EAGLE GREEN ENERGY

A Case Study of ***BRINSON FARMS LLC*** Poultry Broiler Farm energy efficiency with poultry manure waste, biomass and solar technology.

Rock-water feature at Farm Entrance, Solar powered office in background

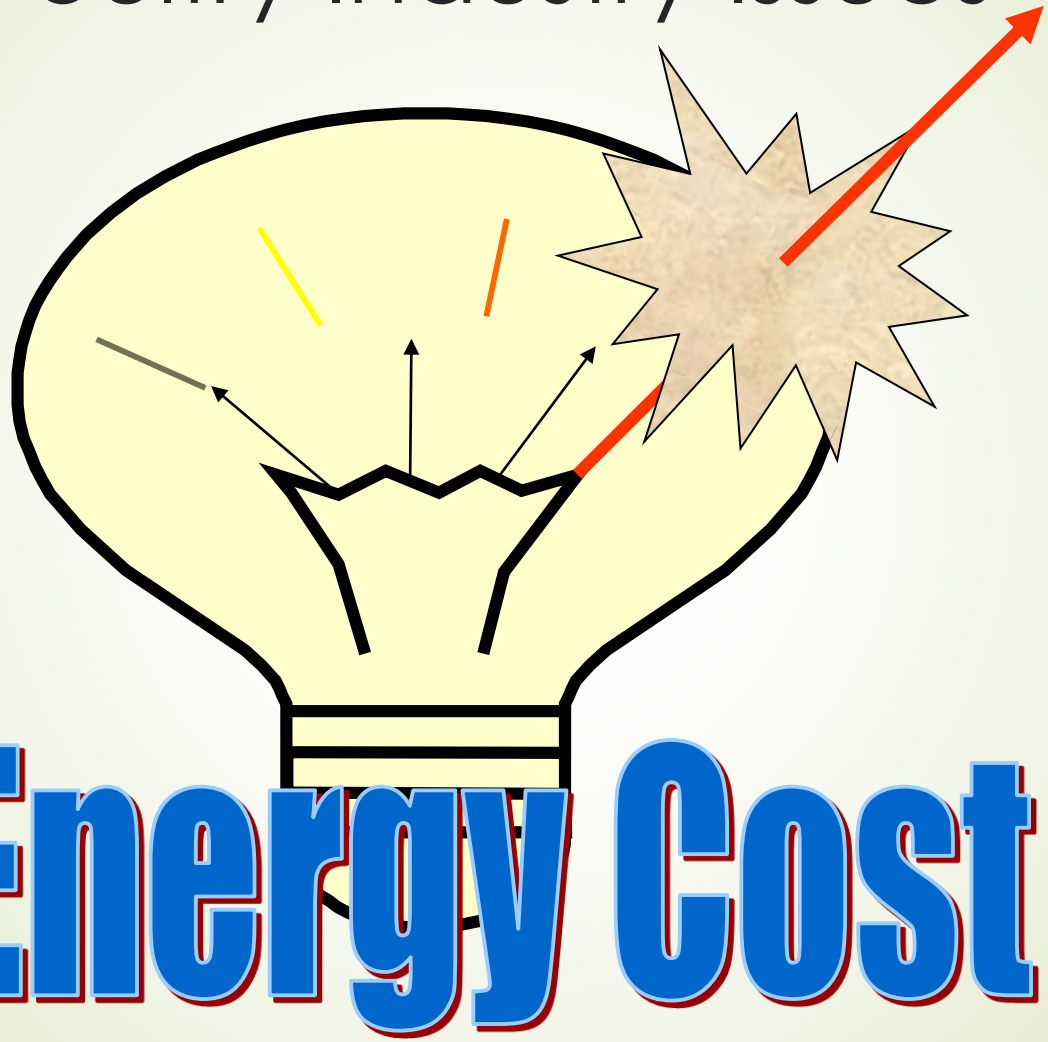
Objectives

- Effectively and Economically reduce energy cost.
- Demonstrate the use of Chicken Manure as a superior biomass fuel.
- Test different types of biomass fuels.
- Demonstrate integrated passive solar heating components.

Introduction to Brinson Farms

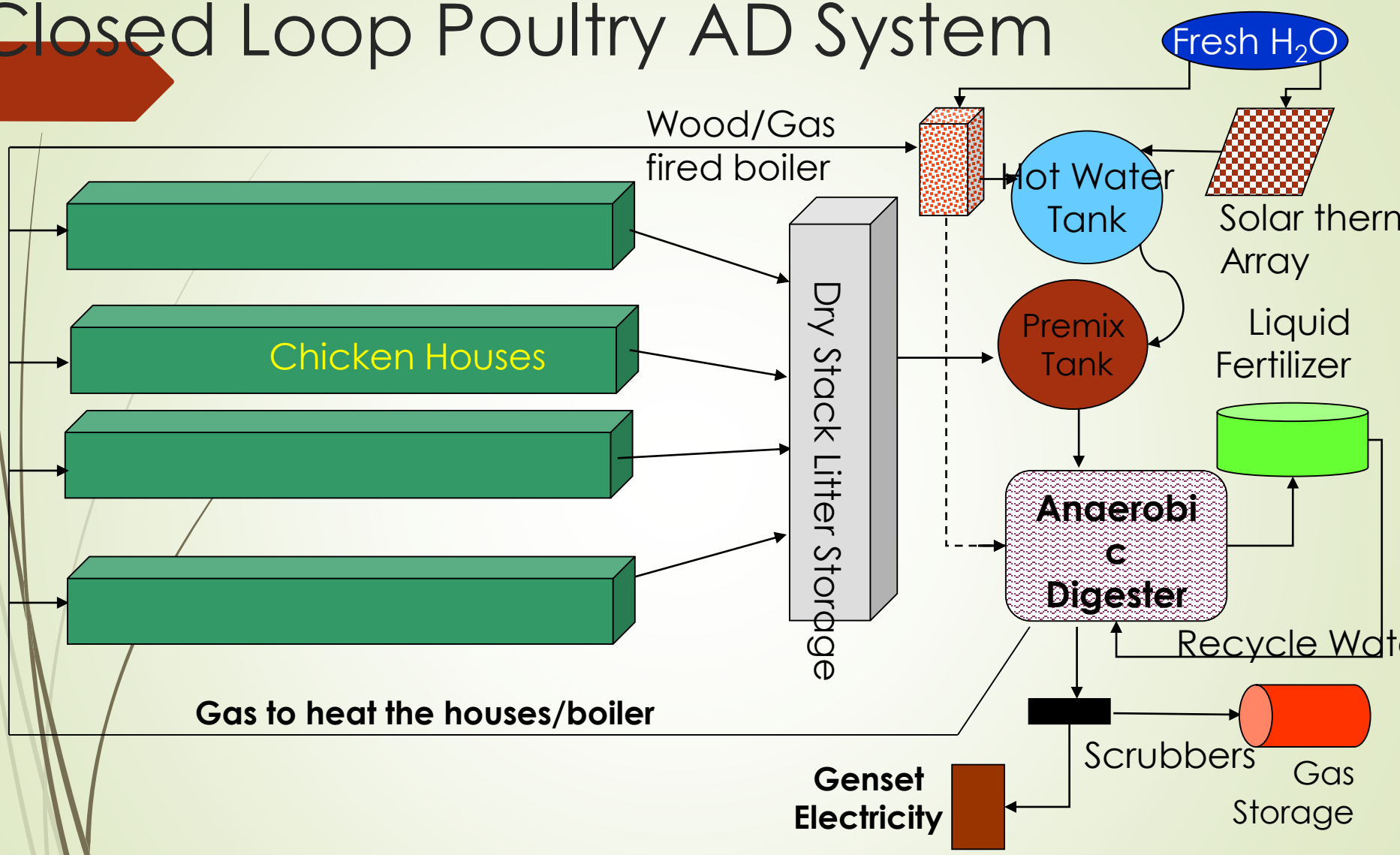
- Poultry, cattle, and timber farm located in Jeff-Davis county MS.
- Winner of several environmental stewardship awards.
- Began researching means of reducing utility dependency in 2003.
- Developed/operates patented anaerobic digester to reduce energy consumption.

Poultry Industry Issues



Brinson Farm Digester Complex

Closed Loop Poultry AD System



AD Technology proved on dairy and swine farms worldwide and experimental poultry unit operational for four years in the US.

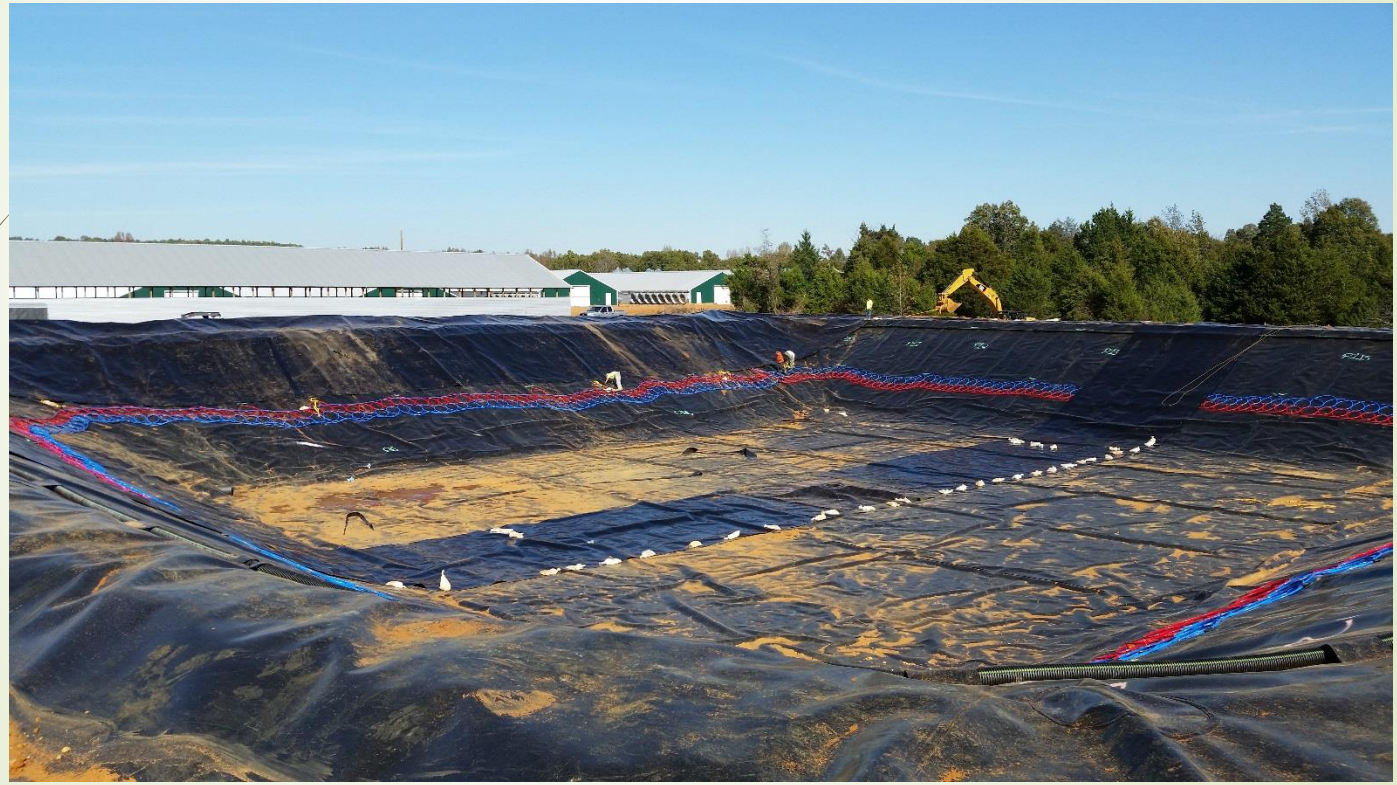
Energy found in this product
8 times stronger than dairy &
5 times stronger than swine.

System Overview & Requirements

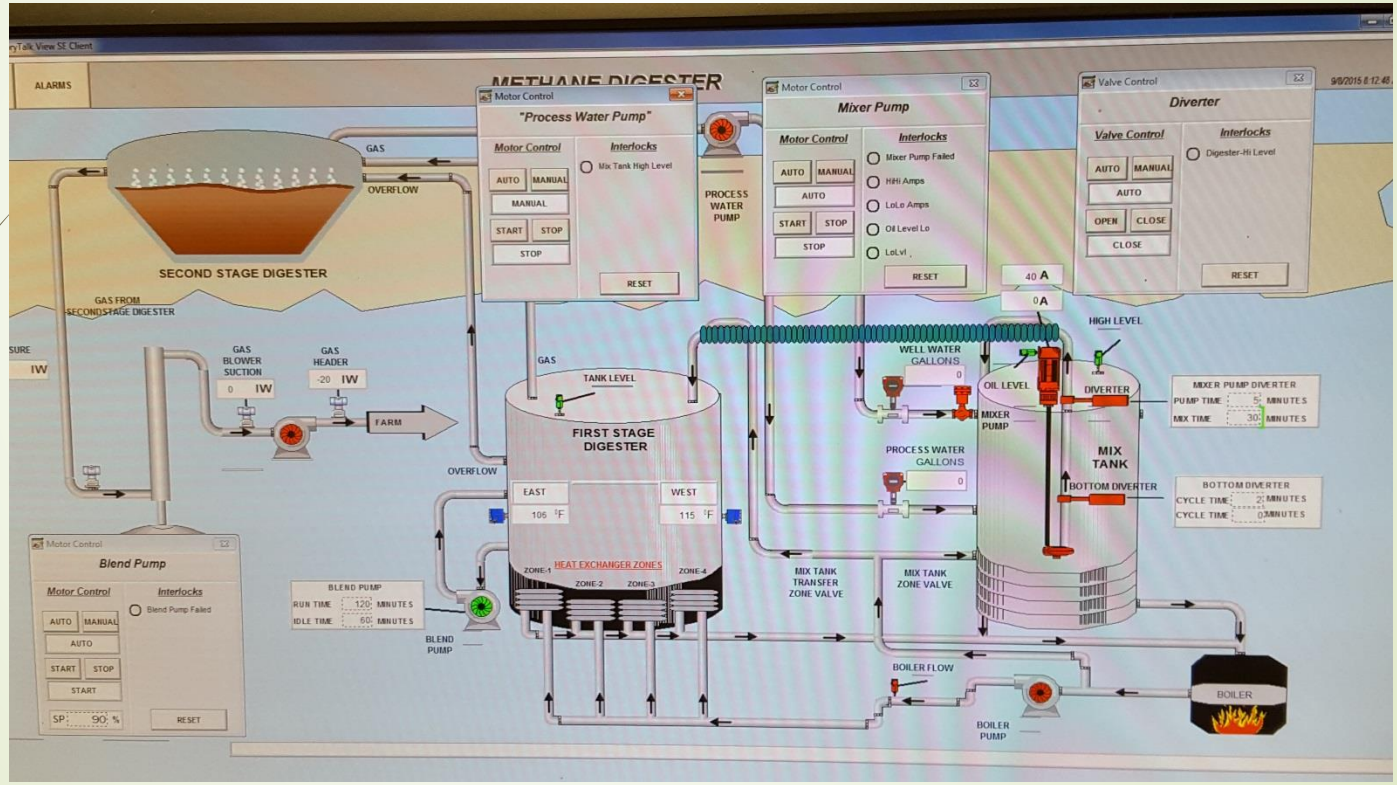
- Capable of reducing the farm's utility expenses by over 60% with a goal of 100%
- Achieve the greatest biogas production possible through true energy efficiency, thus increasing lower dependency on power
- Evaluate all potential heat source to prevent system cannibalization. LIMIT WASTED BTU's

Biogas Storage from Poultry Manure Digestion

Larger 20 house poultry farm storage in Arkansas.



Controlled by elaborate computer systems.



Heats fresh water from reservoir or well water

1 million btu. Biomass Boilers & 5KW Solar Electric Array

A Word on Biomass Boilers

- 1,000,000 btu. output capable of heating the brood chambers for two large broiler houses approx. 25,000 sq. ft.
- Many types of biomass may be used as fuel, everything from wood trimmings to poultry manure.
- The adjacent 5KW solar array provides for the electrical needs of the boiler first, then any excess will enter the grid for the entire campus.

Solar Power and Solar Thermal to support two chicken houses and office

Wood Grinder

Sawmill Wood Grindings

In Conclusion

- As one can see, we at Brinson Farms have gone to great lengths to reduce energy consumption.
- A combination of all the technologies described in this presentation has greatly improved our bottom line and allows the farm to remain profitable even in times of rising fuel and electricity cost.

Questions ?

Potential for land application of liquid from a broiler litter digester

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ABSTRACT
(Abstract No. 37138)

Efforts are underway to commercialize digesters that produce marketable fuel gas from broiler litter. The process results in considerable amounts of residual liquid. This residual liquid digestate may be suitable for application as a fertilizer. Laboratory results from a digestate produced on a Mississippi broiler farm showed that the digestate tested contained 800 ppm N, 70 ppm P, 1490 ppm K, 130 ppm Ca, 11 ppm Fe, and less than 10 ppm of Al, Mn, Cu, Zn, and B. The sample, which contained less than 1% solids, also contained less than 0.5 ppm of Cr, Ni, Pb, and Cd. Initial studies of the digestate liquid on tomato growth in the greenhouse have shown a positive growth response to the product, with no significant negative effects on growth or appearance. In subsequent field and greenhouse tests of the product on ryegrass, up to four application rates of digestate were tested with or without the addition of standard commercial fertilizer. To date, the tests have shown no negative effects, with or without the simultaneous application of standard commercial fertilizer. Based on these results, additional testing of the product is warranted, including evaluation of variability the digestate within and among producing facilities, suitability of the digestate for various fertilizer uses, and appropriate management techniques.

Table 1.Nutrient concentrations in broiler litter liquid digestate.

Nutrient	Concentration (Pounds/ 1000 gallons[2])
Total Nitrogen	6.8
Ammoniacal	1.7
Phosphorus	7.82
Potassium	11.1
Sulfur	1.11
Magnesium	1.62
Calcium	5.10
Sodium	2.60
Iron	0.335
Aluminum	0.218
Manganese	0.182
Copper	0.123
Zinc	0.155
Boron	<0.02

[2]1 pound/1000 gallons = 0.12 kg/1000 liters

Table 2.Concentration of heavy metals in broiler litter liquid digestate.

Element	Concentration (ppm)
Cadmium	<0.098
Chromium	<0.245
Nickel	0.867
Lead	<.294

Figure 1. Anaerobic digestion system in south central Mississippi.

Introduction

A series of laboratory, field and greenhouse experiments have been conducted or are underway to determine the suitability and efficacy of a liquid byproduct of anaerobic digestion of broiler litter. The litter is blended with water and allowed to digest in a closed vessel (Fig 1). The digestion produces methane for fuel, leaving behind a brown liquid (referred to here as "digestate", that may have fertilizer or other land application value. Here we present the results and discussion of the make up of the digestate, the results of two greenhouse studies and the methods of one field study underway to assess suitability and efficacy.

For each of the three experiments discussed here, the digestate was drawn from a pipe plumbed to the bottom of the digestion tank.

Study Summaries

Digestate composition: The liquid digestate contains less than two percent solids (data not shown). Analysis showed that the liquid contained all the essential plant elements screened for (Table 1.). The concentration of these nutrients in the sample tested was modest, indicating the product could be a complete, but not a concentrated, source of plant nutrients. The digestate did not contain high levels of the heavy metals tested for (Table 2).

Tomato Seedling Study: Seedlings of tomato cv. Mountain Spring were transplanted into 1 gal. nursery pots in April 2009. The plants were watered daily as needed, and fertilized once a week with 0, 5, 10, 20, or 40 ml of the digestate poured over the substrate at the base of each plant.. The digestate was the only fertilizer the plants received other than the starter charge in the commercial greenhouse substrate used (Fafard 3B).

Increasing the application rate of digestate increased plant canopy volume as expressed as Growth Index without significantly increasing plant height (Figures 2 and 3).

Ryegrass Seedling Study: Twenty ryegrass (cv. Prine) seeds were sown into 6 inch (15 cm) plastic pots containing Fafard 3B potting substrate on Sept. 18, 2009. After emergence and each cutting, an application of broiler litter digestate (0, 25, 50 ml/pot/week) and/or water-soluble 20-10-20 fertilizer (50 ml/pot/weeek of 0, 50 100 or 200 ppm N solution), and/or distilled water, were made to the surface of the substrate using a 75 ml plastic syringe. The volume of each treatment was kept uniform by the application of sufficient distilled water to do so. Both the fertilizer and the liquid digestate increase fresh and dry weight of the ryegrass (Fig. 4).

Ryegrass Field Study: In Fall 2009, a pasture ryegrass (cv. Prine) experiment was established to test the influence of the digestate liquid on pasture growth, with and without nitrogen fertilizer application (Fig. 5). Three rates of digestate (0, 40 and 80 gal./acre) and four rates of nitrogen as ammonium nitrate (0, 0.5, 1.0, and 1.5 lbs. N/acre/day) were applied in a factorial combination of the two treatments. All plots received P and K abased on soil tests at planting. To simulate a managed grazing system, the plots are being harvested with a rotary mower every 28 days, after which each of the plots receives an application of digestate and/or fertilizer according to assigned treatment. At each cutting, fresh and dry weights are determined. Dry samples will be sent for nutrient analysis. Weather has been unusually cold during the early months of the trial, leading to slow growth of the grass. Through the first two cuttings, no signifcant influence of digestate on fresh or dry weight (data not shown).

Fig. xx. Influence of [illegible] 09

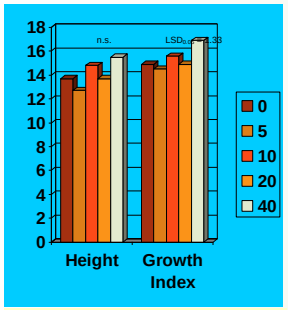

Figure 3. Tomato response to litter digest liquid applied 1 X per week.

Conclusions

Tests from a third party laboratory indicate that the digestate sample submitted contained all essential plant elements tested for. None were present in amounts that would indicate possible toxicity from appropriate rates of foliar or ground application. The digestate did not have large quantities of cadmium, lead, nickel, or chromium. An additional test for arsenic is pending.

Applications of the digestate to tomato and ryegrass seedlings increased the growth of both under greenhouse conditions.

A field trial of ryegrass for pasture production is underway.

Additional evaluations of the liquid byproduct, and the residual solids not studied here, appear to be warranted.

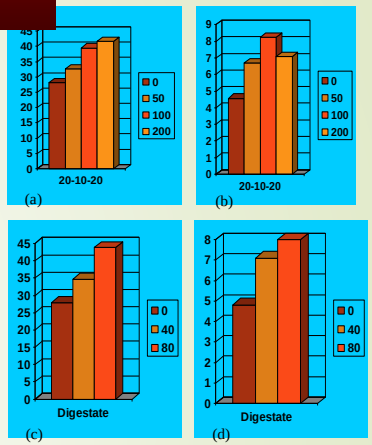

Fig 4. Influence of nitrogen fertilizer application (50 ml 0, 50, 100, 200 of 100 ppm N solution/pot) and broiler litter digestate rate (0, 25, 50 ml/pot) on ryegrass shoot yield (g/pot) over three cuttings under greenhouse conditions: Responses to nitrogen fertilizer: (a) fresh weight, (b) dry weight. Responses to liquid digestate: (c) fresh weight, (d) dry weight. All responses are signficant at p<0.05.

Figure 5. Testing broiler litter digestate and nitrogen fertilizer rate on ryegrass pasture growth at Crystal Springs

Important message for our future farmers and energy

How far do you really want to take organics