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The ISU Compost Facility after Eight Years

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Introduction

The University Compost Facility has completed eight 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 x 140 ft hoop barns and a 55 x 120 ft hoop barn, all with paved floors. The facility also has a Mettler-Toledo electronic scale with a 10 ft x 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 2017 dump trailer made by Berkelman Welding, ON, Canada, 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 PTO 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. 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: 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 8,424 tons were received in 2016 (Table 1). This is 3 percent less than 2015. About 77 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 7,694 tons were outgoing from the facility in 2016, which was about double (109 percent) compared with 2015 (Table 2). This was due to several large construction projects on campus reaching completion. The inventory of finished compost decreased due to slightly decreased inputs and greatly increased

outputs. About 29 tons of compost, 7,389 tons of amended soil, and 276 tons of black dirt were outgoing. The primary outgoing product was amended soil. Amended soil is a blend of compost and topsoil. Compost was used for several research projects as a soil amendment to plots.

The covers on some of the hoops are showing significant wear, mostly along creases. The hoop cover installed in 2013 that covers the entire hoop structure from concrete wall to concrete wall works well. A similar new cover was installed for another hoop barn in the summer. One-and-a-half covers will be replaced in the coming year and one per year thereafter until all hoops have new covers.

The concrete side walls on the remaining hoops were completed December 2015. Concrete aprons were added to the ends of hoop barns last year to reduce gravel being scraped up when pushing the ends of windrows before turning. More aprons will be added this year.

Composting at the facility went well. The winter was average temperatures with little snowfall. Rainfall was slightly above average during the spring and summer, but it had little effect on composting. A dry spell in October offered an opportunity to screen the finished compost. Wetter finished compost from the previous year was put into windrows in the summer, turned to dry, and later screened.

The facility started screening all compost last year at the request of ISU Facilities Planning and Management. The screener removes the foreign material and rocks. However, the screener does not break up soil chunks or screen wetter material well. Therefore, by

drying this material and re-screening, 80 percent can be recovered as clean.

During 2016, 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 barn was used for storing finished compost, topsoil, and mixing/storage of amended soil; and 3) the remaining five hoop barns plus the smaller hoop barn 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.

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Mention of a trade name, proprietary product, or specific equipment does not constitute a guarantee, warranty, or endorsement by Iowa State University and does not imply approval at the exclusion of other products that may be suitable.

Table 1. ISU Compost Facility inputs.

	<u>2016</u>	<u>2016</u>	<u>2015</u>	<u>2014</u>	<u>2013</u>	<u>2012</u>
	tons	% of total	tons	tons	tons	tons
Source						
Dairy manure ¹	3,901	46.3	3,642	3,327	2,841	3,395
Dairy solids ²	846	10.0	1,404	1,806	1,529	1,220
Dairy pack ³	1,728	20.6	1,683	1,254	875	992
Dairy subtotal	6,475	76.9	6,729	6,387	5,245	5,607
Campus ⁴	466	5.5	672	520	544	557
An Sci manure	579	6.9	461	363	158	205
Dining ⁵	292	3.5	340	344	321	372
Biomass ⁶	365	4.3	292	340	305	194
Stalks ⁷	189	2.3	165	215	162	151
Other ⁸	<u>58</u>	<u>0.6</u>	<u>29</u>	<u>30</u>	<u>32</u>	<u>33</u>
Total	8,424	100.0	8,688	8,199	6,767	7,119

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>2016</u>	<u>2016</u>	<u>2015</u>	<u>2014</u>	<u>2013</u>	<u>2012</u>
	tons	% of total	tons	tons	tons	tons
Amended soil	7,389	96	3,381	3,648	5,525	5,233
Compost	29	0.3	26	630	87	353
Stalks	0	0	22	0	0	0
Black dirt	276	3.7	246	0	0	0
Total	7,694	100.0	3,675	4,278	5,612	5,586