6/11/97

SARE Producer Grant Final Report

Project Title: Small Farm Biogas Production and Use FNE 93-19

Project Leader: Ara Lynn
Adress: Liberty Farm
202 Poor Farm Road
New Ipswich, NH 03071 (603) 878-3552

1. Objective.

The objective of this project was to demonstrate that a biogas digester can be built inexpensively and operated effectively by small-medium farmers; to determine cost savings of using biogas rather than electricity for brooder heating, and to determine the nutrient value of the effluent for fertilizer.

2. Updated farm information.

Since we received the producer grant, poor hog market conditions covering several years caused us to reassess our livestock production. We decided to sell out of pigs and we converted the entire barn (40' x 40', 2 stories) to chicken production. We made an arrangement with a larger pig farmer to get a load of pig manure to start the digester when it was ready, and planned to feed the digester with chicken manure and weeds and other plant wastes. We planned to use the heat to run brooders for baby chicks. Our chicken operation is a niche market; we hatch our own eggs and sell young birds of specialized breeds (not broilers) to an ethnic market for meat. This change has given our farm an improved profit margin.

3. Cooperators and their roles.

Paul Bush assisted in the construction phase of the project and aided in our outreach program. Clark Gunness of Resicon Engineering Services provided some design suggestions and his company installed the liner. Bill Hadley, a digester installer, was not used. Roger of Colonial Plumbing in Manchester, NH, did calculations for the technical BTU production. My brother, Andrew Meyer of Beginnings Technology, assisted with some of the problem solving when we ran into problems with the liner. Dr. B.T. Lingappa and Vicki Smith were not used because the project did not progress far enough. Rick Estes of NOFA-NH was not used; however, we did do a workshop on our project at the NOFA Summer Conference in Amherst, MA.

4. What we actually did in our project.

We provided drainage to divert groundwater away from the project site and we installed concrete block, insulation, and a liner for the actual digester. We also installed the hot water

heaters and a manifold for converting the bio-gas to useable BTU. Ara Lynn spent many, many hours re-bonding weak and open seams in the liner. We also began filling the digester with water for a test phase.

5. Findings and results.

We ran into major technical difficulties with the liner, necessary to ensure that the digester effluent remained separated from the groundwater, and were very disappointed in the workmanship of the company that initially installed the liner. The digester must be sealed against both water and gas leaks. The failure to achieve a sealed liner stopped the project.

Sealing the seams involves cleaning the liner surfaces with a solvent and then applying bonding liquid to both dry surfaces of the seam and pressing it with a roller while applying heat (they used a heat gun, I used a hair dryer). The Aquaweld causes a chemical change in the liner fabric that welds the seam together. When Resicon left (some of their workers had never worked with this type of fabric before!) I found gaping holes and many unsealed seams. I tried to repair them but there were so many that I finally had to call them back to fix the liner.

After they left the second time & I had checked everything out, I tested the liner by running water through a hose behind the liner, and discovered there were still leaks. By this time we had spent so many weeks trying to seal the liner, and the material was so difficult to work with, that I reluctantly concluded it would not be possible to achieve an adequate seal using this material. So, for the time being, I gave up.

6. Site specific information relevant to the results.

Trying to retrofit the project into a preset site beneath the floor of the barn did make the project more difficult because there were more angles and odd shapes that had to be worked around (one boulder in the corner of the digester could not be moved), and if we had not had those site specific restraints, the installation of the liner probably could have been achieved more successfully because there would have been fewer seams.

Or, it may have been possible to use another method to seal the digester (by making it out of concrete rather than concrete block, for example). As it was we did not have enough clearance for forms for pouring concrete.

The presence of a spring beneath the floor of the barn also made this site more difficult to work with, although we did solve the groundwater problem with drainage.

7. What were your economic findings?

The project did not proceed far enough to make the economic savings comparisons we had hoped to make. However, I was surprised and encouraged when making the final financial report to discover that the construction work we had done was very close to budget. I think that if we had not had the liner problems we could have accomplished the project near budget. It would have been interesting to see whether the biogas could have completely replaced the propane that we are now using to run the brooders.

8. New ideas & next step.

While searching for solutions to the liner problem, I learned from a company in California that there was an alternative fabric available that was easier to work with, using bonding cement similar to PVC cement and which could be repaired underwater. This would have been a better choice for us because it is difficult to dry the workspace out completely once it gets wet. Alternatively, there may be some way to replace the liner with concrete (at least cracks in the concrete can be seen, sealed, and repaired). Perhaps fiberglass would also be a possibility, although more expensive.

Another mistake we made which has not caused us problems yet (but probably would eventually) was that we did not use stainless steel lag bolts in the cement to hold on the digester cover. Stainless steel would be the best choice because of the corrosive atmosphere in the area of the digester (dampness, ammonia, etc.). If I were to do this project again I think I would be much more precise in ensuring a broad, smooth, flat surface in the cement area where the liner and the cover have to join. I would also probably use plastic lumber instead of pressure treated for bolting down the cover, because even pressure treated lumber shrinks and warps depending on the humidity, and such changes affect the seal between the cover and the liner.

9. Will you continue? Why or why not?

If we get enough time and money to replace the liner with a different solution, I would still like to finish this project; I still think it may work and is a good idea. However, unlike the pigs, our chickens manage to make a decent profit even with the expense of the propane.

10. What do you tell other producers about your project?

That we failed. See # 11.

11. Outreach program.

On August 9, 1996, we presented a workshop on Small Farm Biogas Digester at the Annual NOFA Summer Conference. We de-

scribed our experiences realistically and were probably somewhat discouraging to workshop participants. Essentially we recommended that if people embark on such a project, they should make the system as simple as possible, and warned them that it can be very difficult to get a good seal. We warned them of the pitfalls of "technologically advanced" materials. We told them that the support network for this kind of project is very limited, and the "experts" often disagree with each other. We told them that they would have to depend on themselves--they'll most likely have to fix all the bugs on their own--and to be prepared to overspend on time and money. We had a few handouts which I will send on to you by mail, but we have not written any articles about our project.

End of Technical Report, FNE 93-19

FNE 93-19 Outreach Handouts

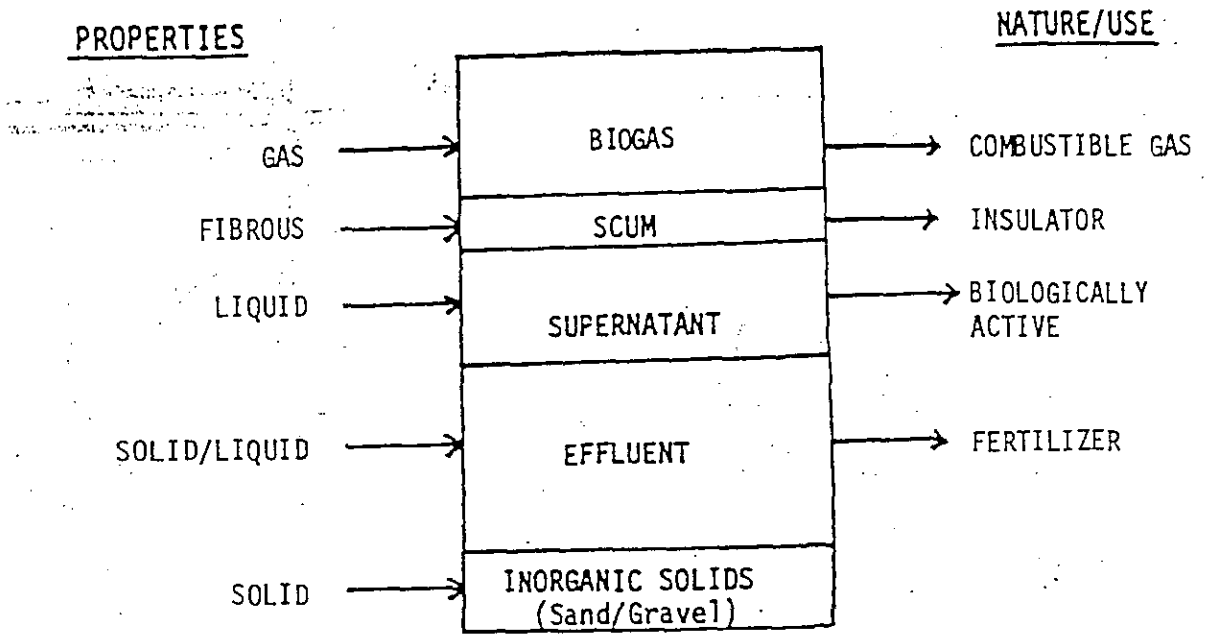

Table 1. Anaerobic Decomposition of Organic Material in Biogas Digesters

Fig. 1. Basic elements of an anaerobic digestor.