

The ISU Compost Facility after Eight Years

RFR-A17121

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Introduction

The University Compost Facility, 52274 260th Street, Ames, Iowa, has completed eight 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.

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 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 25 to 30 turns. Frequency of turning is determined by windrow temperature and moisture content. 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 8,110 tons were received in 2017 (Table 1). This is 4 percent less than 2016. About 71 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 5,637 tons were outgoing from the facility in 2017, a decrease of 2,022 tons (26 percent) compared with 2016 (Table 2). This was due to a decrease in the needs from construction projects on campus. The inventory of finished compost remained about the same even with slightly decreased inputs and decreased

outputs. About 291 tons of compost, 5,637 tons of amended soil, and 193 tons of black dirt were outgoing. 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 covers that cover the entire hoop structure from concrete wall to concrete wall work well and appear to be fairly durable. One-and-a-half covers were replaced in 2017. One or two more covers will be replaced this summer. More covers will continue to be installed until all are replaced.

Concrete aprons were added to the ends of hoop barns last year to reduce the gravel when pushing the ends of windrows before turning. More aprons will be added this year.

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

The facility continued screening all compost at the facility. The screener removes the foreign material and rocks. However, the screener does not break up soil chunks or screen wetter material. Therefore, by drying this material in a windrow and re-screening, 80 percent can be recovered as clean.

During 2017, 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.

Acknowledgements

The authors gratefully acknowledge the support and interest of the Iowa DNR, ISU College of Agriculture and Life Sciences, ISU Extension, Leopold Center for Sustainable Agriculture, and ISU Research Farms.

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

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Table 1. ISU Compost Facility inputs.

	<u>2017</u> tons	<u>2017</u> % of total	<u>2016</u> tons	<u>2015</u> tons	<u>2014</u> tons	<u>2013</u> tons
Source						
Dairy manure ¹	3,722	45.9	3,901	3,642	3,327	2,841
Dairy solids ²	552	6.8	846	1,404	1,806	1,529
Dairy pack ³	<u>1,507</u>	<u>18.6</u>	<u>1,728</u>	<u>1,683</u>	<u>1,254</u>	<u>875</u>
Dairy subtotal	5,781	71.3	6,475	6,729	6,387	5,245
Campus ⁴	649	8.0	466	672	520	544
An Sci manure	458	5.6	579	461	363	158
Dining ⁵	411	5.1	292	340	344	321
Biomass ⁶	481	6.0	365	292	340	305
Stalks ⁷	287	3.5	189	165	215	162
Other ⁸	<u>43</u>	<u>0.5</u>	<u>58</u>	<u>29</u>	<u>30</u>	<u>32</u>
Total	8,110	100.0	8,424	8,688	8,199	6,767

¹Semi-solid dairy barn scrapings.

²Solids from the manure separator.

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.

⁸All other sources.

Table 2. ISU Compost Facility outputs.

	<u>2017</u> tons	<u>2017</u> % of total	<u>2016</u> tons	<u>2015</u> tons	<u>2014</u> tons	<u>2013</u> tons
Amended soil	5,637	92.1	7,389	3,381	3,648	5,525
Compost	291	4.7	29	26	630	87
Stalks	0	0	0	22	0	0
Black dirt	<u>193</u>	<u>3.2</u>	<u>276</u>	<u>246</u>	<u>0</u>	<u>0</u>
Total	6,121	100.0	7,694	3,675	4,278	5,612