The ISU Compost Facility after 10 Years

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Introduction

The University Compost Facility has completed 10 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 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 8,860 tons were received in 2018 (Table 1). This is 9 percent more than 2017. About 80 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 4,996 tons were outgoing from the facility in 2018, a decrease of 641 tons (12 percent) compared with 2017 (Table 2). This was due to a decrease in the needs from construction projects on campus. The inventory of finished compost increased slightly with increased inputs and decreased outputs. About 222 tons

of compost, 4,996 tons of amended soil, and 92 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 that haven't been replaced 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 cover was replaced in 2018. One cover will be replaced this summer. More covers will continue to be installed until all are replaced.

Concrete aprons were added to the ends of some of the 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.

In 2018, composting at the facility was challenging. The winter had average to below average temperatures with little snowfall until late winter/early spring. Cool temps and above average rainfall and snow during the spring slowed composting, and the summer had a lot of rain, which had little effect on composting under the hoops. The exterior windrows (not under hoops) did not dry out because of the excess rainfall and were not screened in the fall. A wet and cool fall slowed composting considerably. It offered no opportunity to screen the finished compost until December.

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 well. Therefore, by drying this material in a windrow and re-screening, 80 percent can be recovered as clean.

During 2018, 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.

In 2019, a new finished compost storage building is planned. Then the hoop barn used for finished compost will be used for composting. The hoop barn will be needed as the new ISU Poultry Farm comes online.

The ISU Compost Facility continues to serve a unique and vital role in assisting ISU to 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.

	2018 tons	2018 % of total	2017 tons	2016 tons	2015 tons	2014 tons
Source						
Dairy manure[1]	4,729	53.4	3722	3,901	3,642	3,327
Dairy solids[2]	688	7.8	552	846	1,404	1,806
Dairy pack[3]	1,709	19.3	1,507	1,728	1,683	1,254
Dairy subtotal	7,126	80.4	5,781	6,475	6,729	6,387
Campus[4]	421	4.8	649	466	672	520
An Sci manure	476	5.4	458	579	461	363
Dining[5]	355	4.0	411	292	340	344
Biomass[6]	6	0.0	481	365	292	340
Stalks[7]	275	3.1	287	189	165	215
Other[8]	201	2.3	43	58	29	30
Total	8,860	100.0	8,110	8,424	8,688	8,199

[1]Semi-solid dairy barn scrapings.
[2]Solids from the manure separator.
[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.
[8]All other sources.

Table 2. ISU Compost Facility outputs.

	2018 tons	2018 % of total	2017 tons	2016 tons	2015 tons	2014 tons
Amended soil	4,996	94.1	5,637	7,389	3,381	3,648
Compost	222	4.2	291	29	26	630
Stalks	0	0	0	0	22	0
Black dirt	92	1.7	193	276	246	0
Total	5,310	100.0	6,121	7,694	3,675	4,278