergy applications

DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
Torgauer Straße 116 | 04347 Leipzig | www.dbfz.de
Contact: Fabian-Constantin Sittaro | fabian.sittaro@dbfz.de

[1] Bioenergy Systems Department, Working Group Resources
[2] Bioenergy Systems Department, Working Group Applied Sustainability Assessment
[3] Bioenergy Systems Department, Working Group Mobilisation

Im Auftrag des
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