Despite significant **internal resource use**, agroecological farms in Southern Brazil still depend on external organic fertilisers, suggesting a **minimal substitution effect**.

Energy analysis of smallholding farms in Southern Brazil: an agroecological approach

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Introduction

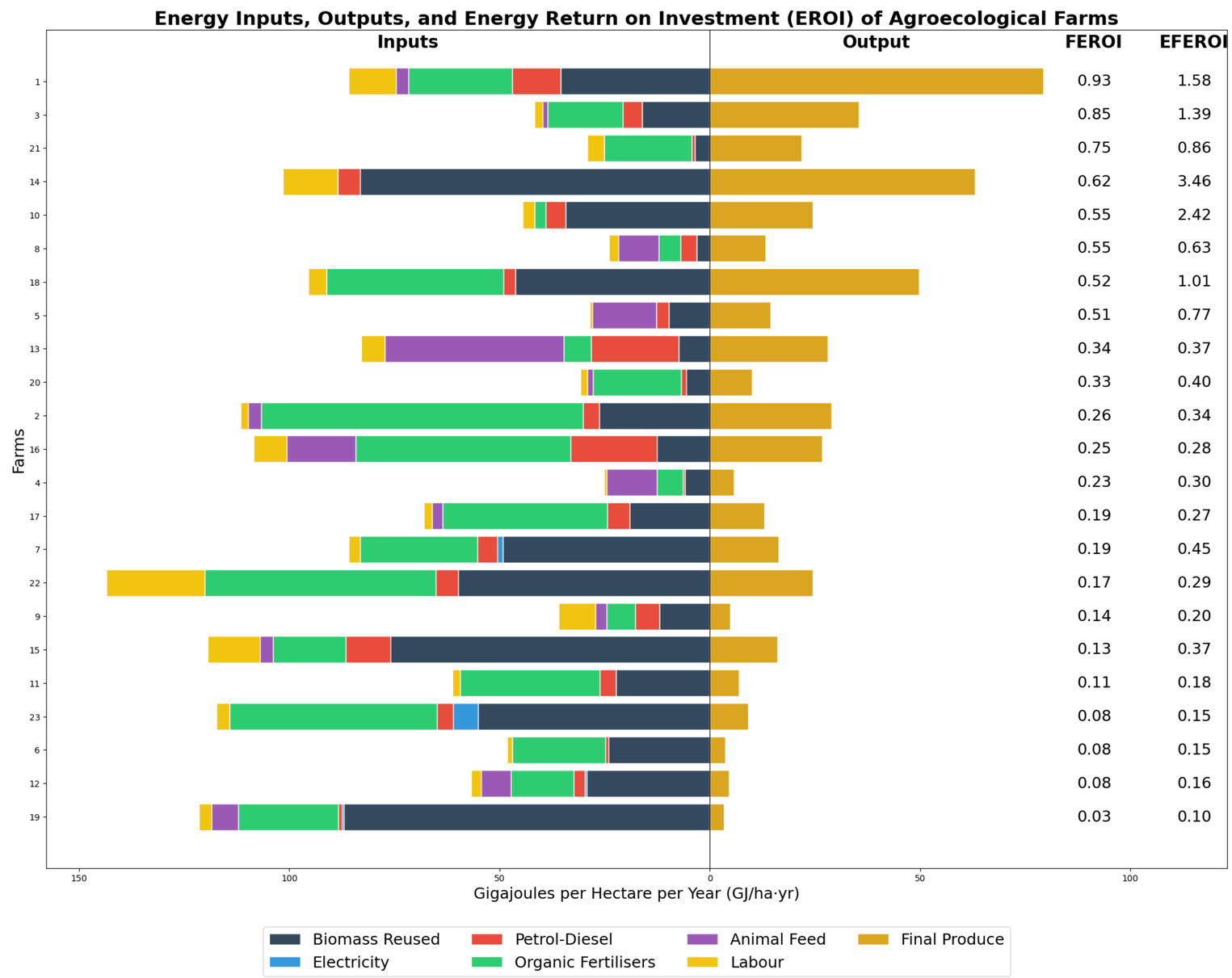
- Agriculture heavily depends on fossil fuel-based inputs, which contribute to environmental degradation and economic vulnerability.
- In Brazil, agroecological practices like recycling internal resources, such as farm-produced organic fertilisers and fodder, can reduce reliance on external inputs, but require more labour, which can affect the Energy Return on Investment (EROI).
- This study examines how internal resource cycling impacts external input reduction and EROI outcomes in agroecological farms in Southern Brazil.

Data and Methods

- Instrumental case study design
- Data: 23 organic horticultural and mixed crop-livestock smallholdings, all members of the Ecovida Agroecology Network in Santa Catarina, Brazil
- Average farm size: 4.78 hectares
- Data analysis method: Agroecological Energy Analysis (based on Tello et al., 2015; Guzmán Casado and González de Molina, 2017)

Results

- Biomass reuse and external organic fertilisers are the main inputs for most farms.
- Final EROI and External Final EROI are generally low (below 0.6).
- Farms with higher labour input per hectare tend to reuse more biomass.
- Low petrol-diesel consumption indicates minimal mechanisation and reduced reliance on fossil fuels.



Note 1: Biomass Reused refers to resources generated and used on the farm, such as green manure and crop by-products (e.g., leaves, stems, straws) used as organic fertilisers and animal feed.

Note 2: Output refers to land produce (e.g., fresh fruits, vegetables, spices, legumes, cereals) and barnyard produce (e.g., meat, eggs, milk, honey) intended for surplus or self-supply.

Note 3: Final EROI (Final Energy Return on Investment) is the ratio of resulting energy (output) to the total energy invested, including external inputs, reused biomass, and labour. A higher EROI indicates a more energy-efficient system.

Note 4: External Final EROI (EFEROI) is the ratio of resulting energy (output) to the external energy invested, excluding reused biomass. A higher EFEROI indicates less reliance on external inputs and more self-sufficiency.

Discussion

- The substitution effect is minimal, as external organic fertilisers remain essential, likely due to certification requirements or labour constraints.
- Biomass reuse has a limited impact on EROI, which is mainly linked to produce per hectare. Low-energy-content products, such as fruits and vegetables, can distort energy returns.
- Variability in the results suggests that factors such as crop types, certification standards, and market access may better explain differences in internal resource use and EROI outcomes.

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Acknowledgements

Financial support from the Institute of Agricultural Policy and Market Research (JLU Gießen), SDGnexus Network (grant no. 57526248), Foundation Fiat Panis, and the German Academic Exchange Service (DAAD, contract no. P1401273) is gratefully acknowledged.

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SDG nexus network

Foundation fiat panis

IPPAE International PhD Program – Agricultural Economics, Bioeconomy and Rural Development

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