Feeders Seek Solutions in Compost

It isn't easy to turn a potential liability into an economic asset, but that is precisely what happened when Agri Beef Co. teamed up with the Kansas Livestock Association to make compost.

Story & photos by ***Ed Haag***

Rick Stott, Agri Beef Co.'s vice president for business development, has always taken great pride in keeping his company's feedlot operations ahead of the environmental curve.

"One of Agri Beef's primary tenets has been to find environmentally positive ways to manage our business," he says, adding that the company was in the lead in helping develop the air quality standards for the State of Washington, as well as water quality standards on a national level.

So it came as an unpleasant surprise in 2000 when he was told by some high-ranking Environmental Protection Agency (EPA) officials that the manure produced in feedlots was perceived as a toxic waste and would fall under the same regulatory category as urban sludge.

"After considerable discussion we were able to show them it wasn't that kind of product," Stott says. "But we also realized that this was going to be an ongoing difficulty for the feedlot industry."

For Stott and his associates at Agri Beef, it was a wake-up call.

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►**Right:** "To keep the compost active, you have to add water back," says Agri Beef's Rick Rees, shown with compost produced at the company's Boise Valley Feeders lot in Parma, Idaho.

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— Rick Stott

alternatives available to take a product that is perceived to be somewhat negative and turn it into a product that is viewed in a more positive light," Stott says. "Because we were already taking a holistic approach to environmental management, composting seemed like a natural fit."

In addition, his preliminary research showed that composting had the potential of adding a profitable value-added byproduct to Agri Beef's financial portfolio. As Stott notes, his company wasn't the only entity in the feeder industry to be seriously evaluating composting as a future feedlot tool.

"At the same time the Kansas Livestock Association (KLA) also came to that conclusion," he says. "They were involved in a project that developed a unique way of composting."

Successful pilot

Allie Devine, KLA senior vice president and general counsel, has been involved from the outset in her organization's efforts to develop a composting program for feedlots. Like Stott, Devine and her colleagues at KLA were uneasy about how raw manure would be regulated in the future.

"Our concern was that EPA was going to continue to increase its requirements on where manure was going and how it fit into that whole nutrient management issue," she says, adding that KLA was also actively seeking a more cost-effective method for disposing of mortalities. "We wanted to see if there was another way to manage mortalities other than rendering."

In 2004 KLA approached Agri Beef to include its Superior operation as one of three Kansas feedlots involved in a pilot composting study. Working with Kansas State University (K-State), KLA's goals were to develop protocols for feedlot composting on the High Plains.

The pilot would involve a total of 100,000 animals representing about 4% of Kansas' 2.5 million-head feedlot capacity.

Devine points out that one of the challenges they faced in the pilot was to develop a system of composting that specifically used the resources available in Kansas feedlots. "In Canada they do a considerable amount of composting," she says. "But, unlike here, they bed their animals with straw or hay because it is colder. That adds a carbon (C) source to the mix, which assists in the composting process."

For KLA staff and K-State researchers, the challenge was to reach and maintain the appropriate temperature in their composting windrows without adding an additional carbon source such as straw or wood chips.

"What we found was that you can compost without adding a carbon source if you manage the oxygen levels and the temperatures within the compost pile and keep it within the acceptable range," she says.

Devine notes that the most important single criteria used to determine whether or not a material is successfully composting is its temperature. Prolonged high temperatures are required to destroy pathogens and weed seeds in manure or other organic materials. The EPA recommends the temperature within the windrows be maintained at 131° F or above for a minimum of three days to destroy all potentially hazardous pathogens. In order to destroy all weed seeds, a temperature of 145° F within the compost pile is required.

How it works

Nate Gilliam, general manager at Agri Beef's Boise Valley Feeders in Parma, Idaho, and Rick Rees, operations manager, have been overseeing the feedlot's composting operation. The feedlot's raw manure is scraped out of the pens and piled in long windrows. Once a week, the windrows are turned and simultaneously sprayed with water.

"To keep the compost active, you have to add water back," Rees says. "That is an important step in keeping the process going."

According to composting literature, the length of time it takes to compost cattle manure depends on the ambient temperature. The composting process may take two to six months. Manure production per 1,000-pound (lb.) live animal weight per day runs 52 lb. wet weight, 7 lb. dry weight, and 14.2 lb. of combined dry manure and soil scraped per head per day.

As was discovered in the KLA's pilot study, manure collected from feedlots can be composted as is (with no bulking agents) or with high-carbon materials such as straw and wood chips to increase the carbon-to-nitrogen ratio and reduce nitrogen (N) loss.

Windrow composting is the most common method used for beef cattle feedlot manure. The windrows are normally 3 feet (ft.) to 6 ft. high and 8 ft. to 12 ft. wide. Limitations on the size of

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the windrow are usually dictated by the size of the machine turning the compost.

For Gilliam's composting operation in Idaho, the limiting factor is the ambient temperatures in the winter. Cold weather prevents the internal temperatures in the windrows from rising to the levels needed to complete the composting process.

"We really can't compost in the winter months," he says. "With our new composting machine we can turn compost eight hours a day starting April 1 and ending by Sept. 30."

Rees notes that in order to be a certified composting operation by the State of Idaho, operators are required to submit samples to confirm the final product meets the criteria established by scientists.

"It is really a matter of testing your compost," he says. "Once you become certified in the state program, it is verification that you are producing a consistent product. After that you have to send in tests on a regular basis, and they have to meet all the required standards."

A new use

Shortly after successfully completing their pilot project, KLA entered into a partnership agreement with Agri Beef, establishing Earthsolutions LLC at the end of 2004. Both Stott and Devine believe that their organizations' efforts to develop specific applications for their new compost show real promise.

"The approach we are taking is to find nontraditional uses for what we are producing," Stott says. "From our preliminary work we already have patentable products."

One market that Earthsolutions' research and sales teams have targeted is the land reclamation sector. Working with internationally recognized soils expert Lakshmi Reddi of K-State, the new company has developed a patented process of pelletizing its compost.

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"Pelletizing allows ease of handling and ease of application," Devine says. "What we also learned is that by combining pelletized and non-pelletized material we had zero erosion at a sustained 35 mile-per-hour wind."

In addition, Reddi's research revealed that Earthsolutions' new product had extraordinary rain erosion control properties. As reported in his research abstract, Reddi's team constructed a rainfall simulator that emulated the natural rainfall of a 10-year event in Kansas. Initially a loam-based soil was tested for erodibility. Results confirmed that when water was applied, the results significantly exceeded the tolerable soil loss.

Then, two forms of Earthsolutions compost were applied on the same base soil as the surface erosion control layer. The first, consisting of three different pellet sizes, was laid on upslope, midslope and downslope, respectively. Finer compost was applied on upslope and coarser compost on downslope. The second form used was vegetated compost — the compost layer was vegetated using grasses.

Results showed that soil loss was within the tolerable limit in the two compost applications. From that set of experiments Reddi concluded that the proprietary compost soil was a suitable material for roadside embankment rainfall erosion control.

Devine adds that the research also demonstrated that Earthsolution's new product had major water retention capabilities. "In a simulation of an inch of rain over a 15-minute period on a 1-to-3 slope we found no runoff," she says. "As Dr. Reddi likes to say, our new product has a love affair with water."

Since those initial tests, Earthsolutions has applied its product on a road remediation site in the sandhills of Southwest Kansas where five other types of applications had failed to establish vegetation.

"We were able to turn the sandhills into a nice vegetative state within 60 days and basically stop wind and water erosion in a location where others had failed," Stott says.

Devine notes that Earthsolutions next major remediation project involves establishing test sites as part of a larger effort to restore a long-standing lead (Pb) and cadmium (Cd) mining area in southwest Kansas.

"So far they have not been able to revegetate those areas because of the soil contamination from the lead and cadmium," she says. "We feel that our pelletized and non-pelletized compost has a good chance of sealing up the site so we don't have contaminated water and soil runoff."

Markets will decide

As for other uses for their new product, Devine is confident that as the cost of commercial fertilizers continues to rise, the demand for nutrient-rich alternatives such as compost will grow. "With that ability to retain water, our product definitely has

► Windrows of finished compost bear no resemblance to their former state.

potential agricultural applications," she says. "Some of our feedlots have already established impressive local markets with landscapers."

In spite of the promise of a growing demand for their new product, Devine sees the transfer of their proprietary technology to other feedlots as not occurring overnight.

"It will continue to grow in popularity, especially in the management of mortalities," she says, adding that their research into composting mortalities has confirmed that under ideal conditions a carcass can be totally composted within 90 days.

Meanwhile, Devine believes that it will take a combination of additional regulatory pressure on the sale and application of manure and a willingness on the part of the purchaser to pay a premium for higher-quality finished product to drive major change in the industry.

"As we can quantify compost benefits where the final product can demand more return on the time spent in production, we will see more feedlots switching to compost," she says, adding that when that happens, Earthsolutions will be ready.

►Rees and Nate Gilliam oversee Agri Beef's composting operation in Parma, Idaho.