Optimizing Biogas Production from Anaerobic Digestion of Feedlot Manure

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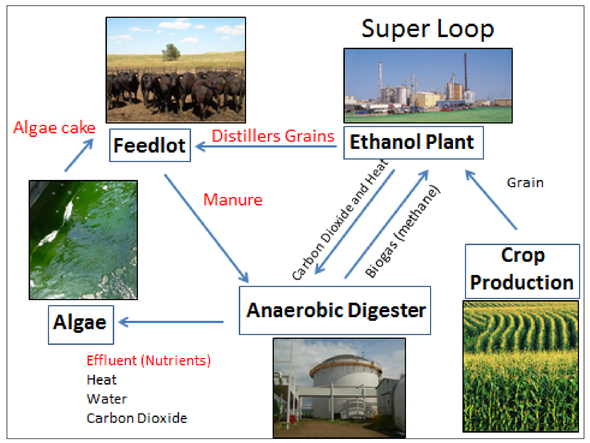
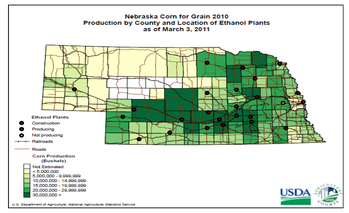
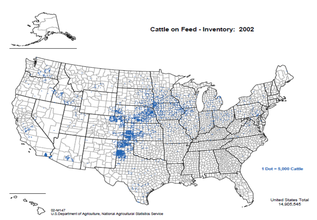
Introduction



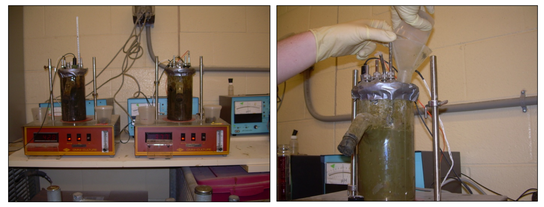




Trial 1 Seven, 1 L anaerobic digesters

Trial 2 Ten, 45 L anaerobic digesters

algae production



Cattle Diets:

Control	WDGS
82.5% DRC	47.5% DRC
5% Molasses	40% WDGS
7.5% Alfalfa	7.5% Alfalfa
5% Supplement	5% Supplement
0.986% Urea	

Inorganic settling and ash removal

Trial 3

Ten, 45 L anaerobic digesters

Cattle Housing:

Slatted floor barn	65% OM
Cement pad	40% OM
Soil surface of pen	15% OM

Current 5,000 gallon anaerobic digester and 1/10 acre algae production

Construction site

August 2013 March 2014

Individual feeding barn; cement slats

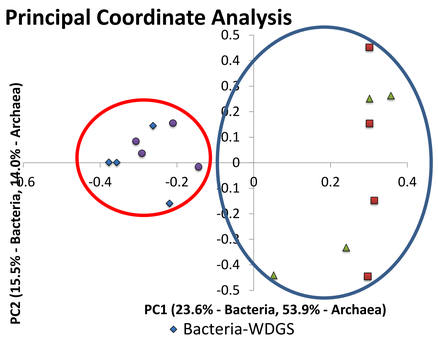
Manure collection in settling basin

Results

Trial 1 and 2: Effects of cattle diet

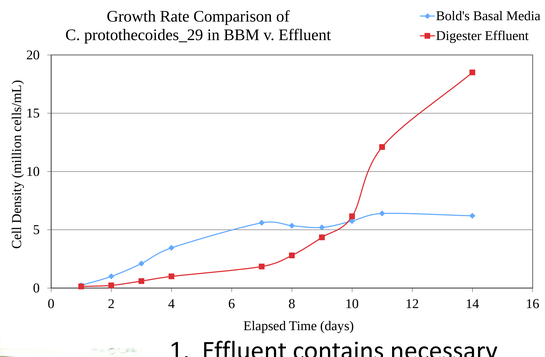
Trial 3: Effects of cattle housing

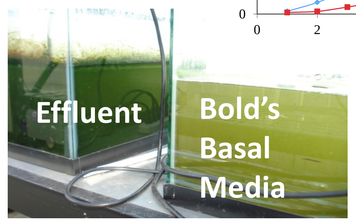
	CONT	WDGS	SEM	*P*-value	15% OM	40% OM	65% OM	*P*-value
Organic Matter Digestibility, %	51.0	52.9	1.14	0.10	54.1^{a}	56.5^{ab}	63.2^{b}	0.049
Methane, L / L digester daily	0.551	0.634	0.05	0.10	0.425^{a}	0.501^{ab}	0.589^{b}	< 0.01
Methane, L / g OM fed	0.116	0.137	0.01	0.05	0.139^{a}	0.167^{b}	0.187^{b}	0.02



Sequencing and Isolating methanogens

1. Who is there?
2. What role do they play?
3. Interactions?





1. Effluent contains necessary nutrients for algae growth
2. Algae can outcompete contaminants within effluent
3. Chlorella strains do well

Conclusions

1. Dietary changes can lead to changes in manure OM composition and microbial community composition
2. These changes provide opportunities to alter methane production from cattle manure
3. Algae can be economically grown on nutrients provided by effluent from digesters
4. Open lot manure can be used as anaerobic digester feedstock if ash buildup is avoided
5. These findings support the addition of anaerobic digestion and algae production as revenue streams to existing feedlot industry in Nebraska

Publications and Other Grants

N. Kobayashi. 2013. Bioresource Technology 150:377-386.

A. Watson. 2013. Nebr. Beef Cattle Report 98-A:98-99.

The Nebraska Environmental Trust "preserving NATURAL NEBRASKA™ for future generations"

Nebraska Environmental Trust Fund. Integrated Anaerobic Digestion with Algae Bioenergy.