

The ISU Compost Facility after Seven Years

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Introduction

The University Compost Facility has completed seven 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, 2013 John Deere 624K high lift. The wheel loader is the main loader used and the telehandler provides backup and operates in areas the wheel loader cannot get into. 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 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, 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 equine barns), Campus Services (yard and greenhouse waste), ISU Dining (food waste), Hansen Learning Center (arena wood shavings), Ag Engineering/Agronomy Farm, BioCentury Research Farm, Plant Introduction Station, Reiman Gardens, Horticulture Station, and others. A total of 8,688 tons were received in 2015 (Table 1). This is 6 percent more than 2014. 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 3,675 tons were outgoing from the facility in 2015, which was 14 percent less than 2014 (Table 2). The inventory of finished compost increased due to increased inputs and reduced outputs. About 26 tons of compost, 3,381 tons of amended soil, and 246 tons of black dirt 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 were completed in December 2015. Now the facility will work on adding concrete aprons to the end of each hoop to reduce gravel being scraped up when cleaning up the ends of windrows before turning.

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. Eventually, most if not all hoops will have covers like this one.

Composting at the facility went well. The early, cold winter combined with late snow slowed composting more than usual. Less usage of compost/amended soil resulted in a larger compost stockpile than usual this spring. Despite high rainfall levels during the spring and summer, a dry spell in October offered an opportunity to screen the finished compost that was dry enough. Wetter finished compost was put in smaller piles that were peaked to shed water and hopefully dry out more so it can be screened next year.

The facility started screening compost this year at the request of ISU Facilities Planning & Management. The goal was to remove the foreign material and gravel from the amended soil. It was successful at cleaning the compost. However, rocks and foreign material in the top soil remain and need to be removed by hand, because the screener doesn't break up soil chunks or screen wetter material very well, resulting in the material being discarded by the machine.

During 2015, 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.

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.

	<u>2015</u> tons	<u>2015</u> % of total	<u>2014</u> tons	<u>2013</u> tons	<u>2012</u> tons	<u>2011</u> tons
Source						
Dairy manure ¹	3,642	41.9	3,327	2,841	3,395	3,984
Dairy solids ²	1,404	16.1	1,806	1,529	1,220	3
Dairy pack ³	1,683	19.4	1,254	875	992	1,150
Dairy subtotal	6,729	77.5	6,387	5,245	5,607	5,137
Campus ⁴	672	7.7	520	544	557	936
An Sci manure	461	5.3	363	158	205	491
Dining ⁵	340	3.9	344	321	372	367
Biomass ⁶	292	3.4	340	305	194	553
Stalks ⁷	165	1.9	215	162	151	0
Other ⁸	<u>29</u>	<u>0.3</u>	<u>30</u>	<u>32</u>	<u>33</u>	<u>348</u>
Total	8,688	100.0	8,199	6,767	7,119	7,832

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.

Table 2. ISU Compost Facility outputs.

	<u>2015</u> tons	<u>2015</u> % of total	<u>2014</u> tons	<u>2013</u> tons	<u>2012</u> tons	<u>2011</u> tons
Amended soil	3,381	92.0	3,648	5,525	5,233	2,117
Compost	26	0.7	630	87	353	3,484
Stalks	22	0.6	0	0	0	0
Black dirt	246	6.7	0	0	0	0
Total	3,675	100.0	4,278	5,612	5,586	5,601