

The ISU Compost Facility after Six Years

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Introduction

The University Compost Facility has completed six 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. It 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; 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; and 5) a used wheel loader, 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 Facility plans to trade the W14C wheel loader for a newer, larger machine in 2015.

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), Hansen Learning Center, Ag Engineering/Agronomy Farm, BioCentury Research Farm, Plant Introduction Station, Reiman Gardens, Horticulture Station, and others. A total of 8,199 tons were received in 2014 (Table 1). This is 21 percent more than 2013 and 5 percent more than the peak year of 2011. 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 4,278 tons were outgoing from the facility in 2014, which was 24 percent less than 2013 (Table 2). The inventory of finished compost increased due to increased inputs and reduced outputs. About 630 tons of compost and 3,648

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

The covers on a few of the hoops are showing significant wear, mostly along creases or areas where it appears they were folded. Some covers will be replaced this year. The concrete side walls on the remaining hoops will be finished this year.

The hoop cover installed in 2013 that covers the hoop structure from concrete wall to concrete wall is performing well. The cables installed in the ends of the hoop covers inside plastic conduit on all the hoops also are doing well. They are more durable than the straps used previously.

Composting at the facility went well. The early, cold winter combined with late snow slowed composting down more than usual. Less usage of compost/amended soil resulted in a larger compost stockpile than usual this spring. No significant weather events occurred during the summer to cause any problems.

During 2014, 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 six hoops plus the smaller hoop were dedicated to general composting.

Compost was used for several research projects as a soil amendment to plots. Research also was conducted on-site with biorenewable plant containers. Also, a composting trial with shredded pizza boxes was conducted.

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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Table 1. ISU Compost Facility inputs.

	2014	2014	2013	2012	2011	2010
	tons	% of total	tons	tons	tons	tons
Source						
Dairy manure ¹	3,327	40.6	2,841	3,395	3,984	3,772
Dairy solids ²	1,806	22.0	1,529	1,220	3	1,392
Dairy pack ³	1,254	15.3	875	992	1,150	964
Dairy subtotal	6,387	77.9	5,245	5,607	5,137	6,128
Campus ⁴	520	6.3	544	557	936	616
An Sci manure	363	4.4	158	205	491	214
Dining ⁵	344	4.2	321	372	367	333
Biomass ⁶	340	4.2	305	194	553	263
Stalks ⁷	215	2.6	162	151	0	160
Other ⁸	<u>30</u>	<u>.4</u>	<u>32</u>	<u>33</u>	<u>348</u>	<u>29</u>
Total ⁹	8,199	100.0	6,767	7,119	7,832	7,743

¹Semi-solid dairy barn scrapings.

²Solids from the manure separator. Separator was not operative during 2011.

³Bedded packs from dairy barns.

⁴Consists of campus yard waste (leaves, etc.) and greenhouse waste.

⁵Compostable dining hall and kitchen food wastes.

⁶Biomass research wastes, usually corn stalks, switchgrass, corncobs, or similar waste feedstocks.

⁷Cornstalks as a carbon source. In 2011, all cornstalks came as biomass research wastes.

⁸All other sources.

⁹Setup year (2009) not shown.

Table 2. ISU Compost Facility outputs.

	2014	2014	2013	2012	2011	2010
	tons	% of total	tons	tons	tons	tons
Amended soil	3,648	85.3	5,525	5,233	2,117	2,593
Compost	630	14.7	87	353	3,484	616
Stalks	0	0	0	0	0	39
Bedding ¹	0	0	0	0	0	110
Partial compost ²	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2,234</u>
Total ³	4,278	100.0	5,612	5,586	5,601	5,592

¹Dairy separator solids composted and used as bedding for dairy cattle.

²Manure that partially composted was field applied.

³Setup year (2009) not shown.