

Dry Litter Systems for small-scale piggery operations

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Introduction

What started as a frustrating day for George Kahumoku, Jr., farm owner of Kealia Farms in South Kona, has turned into a technology that is gaining interest across the entire Pacific basin. In the extension profession, it is a joy to work with producers who we call the “early adopters”. These producers latch on to new ideas and technology and make it work for their operations, improving production efficiency and their bottom-line.

George was an early adopter who had many projects going on at the farm, within his community, with his music business, and in his life. One of his projects (and passions) was raising pigs and so George and I were looking at ways to improve his deep-bedded waste management system using the carbon-rich macadamia nut by-products of shells and husks. One summer, due to George’s great reproductive management skills, he had a bumper crop of weaned pigs, which he temporarily housed in his dog kennels. The kennel had sloping floors that dropped-off into a lower containment level with a drain for the wash water. Husks were used as shallow bedding in the pens, but the pigs (and gravity) forced all of the material out of the pen into the basin where it clogged the drain. Being curious animals, the pigs played with the water nozzle until the lower containment area was filled with water too. When I arrived on George’s farm, he was frustrated with the big mess the pigs were making in their pens. What I saw was not the mess, but an innovative idea. This is when the light bulb in my brain started flashing and I told George, “This is it!”

The deep-bedded system had already been implemented in several European and Asian countries in the early 90’s, however there were some emerging concerns. The carbon bedding was immobile making clean-up difficult. As the manure accumulated, so did the liquid waste increase in the pens and the heat from the composting; conditions that optimized disease and parasite build-up that stressed the pigs.

Modified Dry Litter Concept

With the sloping floors (and gravity) of the dog kennel, and with a pig’s natural grubbing and hoof actions, the bedding material could flow out of the pen into a (waste) holding area,



Figure 1. Photograph of the first USDA Natural Resources Conservation Service Environmental Quality Incentive Program funded Modified Dry Litter System installed on the island of Tinian, Commonwealth of the Northern Mariana Islands. Bottom left corner of the photograph shows the old pig pen.

eliminating any build-up of manure in the pens. The pens would stay dry and the bedding material that was discharged into the holding area was already pre-mixed with animal nutrients creating a ready-made compost. Odors and fly populations would be very minimal and no water would be used for pen clean up. That “aha moment” (a sudden understanding, recognition or resolution) was when the modified deep litter system was born. It took several years of on-farm research trials to prove the technology worked and for the concept to evolve into the modified dry litter (since it is not deep bedded) or dry litter technology. Other name iterations include: composting piggery, portable dry litter pen, and dry litter piggery. The key paradigm shift in the modified dry litter concept is that the pig waste is now a valuable and easy to handle resource, which can add value to the operation (sales of compost) or save cost in nutrient input for the farms' crop enterprise.

A recent article in the Samoa News called the modified dry litter waste management system ‘a model for the Pacific’.”

Outreach, Adoption and Implementation

The U.S. E.P.A. 319 research portion of the project was completed in 1995-96. The first outreach and introduction of the technology to the Pacific island nations was through a Western SARE project in 1997. National exposure and the results of the research work were published as a proceedings article in 1999.

Three demonstration projects of the Modified Dry Litter System has been deployed in the Pacific: 1) Northern Marianas College-Cooperative Research, Extension and Education Service-Tinian Island, 2) University of Guam-Dededo Agriculture Research Station, and 3) American Samoa Community College.

There are currently six producer operated Modified Dry Litter Systems; two on Tinian, CNMI, one in American Samoa, two on Hawaii island and one on Oahu. The greatest impact of the technology will be on American Samoa, where 11 facilities are currently under construction and by the end of 2010 (if all plans go through), there will be 25 dry litter facilities on Tutuila island. In addition, there are several portable dry litter systems in place as well (<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/AWM-2.pdf>). A recent article in the Samoa News called the modified dry litter waste management system ‘a model for the Pacific’.”

Other regions of the Western Pacific (Fiji and Tuvalu) have implemented the concept calling it “composting piggeries” and a trial was conducted for dairy cows in Iran (<http://www.docstoc.com/docs/22304730/Plants-residue-effects-on-animal-wastewater-purification-to-reduce->).

Limitations and Benefits

The one limiting factor for the Modified Dry Litter System is the availability of carbon resources for the litter material in island communities. The litter material does not need to be dry, but having dry materials will absorb excess moisture from the pig wastes. Through the resourcefulness of local producers, this issue has not been a barrier to dry litter technology implementation.

Most small piggeries in the Pacific islands are small and dependent upon the use of clean water for pen washing where polluted run off (nutrients and pathogens) is often directly discharged into streams, mangroves, the ocean or left to flow uncontrolled and unmanaged over the landscape. The Modified Dry Litter System virtually eliminates the use of water for pen clean up resulting in water cost saving and protection of the surface, ground and coastal water resources. The system promotes the collection, processing and beneficial use of the nutrients through a managed composting system. In the composting process, odors are reduced, pathogens are destroyed and carbon resources, once destined for municipal landfills, are recycled in the production of a highly valuable organic soil amendment.

Key Development

One of the most significant outcomes of the Modified Dry Litter System over the past decade is the 'acceptance' of the technology under the conditions, criteria and considerations of the Conservation Practice Standards for the waste treatment, the waste facility cover and the waste storage facility (USDA NRCS, PIA, Field Office Technical Guide). This step cleared the way of what was once the largest barrier - the capital cost for construction of the facility. The Environmental Quality Incentive Program (EQIP) funds available to qualified producers can now be used for implementation and construction of the Modified Dry Litter System. Cost share payments can be applied towards the concrete slab, roof (including columns and footings), waste alley, and compost bins.

Other recognition of the technology include:

- Request from SARE for inclusion in national and international publication

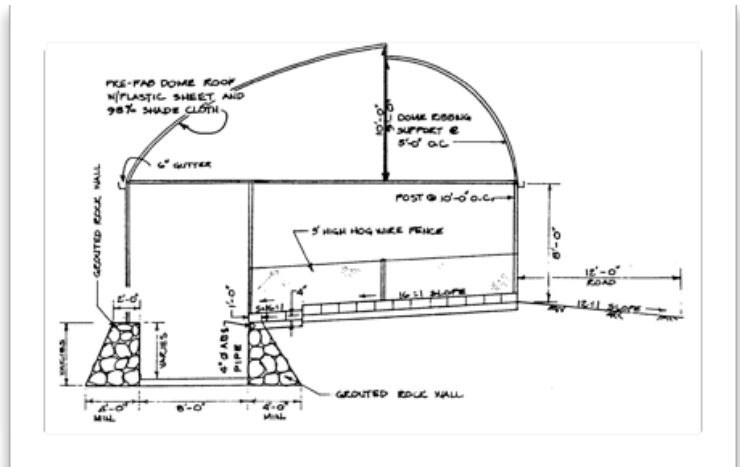
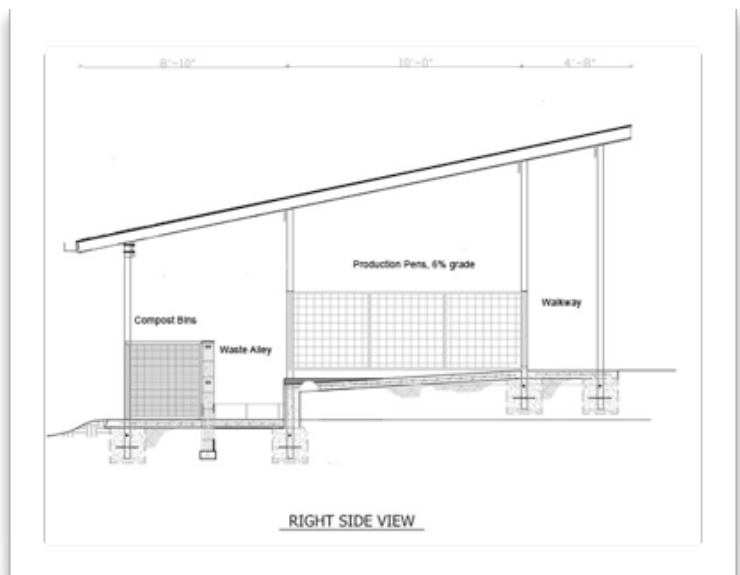


Figure 2. The top graphic shows the original prototype design at Kealia Farms, South Kona and the current modified dry litter system pen design developed for American Samoa. The current designs were developed in collaboration with Mr. Brian Rippey, Civil Engineer. LEED-AP. Full-dimensioned drawings can be found at the American Samoa EPA website: http://asepa.gov/_library/documents/water/piggery/portable-piggery-standard-desi/4pendl.pdf



entitled - Profitable Pork: Strategies for Hog Producers, feature on the dry litter system <http://www.sare.org/publications/hogs/profile2.htm>.

- Acknowledged as a success story in the U.S. Environmental Protection Agency, 319 Program Nonpoint Source Pollution newsletter, <http://www.epa.gov/nps/Section319II/HI.html>.
- Pigs In Paradise project, which included the modified dry litter technology concepts, received the U.S. Environmental Protection Agency, Region IX, 2003 Environmental Award for Outstanding Achievement.

Next Steps and Closing

Through a recently funded project under USDA NIFA's Regional Water Quality Program, I plan to conduct educational outreach and demonstration activities on the Modified Dry Litter System in the Republic of Palau, Republic of the Marshall Islands and the Federated States of Micronesia. And the next step, beyond that project, is to introduce the Modified Dry Litter System to the U.S. Protectorates of Puerto Rico and the U.S. Virgin Islands in the Caribbean Basin.

The Modified Dry Litter System and alternative dry litter systems are CTAHR derived innovations. Through our assistance and relationships with our producers in the states, many creative and innovative contributions have been made to small-scale tropical agricultural production methods, such as the example of dry litter technology. I like this quote, shared by Kauai extension agent Matt Stevenson, because it truly sums up the work of the extension agent. *"The extension work job is not obscure, intricate, involved, or necessarily difficult. It is simple and full of joy of doing things that give immediate help."* (Quote from a 1929 Extension Report "Agricultural Extension Work in Hawaii by William Lloyd, Dean, Agricultural Extension Service).



Figure 3. Photograph of the first EQIP installation on the island of Tutuila, American Samoa. There are six pens and three composting bins built into the unified structure.

On that day of discovery, I'm not sure if I helped George clean out that messy pen or not (probably not), but when I returned to my office I started to write down notes, ideas and laid out the hypothesis for what is now a very appropriate and useful technology.

Acknowledgements

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Islands Regional Water Quality Program for editorial review of the article, and to Mr. Brian Rippy, Civil Engineer LEED-AP, currently with the American Samoa Environmental Protection Agency for taking the modified dry litter system to the next level through his collaborative approach in working on design improvements and championing the concept in American Samoa.

LINKS TO OTHER RESOURCES

Southwest States and Pacific Islands Regional Water Quality Program
<http://ag.arizona.edu/region9wq/index.html>

American Samoa Waste Management Project 2001-02
<http://www.ctahr.hawaii.edu/pigsinparadise/>

American Samoa Environmental Protection Agency, Piggery Compliance Program
<http://asepa.gov/piggery-compliance.asp>

Guidelines for Livestock Waste Management (for Hawaii)
<http://hawaii.gov/health/environmental/water/wastewater/pdf/livestock.pdf>

A Model for the Pacific: the dry litter piggery (Samoa News)
<http://www.samoanews.com/viewstory.php?storyid=13539>

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