

## ISU Compost Facility: 2020 Update

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### Introduction

The University Compost Facility has completed 12 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 260<sup>th</sup> 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. This year a 75 x 189 ft mono-slope steel frame building was constructed to store finished and screened compost, topsoil, and amended soil for sale. 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 includes 1) compost turner, a used pull-type Aeromaster PT-170, 14 ft wide, made by Midwest Biosystems, Tampico, Illinois; 2) a 2017 dump trailer made by Berkelman Welding, Ontario, Canada, used to construct windrows and haul material; 3) a 2019 telehandler, Caterpillar TH408 with a bale spear, pallet forks, 1.25 yd bucket and 2.75 cubic yard bucket; 4) a tractor, 2003 John Deere 7520 (125 PTO hp) with IVT (Infinitely 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 inaccessible to the wheel loader.

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 per week. The composting process takes about 12 to 16 weeks with 25 to 30 turns. Frequency of turning is determined by windrow temperature, moisture content, and weather. Turning provides mixing and aeration. When the oxygen level in the windrow falls below atmospheric oxygen levels, the windrows benefit 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), Poultry Farm, Campus Services (yard and greenhouse waste), ISU Dining (food waste), Hansen Learning Center (arena wood shavings), BioCentury Research Farm, Ag Engineering/Agronomy Farm, Plant Introduction Station, Reiman Gardens, Horticulture Station, and others. A total of 8,058 tons were received in 2020 (Table 1). This is about 14 percent less than 2019. Some of the decrease is attributed to drier weather and changes to dairy cattle management. About 75 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 3,289 tons were outgoing from the facility in 2020, a decrease of 1,153 tons (26 percent) compared

with 2019 (Table 2). This was due to a decrease in the needs from construction projects on campus. The inventory of finished compost increased significantly with decreased outputs. About 62 tons of finished and screened compost were outgoing from the facility. 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.

Due to the COVID-19 pandemic and the associated budget constraints, only ongoing capital projects were allowed to finish on campus. New capital projects were delayed or cancelled, thus requiring less amended soil. With lower demand for amended soil and compost, the decision was made to apply compost to ISU/CAD farm fields near the facility. This applied compost was wetter and about 75 percent composted. Approximately 1,163 tons of compost was hauled to the field. This allowed room to continue composting new material coming into the facility.

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 2020. One more cover will be replaced this spring. More covers will continue to be installed until all are replaced.

On August 10, 2020, the compost facility was hit by a derecho. With winds in excess of 75-80 mph for 20-30 min, one of the hoop barns was destroyed. It will be replaced this year.

No concrete aprons were added to the ends of hoop barns last year. More aprons will be added in the coming year.

The new material handling building was completed in spring 2020. It has been an excellent addition. The material handling building stores finished and screened compost, topsoil, and amended soil. With more material coming into the facility to compost, more space was needed for windrows. Thus, the new building allowed a hoop barn previously used for storage of amended soil to be used for composting.

Variable weather made composting at the facility challenging although the dry year was generally beneficial. The early winter was warmer than average. January and February had average to below average temperatures with little snowfall until late winter/early spring, similar to 2019. The spring was warmer and drier. Combined with hauling compost to the field, composting in the spring went well. The weather cooperated and allowed for screening of compost that had not been able to be screened because of the wet conditions. We were able to screen all finished compost in the fall, which had not happened the previous year. The remainder of the fall was good for composting, thus the windrows were drier going into winter.

The facility continued screening all compost needed for amended soil. A trommel screen is rented one to two times per year. The screen removes the foreign material and rocks. However, the screen does not break up soil chunks or separate wetter material well. The material that does not go through the screen is called overs. This material, consisting mostly of rock, garbage, and large chunks of compost, is put into windrows on an open air dirt pad to be reclaimed. These windrows are turned periodically to aid in drying them out. The warm and dry conditions of this last summer helped dry out the overs windrows so they would be easy to screen. Therefore, by drying this material in a windrow and re-

screening, 80 percent can be recovered as clean.

During 2020, the hoop barns were used as follows: 1) the central hoop barn was used for receiving, mixing, and storage of raw materials; 2) the remaining six hoop barns plus the smaller hoop barn were dedicated to general composting.

An additional project on the horizon is a pilot project where the compost facility will start composting the paper towel waste from the bathrooms around campus and vet med. This is being done to reduce the amount of garbage being sent to the landfill.

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**

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**Table 1. ISU Compost Facility inputs.**

	<u>2020</u> tons	<u>2020</u> % of total	<u>2019</u> tons	<u>2018</u> tons	<u>2017</u> tons	<u>2016</u> tons
Source						
Dairy manure <sup>1</sup>	3,975	49.3	4,497	4,729	3,722	3,901
Dairy solids <sup>2</sup>	450	5.6	609	688	552	846
Dairy pack <sup>3</sup>	1,676	20.8	2,190	1,709	1,507	1,728
Dairy subtotal	6,101	75.7	7,296	7,126	5,781	6,475
Campus <sup>4</sup>	441	5.5	416	421	649	466
An Sci manure	729	9	640	476	458	579
Dining <sup>5</sup>	198	2.5	295	355	411	292
Biomass <sup>6</sup>	14	0.2	0	6	481	365
Stalks <sup>7</sup>	372	4.6	427	275	287	189
Other <sup>8</sup>	<u>203</u>	<u>2.5</u>	<u>201</u>	<u>201</u>	<u>43</u>	<u>58</u>
Total	8,058	100.0	9,275	8,860	8,110	8,424

<sup>1</sup>Semi-solid dairy barn scrapings.

<sup>2</sup>Solids from the manure separator.

<sup>3</sup>Bedded packs from dairy barns.

<sup>4</sup>Consists of campus yard waste (leaves, etc.) and greenhouse waste.

<sup>5</sup>Compostable dining hall and kitchen food wastes.

<sup>6</sup>Biomass research wastes, usually corn stalks, switchgrass, corncobs, or similar waste feedstocks.

<sup>7</sup>Cornstalks as a carbon source.

<sup>8</sup>All other sources.

**Table 2. ISU Compost Facility outputs.**

	<u>2020</u> tons	<u>2020</u> % of total	<u>2019</u> tons	<u>2018</u> tons	<u>2017</u> tons	<u>2016</u> tons
Amended soil	3,289	73	4,442	4,999	5,637	7,659
Compost*	1,225	27	55	222	291	30
Stalks	30	0	0	0	0	0
Black dirt	0	0	0	92	193	276
Total	4514	100	4497	5,313	6,121	7,965

\*Field applied compost included in total.