Whole-Farm Life Cycle Assessment during Transition to Organic and Low-Input Practices

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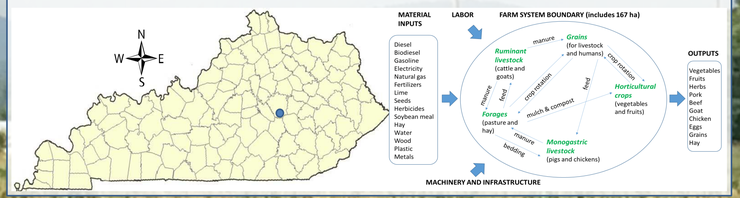
BEREA COLLEGE FARM

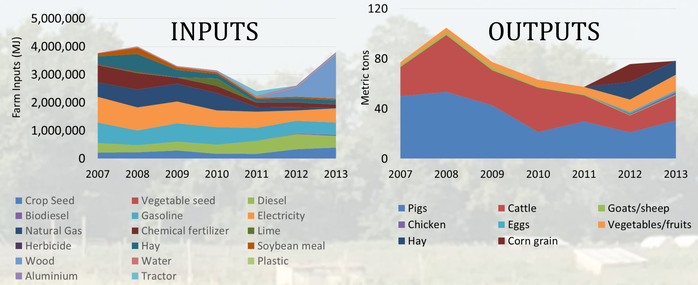
THE FARM

The **Berea College Farm** – the subject of this analysis – operates as an educational laboratory, providing students with opportunities to learn practical skills while testing and demonstrating appropriate methods for sustainable food production in the region. It is the oldest continuously-operating student farm in the US and includes forage and pasture crops, ruminant and monogastric livestock, grains, fruits and vegetables. Students are involved in all aspects of the daily farm operations and play managerial as well as labor roles.



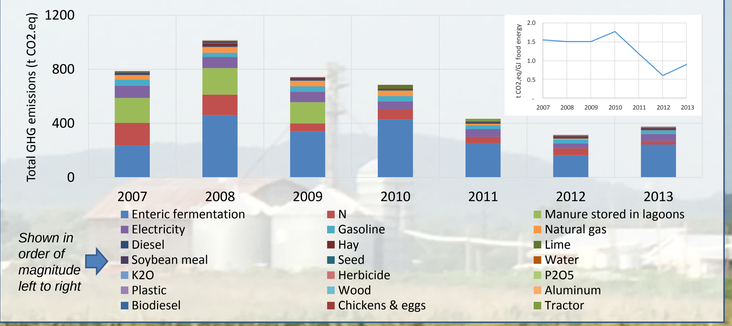
PRODUCTION

The use of many farm inputs, including purchased feed, fertilizer, natural gas and electricity, declined while production shifted toward more plant products (vegetables, grains and hay) to replace decreasing pork and beef production.



GREENHOUSE GAS EMISSIONS

Whole-farm GHG emissions declined during the study as did emissions per unit of output, measured as t CO2,eq/GJ food-energy-output (graph insert below).



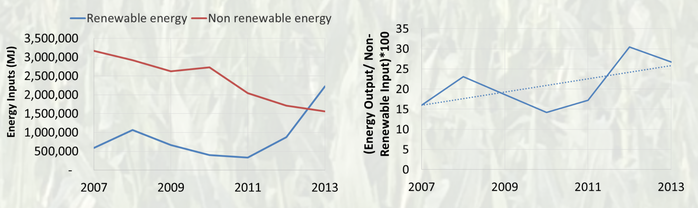
INITIATIVES

Management changes were put into place in 2009-11 to improve the farm's economic performance and reduce negative environmental impacts (Clark, 2014). By reducing inputs - particularly fertilizers, pesticides, fossil fuels, and livestock feeds and supplements – it was assumed that financial savings would accrue, third-party certifications such as 'USDA Organic' would lead to greater net income, and negative environmental impacts could be minimized.

Organic horticulture and grain production were expanded, cattle were transitioned from grain- to grass-finishing, hogs were moved outside and rotated, and the use of renewable fuels, such as biodiesel and wood, was adopted to replace diesel and natural gas.

ENERGY

Non-renewable energy consumption steadily declined throughout the study period – largely due to use of less fertilizer, natural gas, electricity and gasoline – and the greater use of renewable inputs, particularly after 2011. As a result, efficiency, measured as the energy output per unit of non-renewable energy input, showed a positive trend (Clark et al., 2015).



CONCLUSIONS

The farm's dependence on non-renewable energy sources declined as a result of the management initiatives. GHG emissions declined, largely due to a shift from indoor to outdoor hog production, a reduction in N fertilizer use as more land was managed organically, and production of fewer total livestock and more plant products. As a result, GHG emissions per unit of food-energy-output declined.

Future work should include:

- Improving the **efficiency of wood fuel use** in greenhouse production.
- Ramping up **biodiesel** production and use in the tractors and combine.
- Refining outdoor **poultry and egg production** to improve efficiency and minimize losses.
- Breaking down this analysis further to address **individual product supply and value chains**, especially beef and pork.
- Addressing the more complex value chains with the opening of the college **farm store** to include **post-farm-gate processing and storage** before sales.

MORE INFO

Farm Store website: http://www.bereacollegefarmstore.com
Agriculture and Natural Resources Program: http://www.berea.edu/anr/
Facebook: https://www.facebook.com/bereacollegefarm
Sayre, L. and S. Clark (Eds.). 2011. *Fields of Learning: The Student Farm Movement in North America*. University Press of Kentucky, Lexington. 378 p. (ISBN 978-0-8131-3374-4).

REFERENCES CITED

Clark, S. 2014. Resource-use and partial-budget analysis of a transition to reduced-input and organic practices and direct marketing: a student-farm case study. *Journal of Agriculture, Food Systems, and Community Development* 4:113-130.

Clark, S., B. Khoshnevisan, and P. Sefeedpari. 2015. Energy efficiency and greenhouse gas emissions during transition to organic and reduced-input practices: Student farm case study. *Agricultural Systems* (manuscript in review).

ACKNOWLEGEMENTS

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