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The ISU Compost Facility after Five Years

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Introduction

The University Compost Facility has completed five full years of operation. The facility is managed by the ISU Research Farms and has a separate revolving account that receives fees and sales and pays expenses. The facility is designed to be self-supporting, i.e. not receive allocations for its operations. The facility is located at 52274 260th Street, Ames, Iowa.

Materials and Methods

The ISU Compost Facility consists of seven, 80 × 140 ft hoop barns and a 55 × 120 ft hoop barn, all with paved floors. The facility also has a Mettler-Toledo electronic scale with a 10 ft × 70 ft platform to weigh all materials.

Key machinery at the Compost Facility is 1) compost turner, a used pull-type Aeromaster PT-170, 14 ft wide made by Midwest Biosystems, Tampico, IL; 2) a converted dump truck trailer used to construct windrows and haul material; 3) a telehandler, Caterpillar TH407 with cab and 2.75 cubic yard bucket; and 4) a tractor, John Deere 7520 (125 hp) with IVT (Infinite Variable Transmission) and front-wheel assist used to pull the turner and dump trailer. A used wheel loader was purchased from Iowa DOT in 2013. The loader is a 1991 Case W14C. The wheel loader is used in peak operating times as a second loader and provides backup for the telehandler. It also reduces the load on the telehandler, potentially extending its life.

The compost blend targets are a Carbon:Nitrogen ratio of 25-30:1 and a moisture of 45–50 percent. Porosity and structure affect how well oxygen flows into the pile and its availability to the microbes. After a windrow is made with the dump trailer, the windrow is turned to mix all materials thoroughly. Within three to four days the windrow heats to 140-160°F. Later, it is turned one to two times a week. The composting process takes about 12 to 16 weeks with 15 to 20 turns. Frequency of turning is determined by windrow temperature and oxygen measurements. Turning provides mixing and aeration. When the oxygen level in the windrow falls below atmospheric oxygen levels, then the windrow benefits from turning. The porosity of the windrows is related to moisture content and structure from particles like cornstalks.

Results and Discussion

The facility receives manure and biomass from several ISU facilities: the Dairy Farm, Animal Science Teaching Farms (including the horse barns), Campus Services (yard and greenhouse waste), ISU Dining (food waste), Ag Engineering/Agronomy Farm, BioCentury Research Farm, Plant Introduction Station, Reiman Gardens, Horticulture Station, and others. A total of 6,767 tons were received in 2013 (Table 1). This is 5 percent less than 2012 and 14 percent less than the peak year of 2011. The reduction may be partially related to much drier years in 2012 and 2013, and the Dairy Farm started using some of the manure solids for free-stall bedding. About 78 percent of the incoming material came from the ISU Dairy Farm.

The facility generated compost and amended soil primarily for campus use. A total of 5,612 tons were outgoing from the facility, which was similar to prior years (Table 2). About 87

tons of compost and 5,525 tons of amended soil were marketed. The primary outgoing product was amended soil. Amended soil is a blend of compost, topsoil, and sand.

The side curtains were showing significant wear, therefore, were replaced with concrete toe walls and white steel above on three hoops in 2012 and 2013. More replacements will occur in 2014. It has become obvious the side curtains and roof vents are not needed for air movement and will be gradually eliminated as covers are replaced.

A half hoop cover was replaced in 2013. The cover was damaged during a high wind event. The strap securing the cover end flap failed, allowing the end flap to come loose and tear in several places. The end flap strap in the other hoops has been augmented with a steel cable. The new half cover extends to the toe wall, eliminating the need for side curtains.

The decreased rainfall of summer 2013 did not cause major problems for the composting operations. Water was added with the turner to increase moisture lost from the hotter, drier weather. The decreased rainfall made the incoming manure somewhat drier, which saved cornstalks and other carbon for windrow construction rather than using them for moisture absorption. The drier manure was easier and less time consuming to pile.

During 2013 the hoop barns were used as follows: 1) the central hoop barn was used for receiving, mixing, and storage of raw materials; 2) one hoop was used for storing finished compost, topsoil, and mixing/storage of amended soil; and 3) the remaining five hoops plus the smaller hoop were dedicated to general composting.

The ISU Compost Facility continues to serve a unique and vital role in assisting ISU be "greener" and more sustainable. The staff continues to improve the management of the compost to benefit the university.

Acknowledgements

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Table 1. ISU Compost Facility inputs.

	2013 tons	2013 % of total	2012 tons	2011 tons	2010 tons
Source					
Dairy manure[1]	2,841	42.1	3,395	3,984	3,772
Dairy solids[2]	1,529	22.6	1,220	3	1,392
Dairy pack[3]	875	12.9	992	1,150	964
Dairy subtotal	5,245	77.5	5,607	5,137	6,128
Campus[4]	544	8.0	557	936	616
An Sci manure	158	2.3	205	491	214
Dining[5]	321	4.7	372	367	333
Biomass[6]	305	4.5	194	553	263
Stalks[7]	162	2.4	151	0	160
Other[8]	32	0.5	33	348	29
Total[9]	6,767	100.0	7,119	7,832	7,743

[1]Semi-solid dairy barn scrapings.
[2]Solids from the manure separator. Separator was not operative during 2011.
[3]Bedded packs from dairy barns.
[4]Consists of campus yard waste (leaves, etc.) and greenhouse waste.
[5]Compostable dining hall and kitchen food wastes.
[6]Biomass research wastes, usually corn stalks, switchgrass, corncobs, or similar waste feedstocks.
[7]Cornstalks as a carbon source. In 2011, all cornstalks came as biomass research wastes.
[8]All other sources.
[9]Setup year (2009) not shown.

Table 2. ISU Compost Facility outputs.

	2013 tons	2013 % of total	2012 tons	2011 tons	2010 tons
Amended soil	5,525	98.4	5,233	2,117	2,593
Compost	87	0.6	353	3,484	616
Stalks	0	0	0	0	39
Bedding[1]	0	0	0	0	110
Partial compost[2]	0	0	0	0	2,234
Total[3]	5,612	100.0	5,586	5,601	5,592

[1]Dairy separator solids composted and used as bedding for dairy cattle.
[2]Manure that partially composted was field applied.
[3]Setup year (2009) not shown.