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Animal manure-municipal yard waste composting project in Wright County, Iowa

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Abstract
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Budget:
$15,000 for year one
$15,000 for year two

Background

The problems of waste disposal in north central Iowa's Wright County are familiar ones. The number of animals raised in confinement units has increased dramatically and the amount of animal waste produced at these facilities often exceeds the amount of waste generated by human communities. Environmental concerns have arisen about how and where the manure may be safely dispersed.

Meanwhile, the state of Iowa has banned disposal of yard wastes in the state's sanitary landfills since January 1991. Many Iowa communities are seeking alternative methods of disposing of their yard wastes with composting being a popular option.

However, yard waste alone may not be a particularly good composting material. To make a good compost, a source of nitrogen is needed. Poultry manure offers an excellent supply of nitrogen and when combined with yard wastes produces a compost that can provide needed plant nutrients and organic matter. This compost has the potential to improve soil structure, reduce fertilizer requirements, and in some applications, reduce the possibility of soil erosion. Using animal manure for compost creates a relatively stable product that can be land-applied without concerns for environmental contamination. In addition, rural residents will have a convenient way to get rid of most yard wastes with the added benefit of generating a compost useful to gardeners and landscapers.

The objective of this project was to sponsor a cooperative effort between farmers and rural communities to turn two different disposal problems into a valuable resource that could enhance the local economy.

Approach and methods

Clarion, Iowa (located in Wright County) was selected for the experiment because of the high concentration of animal confinement facilities in the area and the strong interest and support of the community in the composting initiative. The city public works office located a site for the compost piles and supplied on-site management of the project. The city offered an area at the municipal airport northwest of town as a composting site.

The initial compost windrow was about 12 feet wide, 8 feet high, and 75 feet long. These dimensions were large enough to contain the heat generated by the compost and small

Preparing compost windrow.

enough to allow air infiltration. The size of the windrow was also chosen to accommodate the equipment used for turning the compost materials.

The yard waste and poultry manure were hauled to the composting site by Clarion Public Works employees using a city dump truck. A city tractor with a front-end loader was used to mix the raw materials and form the windrow. The same tractor was used to turn the compost weekly.

Nitrogen and moisture levels A key factor in producing compost is the carbon to nitrogen ratio (C:N) in the mix of raw materials. The ideal C:N ratio is 25:1 or 30:1. If the nitrogen content of the compost is too high, odors become a problem. In order to keep the nitrogen at an acceptable level, a lower ratio of yard waste was required. Yard waste that contains more leaves and woody material could be mixed with a higher amount of manure, such as three or four parts manure to one part yard waste.

Yard waste and poultry manure were mixed in a 1:1 ratio on May 22, 1995. This ratio was used because the yard waste contained a high percentage of grass clippings which are also good source of nitrogen.

In order to achieve successful composting, there must not be an excessive amount of N in the raw materials, the moisture content must be appropriate, and there must be enough air infiltration to prevent anaerobic conditions. The moisture content of the poultry manure was about 43 percent, roughly the right amount for the compost pile to work. Based on the characteristics of the pile during the active composting stage, the ratio of materials proved satisfactory. The proper temperature was maintained for the compost pile and there was very little odor.

Working with compost pile

After 100 days, the temperature of the windrow was near ambient air temperature and the active phase of composting was complete. The first batch of Clarion compost was moved to a curing pile and made available for distribution.

The second windrow was established September 1, 1995 using the same 1:1 ratio of yard waste to poultry manure. The second pile had a longer active compost period because ambient air temperatures were lower during the fall and winter.

During the second year of the project, compost piles were established in the spring and fall of 1996. The piles were constructed using the same ratio of manure to yard waste.

Results and discussion

The first pile yielded about 130 cubic yards of compost. Depending on the grade of the compost, its commercial value varies from $5 to $50 per cubic yard. At minimum value, the first windrow of compost produced in Clarion was worth about $650. Clarion Public Works Director Jim Redemske estimated that the city invested about $650 in the first pile, which means the city would break even if the compost had been sold. However, in order to generate a compost material that would be suitable for sale to the public, a greater investment in time and equipment is necessary.

A total of about 500 cubic yards of compost were produced at the site. At the close of the project, all the compost had been distributed to area residents.

Compost analysis. A sample of the poultry manure used for the project was collected on May 22, 1995, when the first windrow was established. A composite sample of the finished compost was collected on August 28, 1995. The table below shows the chemical analysis of the poultry manure and finished compost product. Results for 1996 were similar for N and P, but the concentration of K was lower than in 1995.

Assuming that the yard waste used in the compost had an original concentration of about 3 percent N (an average value for a mix of grass clippings and leaves), about 50 to 60 percent of the total N from the original poultry manure/yard waste mix was lost, probably to ammonia volatilization.

A number of characteristics are used to determine the quality and grade of compost, including color, odor, pH, particle size, and soluble salt content. Only the pH and soluble salt level were evaluated for the Clarion compost. The soluble salt concentration was higher than desirable for horticultural use as a top dressing for lawns or potting materials. Use of the Clarion compost should be limited to land application as a soil amendment for gardens or field crops.

Water samples. Lysimeters were installed at the composting site to collect samples of soil water for NO_3-N analysis. The site was arranged with two active compost piles and two lysimeters at the end of each pile.

The first water samples were collected on June 5, 1995, about two weeks after the first compost pile was established. Concentration of NO_3-N in the soil water was less than 3 ppm. Forty-two days after the first windrow was established, the NO_3-N concentration reached its highest level of 11.7 ppm. By the time the ground froze in November, NO_3-N levels had dropped below 6 ppm. During entire 1996 season, the concentration of NO_3-N in water samples did not exceed 1.5 ppm.

Pile temperature. The temperature of the compost pile was monitored daily using a thermometer with a three-foot probe. About four days after the first windrow was established, pile temperature had risen above 120^0 F. Maximum recorded temperature in the pile

	Poultry Manure	Clarion Compost
Total-N (%)	3.8	1.4
NH_4-N (ppm)	8898	145
NO_3-N (ppm)	17	395
Total-P (%)	3.2	2.2
Total-K (%)	4.1	2.5
pH	8.5	8.4
EC (mmhos/cm)	10.4	13

Chemical analysis of the poultry manure mixed with the yard waste to form the initial windrow and Clarion compost finished product.

was around 145^0 F. Temperature of the compost was used as a guide to determine when it was necessary to turn the pile, which was usually about once a week. The goal was to keep the pile temperature near 140^0 F to provide a suitable environment for the microorganisms and to destroy weed seeds and pathogens.

The main difficulty encountered during the project's first year was mixing the compost properly with a tractor. The poultry manure tended to form clumps up to 6 in. in diameter, that were not easily broken up. A compost turner would have made the job easier and more efficient as well as chopping up the small twigs and branches in the yard waste. (The city had a separate waste pile for larger branches and tree limbs, keeping them out of the yard waste supply.) Other materials (cans, bottles, and plastics) were not a problem in the yard waste received from Clarion residents.

Despite initial concerns, no problems were reported with odors emanating from the composting pile during the active phase of the project.

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Education and outreach

The Clarion Compost project was covered in the local print and electronic media. Presentations were made about the project to local civic groups and open houses were held at the site on September 5, 1995, in April 1996, and April 1997.

In June 1996, Jim Redemske, Clarion Public Works Director, held an open house for area public works directors to display the project. A representative from the Iowa Department of Natural Resources presented information about state requirements for composting facilities and funding possibilities. As a result of this meeting, several area communities are interested in developing a joint effort to compost yard waste, perhaps with purchase of composting equipment and operation of a joint composting site. Redemske has taken the lead to continue this discussion with area public works directors about a pooled resources effort for community composting.

City officials heard very favorable comments about the project. There was a noticeable increase in the amount of materials brought to the city collection area and it was attributed to the interest in the composting efforts. It was estimated that 350 to 400 area residents participated during the first season of the project, with similar interest levels in the second year.

In addition to activities at the composting site, project information was disseminated around the state. In July 1996, a display about the project was shown at the Wright County Fair. The ISU College of Agriculture featured the project at the 1996 Farm Progress Show. Presentations were made the 8th Annual Integrated Crop Management Conference in November 1996 and at the Water Quality Conference in January 1997. The investigators described the project at the BioCycle Midwest Conference in December 1996.