Tomatoes from Tomatoes

Using the Effluent of Anaerobically Digested Tomatoes to Fertilize Tomato Plants

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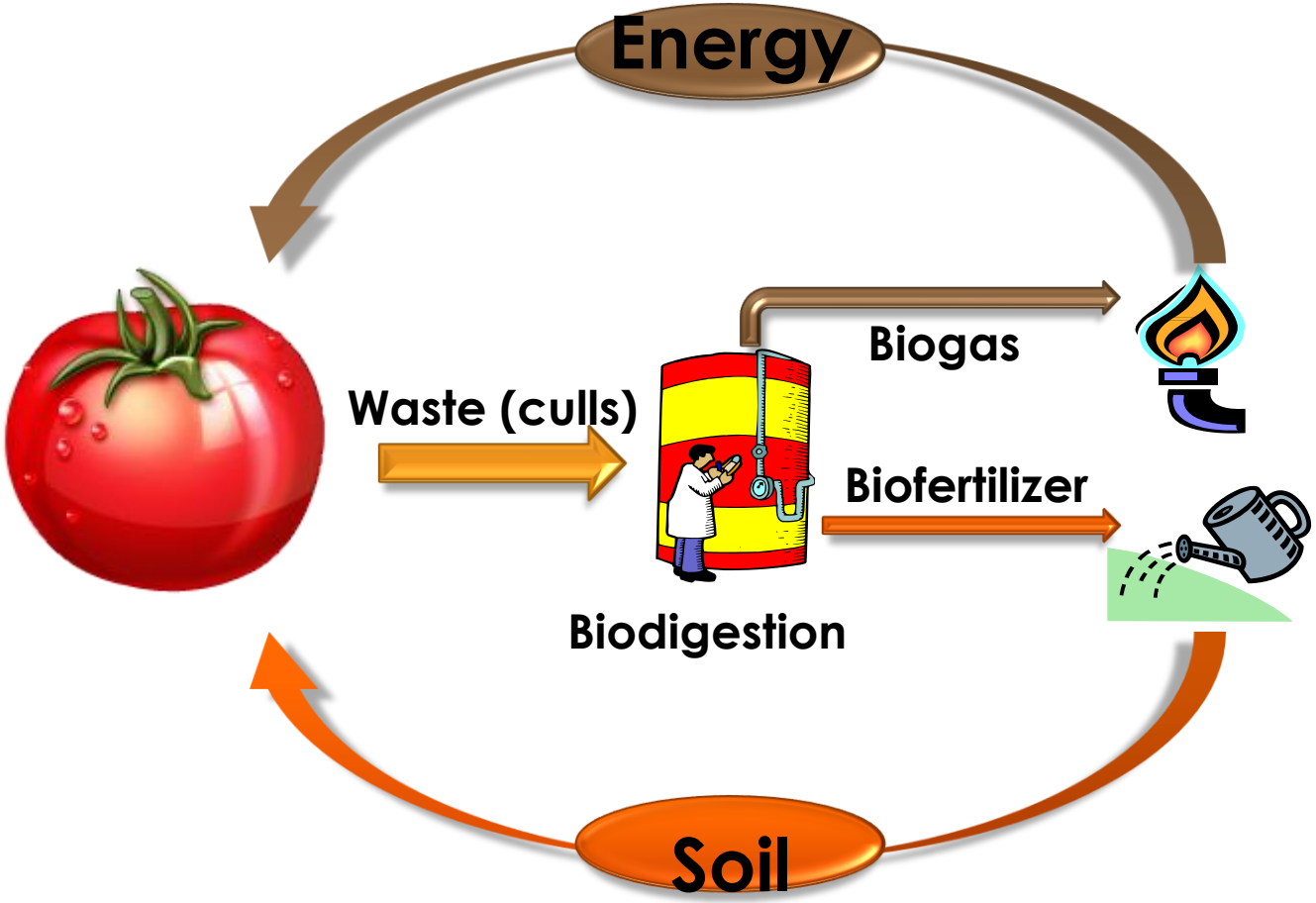
Outline

- Introduction to anaerobic digestion
- Problem
- Objectives
- Method
- Results
- Areas for further study
- Implications to overall sustainability

Anaerobic Digestion

- Microbes break down biodegradable materials in a non-oxygen environment
- Forms methane and other gases which can be used for energy
- Manages waste
- Effluent, or digestate, is another product of this process. It is often thought to be a possible biofertilizer.


Energy
Biogas
Waste (culls)
Biofertilizer
Biodigestion
Soil

Problem

Can anaerobically digested tomato culls be used to grow tomatoes?

Objectives

- To determine if anaerobically digested tomato effluent can be used as an effective substitute fertilizer for tomatoes (compared with NPK and organic fertilizers)
- To determine an effective rate of application for effluent from anaerobically digested tomatoes

Method

- 400 mL BMP bottles (15) were filled with effluent from an anaerobic digester at the BEST Lab and filled with 2 g COD/L of tomato culls (14.41 grams tomato culls)
- The 16th bottle was filled with only effluent and served as a blank for testing


accumet


accumet

Methods (cont)

- Three BMP bottles were tested at random for ammonia content. The average concentration of the three was 533 ppm.
- The amount of effluent needed for each treatment was calculated and then diluted to 250 ppm with tap water
- The plants were fertilized, and each plant was watered 250 mL every day (except when it rained)

Methods (cont)

- A soil substitute was created using peat moss and perlite. For every kg of peat moss, 200 g of perlite was used.
- Pepper plants were substituted for the tomato plants in this experiment as pepper plants are better adapted to Florida's summer climate.
- The pepper plants were transplanted to 1 gallon pots and fertilizer was applied six days later


Helps Prevent
Soil Contamination!
OXIDIZER
5.1
MAJESTIC EARTH


ADE R1 1
ADE R1 2
C1
C2
FE 3
ADE R3 1
ADE R1 3

Methods (cont)

Five Treatments

- Synthetic NPK fertilizer: Miracle-Gro
- Organic fertilizer: Fish emulsion
- Anaerobically digested tomatoes:

  Three rates of application:
  - Low: 10 kg N/ha
  - Medium: 20 kg N/ha
  - High: 30 kg N/ha

  The NPK and organic fertilizer were each applied at 20 kg N/ha

Methods (cont)

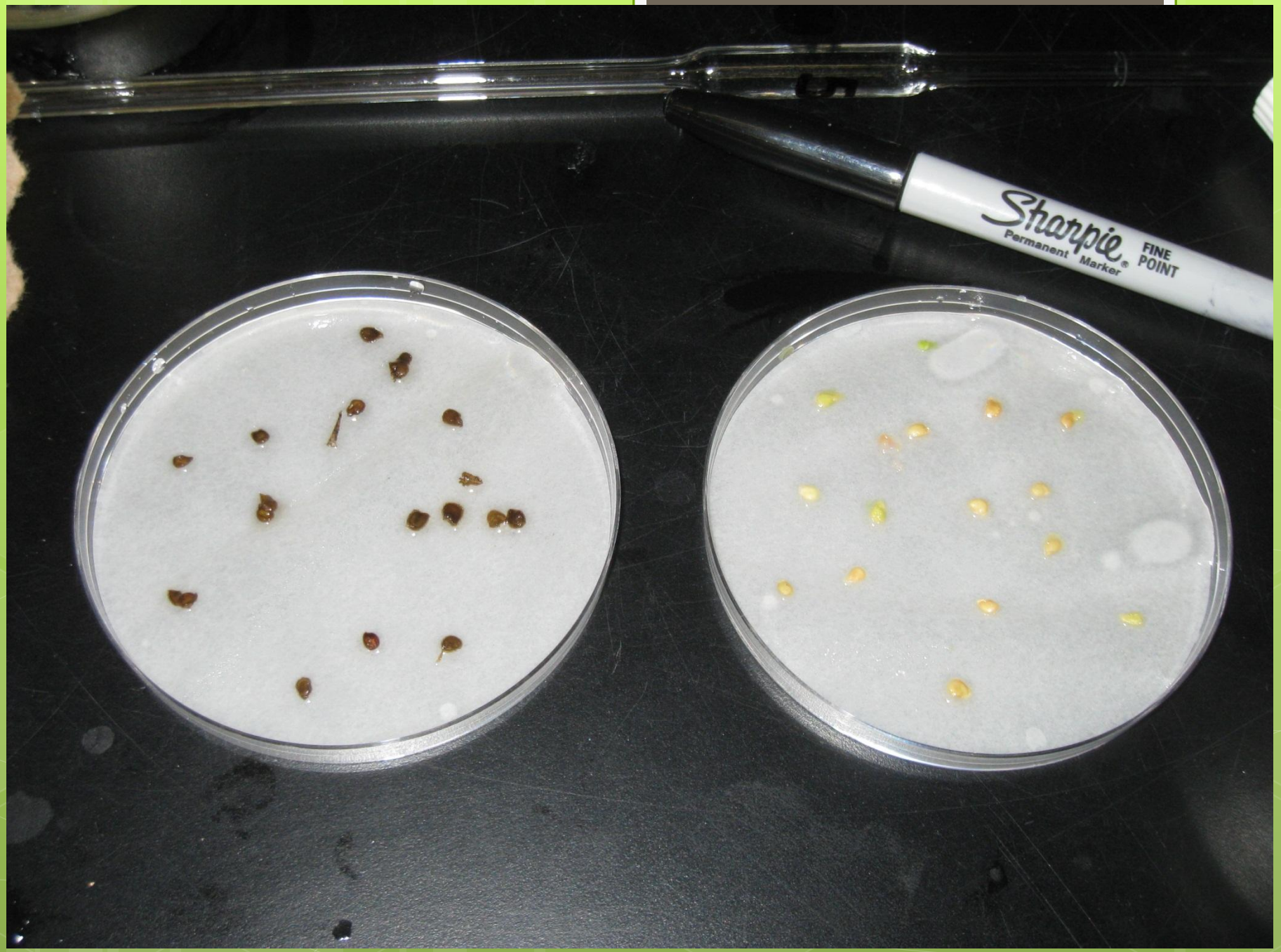
- Each plant was measured every three days and the leaves were counted. Ultimately, the leaf data was collected but not used in the analysis.
- A seed germination test was conducted to determine the viability of tomato seeds post-anaerobic digestion

Results (cont)

Treatment	Average Cumulative Height Change (cm)	Standard Deviation
Control	2.00	1.32
MiracleGro	4.00	3.04
Fish Emulsion	4.17	2.93
ADE Rate 1	3.67	0.76
ADE Rate 2	6.50	4.00
ADE Rate 3	5.33	0.29

Results (cont)

	Dish 1	Dish 2	Total % Germinated
Fresh Seeds	8	9	56.67
Frozen Seeds	0	0	0
Anaerobically Digested Seeds	0	0	0


Sharpie
Permanent Marker
FINE POINT

Implications of the Seed Germination Test

- Only the fresh seeds germinated.
- The post-anaerobic digestion seeds did not germinate, so if effluent of anaerobically digested tomatoes were used as a fertilizer, unwanted plants would not sprout.
- Tomato processors have previously been unable to flush tomato waste because of seed germination
- If processors were unable to use the effluent as fertilizer, they might have the option of flushing their effluent, as the seeds would not germinate

Areas for Further Study

- Nutrient testing: Test effluent for phosphorus and potassium, as it may needs supplements
- Measuring plant growth at the end of experiment by measuring total biomass
- Use effluent from a digester that continuously digests tomato culls
- Larger-scale growth experiment
  - more plants per treatment
  - longer time frame with multiple treatment applications

Implications for Sustainability

- There is potential for the effluent of anaerobically digested tomato culls to be used as a fertilizer for tomato plants
- Effluent quality is dependent upon the feedstock, there could be high variability between batches of effluent fertilizer, so nutrient testing must occur before use.
- Tomato culls as a feedstock could yield more continuous nutrient content.
- If effluent were developed as a fertilizer, the tomato industry could become a closed-loop system

Questions/Comments?