



Iowa State Compost Facility

Steve Jonas—compost facility manager

The Iowa State University Compost Facility has completed 15 full years of operation. The facility is managed by the Iowa State Research Farms and has a separate revolving account that receives fees and sales and pays expenses. The facility is designed to be self-supporting, meaning it does not receive allocations for its operations.

Facility Summary

The compost facility consists of seven, 80 × 140 ft. hoop barns and a 55 × 120 ft. hoop barn, all with paved floors. This year a 75 × 89 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. × 70 ft. platform to weigh all materials.

Key machinery at the compost facility includes: 1) compost turner, a pull-type Aeromaster PT-170, 14 ft. wide, made by Midwest Biosystems 2) a 2017 dump trailer made by Berkelman Welding, used to construct windrows and haul material; 3) a 2019 telehandler, Caterpillar TH408, with a bale spear, pallet forks, 1.25 yard bucket, and 2.75 cubic yard bucket; 4) a tractor, 2019 John Deere 6155R (150 PTO hp), with IVT (infinitely variable transmission) and front-wheel assist used to pull the turner and dump trailer; and 5) a 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 to 30:1 and moisture of 45-50%. 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/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.

2022 Updates

The facility receives manure and biomass from several Iowa State 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 6,896 tons were received in 2022 (Table 1). This is about 8% less than 2021. Some of the decrease is attributed to drier weather and changes to dairy cattle management. About 77% of the incoming material came from the Iowa State Dairy Farm.

Table 1. ISU compost facility inputs.

Source	2022		2021	2020	2019	2018
	tons	% of total				
Dairy manure ¹	2,547	34.8	4,001	3,975	4,497	4,729
Dairy solids ²	0	0	41	450	609	688
Dairy pack ³	2,823	38.6	1,699	1,676	2,190	1,709
Dairy subtotal	5,370	73.4	5,741	6,101	7,296	7,126
Campus ⁴	400	5.5	337	441	416	421
An Sci manure	750	10.3	737	729	640	476
Dining ⁵	222	3	191	198	295	355
Biomass ⁶	223	3	86	14	0	6
Stalks ⁷	201	2.7	260	372	427	275
Other ⁸	153	2.1	79	203	201	201
Total	7319	100.0	7,431	8,058	9,275	8,860

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.

Source	2022		2021	2020	2019	2018
	tons	% of total	tons			
Amended soil	4,058	94	2,893	3,289	4,442	4,999
Compost*	55	1	1,180	1,225	55	222
Stalks	201	5	0	30	0	0
Black dirt	0	0	0	0	0	92
Total	4,314	100	4,073	4,514	4,497	5,313

The facility generated compost and amended soil primarily for campus use. A total of 4,113 tons were outgoing from the facility in 2022, an increase of 1,220 tons (42%) compared with 2021 (Table 2). This was due to an increase in the needs from construction projects on campus. The inventory of finished compost remained about the same. Some compost was field-applied in the fall of 2021, which helped reduce inventory. About 2,084 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. Fifty-five tons of compost were used for several research projects as a soil amendment to plots.

The remaining cover on one of the large hoops that hadn't been replaced was replaced this fall. The hoop covers that cover the entire hoop structure from concrete wall to concrete wall, work well, and appear to be fairly durable. One more half cover on a smaller hoop will need to be replaced. Also in the fall, hoop structure damage from the derechos of 2020 and 2021 was fixed. There were several rafter pieces and legs that needed to be replaced. All of the older remaining hoops had the legs reinforced where these attach to the piers holding them up. A 1/4 inch plate of steel measuring 12 x 24 in. was used to attach the foot of the hoop legs more securely with the goal of minimalizing further damage.

One concrete apron was added to the west end of the smaller hoop barn last year. More aprons will be added in the coming years.

The 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 2021. The spring was cooler and wetter, which slowed the composting process. Overall, composting during the year went well. It was possible to screen all finished compost in the fall, similar to the previous year. The remainder of the fall was good for composting, therefore 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 is put into windrows on an open air dirt pad to be reclaimed. This material is mostly rock, garbage, and compost that was too chunky to fit through the screen. These windrows of material are turned periodically to aid in drying. The warm and dry conditions of this last summer helped dry out the overs windrows so these would be easy to screen. Therefore, by drying this material in a windrow and re-screening, 80% can be recovered as clean.

During 2022, the central hoop barn was used for receiving, mixing, and storage of raw materials, and the remaining six hoop barns, plus the smaller hoop barn, were dedicated to general composting.

A project to compost the paper towel waste from the bathrooms around the vet med facility continued this year. This is being done to reduce the amount of garbage sent to the landfill.

The Iowa State 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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