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The University Compost Facility after Three Years

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Abstract

The University Compost Facility, 52274 260th St., Ames, Iowa has completed three 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 consists of seven, 80 × 140 ft hoop barns and a new 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 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) telehandler, Caterpillar TH407 with cab and 2.75 cubic yard bucket; and 4) tractor, John Deere 7520 (125 hp) with IVT (Infinite Variable Transmission) and front-wheel assist used to pull the turner and dump trailer.

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Introduction

The University Compost Facility, 52274 260th St., Ames, Iowa has completed three 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 consists of seven, 80 × 140 ft hoop barns and a new 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 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) telehandler, Caterpillar TH407 with cab and 2.75 cubic yard bucket; and 4) tractor, John Deere 7520 (125 hp) with IVT (Infinite Variable Transmission) and front-wheel assist used to pull the turner and dump trailer.

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 degrees Fahrenheit. Later, it is turned 1 to 2 times a week for about 12 to 16 weeks with 15 to 20 turns total. 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, Horticulture Station, and others. A total of 7,832 tons were received in 2011 (Table 1). This is similar to 2010. Even though the dairy farm's separator was not operating, the other users increased their deliveries to make up the difference. About 66 percent of the incoming material came from the ISU Dairy Farm in 2011, which was down from 81 percent in 2010.

The facility generated compost and amended soil primarily for campus use. A total of 3,484 tons were outgoing from the facility (Table 2). About 1,366 tons of compost was marketed, including a small amount to private buyers (39.3 tons). The amount of finished compost in 2011 was a major increase compared with 2010, because no partially-finished compost was field applied and the contractors working at the College of Veterinary Medicine made their amended soil on-site. Amended soil is a blend of compost, topsoil, and sand.

The winter of 2010–2011 proved to be less challenging than the prior winter. Because of less snow, composting was able to continue

throughout the winter. The cold temperatures were not a major problem. The compost windrows were allowed to freeze over if necessary and that trapped heat inside them. The windrows were also constructed with more cornstalks to make the windrows drier so they would absorb excess moisture from snow. The carbon-nitrogen ratio was not adversely affected with the extra carbon. During the remainder of the winter, composting progressed well. Dairy manure was stockpiled until spring when finished compost was removed from some hoops allowing new windrow construction.

Crows and starlings were a nuisance on the compost windrows during the winter. The birds came to pick at the compost particularly after turning and sit on the warm windrows. Noise cannons were used to scare the birds away.

The support piers damaged in June 2010 by a lightning strike were repaired and all covers are maintaining well. The side curtains are showing significant wear and will probably need to be replaced in the coming year.

The dry summer of 2011 did not cause major problems for the composting operations. Supplemental water was added while turning 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. This also made piling the manure easier and less time consuming.

During 2011, 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 and storage of amended soil, 3) the remaining five hoops were dedicated to general composting.

Also, a new hoop barn (55 ft × 120 ft) was erected at the facility for research. It has 10-ft metal leg extensions that allow the tarp to fully cover the structure. The ends have a header 14.5 ft above the floor with solid half-moon of fabric above and roll down doors below. This allows the hoop barn to be entirely enclosed for research purposes. Plans include adding fans and air sampling devices. The hoop barn was partially donated by Hawkeye Steel Co., Houghton, Iowa.

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.

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The authors also sincerely acknowledge the major ISU contributors and users: Animal Science Farms, BioCentury Research Farm, Ag Engineering/Agronomy Research Farm, Dairy Farm, ISU Design and Construction Services, ISU Dining, ISU Horticulture Station and Campus Services, as well as other governmental users.

Table 1. ISU Compost Facility inputs.

	2011 tons	2011 % of total	2010 tons	2010 % of total
Source				
Dairy manure[1]	3,984.85	51.0	3,772.5	48.7
Dairy solids[2]	2.72	0.0	1,391.8	22.2
Dairy pack[3]	1,149.85	14.6	964.0	10.1
Dairy subtotal	5,137.42	65.6	6,128.3	80.8
Campus[4]	936.22	12.0	616.6	6.8
An Sci manure	490.72	6.2	213.6	5.5
Dining[5]	367.13	4.7	332.6	1.5
Biomass[6]	553.05	7.1	262.7	3.1
Stalks[7]	0	0.0	159.8	1.4
Other[8]	347.62	4.4	29.3	0.7
Total	7,832.16	100.0	7,742.9	100.0

[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.

Table 2. ISU Compost Facility outputs.

	2011 tons	2011 % of total	2010 tons	2010 % of total
Amended soil	2,118.0	60.8	2,593.0	46.4
Compost	1,366.0	39.2	616.0	11.0
Stalks	0.0	0.0	39.0	0.7
Bedding[1]	0.0	0.0	110.0	2.0
Partial compost[2]	0.0	0.0	2,234.0	39.9
	3,484.0	100.0	5,592.0	100.0

[1]Dairy separator solids composted and used as bedding for dairy cattle.
[2]Manure that partially composted and then was field applied.