An Assessment of Manure-based Compost Markets in Michigan

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Disclaimer

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Abbreviations

cu m	cubic meter
cu yd	cubic yard
EU	European Union
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EPP	Environmentally Preferable Products
FSMIP	Federal-State Marketing Improvement Program
MDARD	Michigan Department of Agriculture and Rural Development
MSU	Michigan State University
STA	US Composting Council Seal of Testing Assurance
USCC	US Composting Council
USDA	U.S. Department of Agriculture
WTP	Willingness to pay

Executive Summary

The goal of this study was to generate a report that farmers can use to make informed decisions about making compost from manure and other agricultural byproducts to increase farm income by selling compost to consumers. The study and report update a similar effort that was conducted in 2005.

In this descriptive study, researchers surveyed Michigan equine operation owners, farmers, landscapers, and nursery and greenhouse operators. The surveys differed across industries. For example, farm, landscape, and greenhouse and nursery respondents were asked questions related to their operations, preferred compost specifications, compost manufacturing and use, and demographics. Owners of equine operations were asked about their businesses, bedding and manure management preferences, and demographics.

The survey instruments included Likert-type, dichotomous, multiple answer, and open-ended questions.

Findings

The analysis of the survey data show that while farmers, landscapers, and greenhouse and nursery operators are familiar with compost, many are strongly reluctant to use it because they don't see its value.

When asked what compost specification was considered most important, landscapers and greenhouse and nursery operators indicated "consistent product quality" while farmers indicated "cost/quality relationship." "Cost/quality relationship" and "consistent product quality" were also the most important compost specification identified by farmers and landscapers, respectively, in the 2005 compost marketing study (Gould, 2005). In the 2005 study, "consistent product quality" was ranked the second most important specification behind "nutrient availability" for greenhouse and nursery operators.

When farmers, landscapers, and greenhouse and nursery operators were asked in 2005 and 2019 whether they intended to increase compost use, the majority said no. The consistency of this response is significant because it shows that efforts to educate these audiences about producing and using compost over the past 14 years have been largely ineffective. Attitudes and perceptions toward compost across the three sectors have not changed.

The study did uncover opportunities to change the perceived value of compost. Farmers and landscape operators indicated they would be willing to use compost that has proven and demonstrated ability to improve soil health. Farmers, landscapers, and greenhouse and nursery operators indicated they would consider using compost if its economic value could be clearly demonstrated to them. Landscapers expressed interest in composting waste materials generated in their own operations. These three opportunities provide a clear roadmap for increasing compost manufacturing and use in the state.

Farmers and greenhouse and nursery operators said they were willing to pay up to $25 per cubic yard while landscape operators were willing to pay between $26 and $50 per cubic yard for compost with a proven and demonstrated ability to improve soil health. Price lists obtained in April 2020 from 29 municipal and commercial composting operations on the Michigan Department of Environment, Great Lakes, and Energy registered composting facilities list found the price for bulk compost ranged from $6 to $34.50 per cubic yard. These prices all fall within the range farmers, landscapers, and greenhouse and nursery operators indicated they would be willing to pay for compost. This suggests that the use of compost could increase if quality standards could be met at a competitive price.

Equine operations are generally considered good sources of carbon for compost production. (Wood shavings and sawdust make up 60% of the bedding used in equine operations.) Transporting carbon-laden horse manure to composting sites is a challenge, however. Equine owners were asked how likely they would be to use one of four manure management service options. Of those options, 42% of operators indicated they would most likely choose to have someone come to their operation and pick

up a supplied container on a regular schedule or as needed. Equine operators said they would pay $92.50 a month for this service, the greatest value they placed on any of the manure management options offered. This combination of factors suggests that compost producers might want to consider placing containers at equine operations to collect manure and spent bedding.

Cost of compost production figures from four farming operations – one organic vegetable farm, one beef operation and two dairy farms – ranged from $19.39 to $34.46 per cubic yard. Given these cost of production figures and landscape firms and nurseries willingness to pay $25 to $50 per cubic yard for proven compost, it appears that the use of compost could increase. Farmers appear unlikely to use more compost they have to buy; however, they may be willing to use more compost they produce from their own farm operations.

The value of nutrients in compost could match that of some fertilizers and soil conditioners at a lower price. Furthermore, the cost of land application for a composted product may be lower and more environmentally sustainable than the direct application of manure, especially during the winter months.

Recommendations

The following recommendations and action items can be used to develop a plan with short- and long-range goals to increase compost use in the agricultural, landscape, and greenhouse and nursery sectors.

Recommendation	Action Item
Increase consumer confidence in compost's performance as a soil amendment.	• Adopt a standard set of compost specifications that enable compost manufacturers to make compost with a proven ability to consistently improve soil health. • Secure funding for basic and applied research projects to prove the relationship between the cost and quality of compost and soil health. • Conduct basic education with and for farmers, landscapers, and greenhouse and nursery operators to increase their understanding of how to use compost to improve soil health. • Teach farmers, landscapers, and greenhouse and nursery operators how to manufacture compost that meets their soil improvement needs.
Increase investment in composting facilities.	• Facilitate communication of potential compost users and producers with officials from the Michigan Department of Agriculture and Rural Development (MDARD), the Michigan Department of Environment, Great Lakes, and Energy (EGLE), Michigan State University, and other stakeholders about possible changes to Part 115: Solid Waste Management of Public Act 451 of 1994. EGLE has proposed legislative changes that would impose registration, oversight, permitting costs, and inspection requirements on commercial compost sellers. Farmers are reluctant to invest in developing commercial compost operations until their concerns about the pending legislation are addressed. • Ensure effective implementation of state policy so that yard waste, food waste, and other organic feedstocks end up in composting sites, anaerobic digesters, animal feed, and other suitable places rather than in landfills. • Work with compost manufacturers to develop compost delivery options to agricultural, landscaping, and greenhouse and nursery operations. • Study the feasibility of using containers to haul manure from equine operations to central composting sites. • Explore the feasibility of forming one or more cooperative ventures to produce compost.

Introduction

To better understand why this project was initiated, it is helpful to understand the conditions in the agricultural industry in Michigan that created the need for a compost marketing study. Following is a brief overview of the situation farmers were in from 2000 through 2020, when this project was initiated.

Agricultural conditions (2000–2018)

In the early 2000's, tight profit margins, high manure transportation costs, water quality concerns, and other factors caused Michigan farmers to take a serious look at compost production as an alternative manure management practice. Responding to farmers' need for market information, in 2005 MSU Extension was awarded a Federal State Marketing Improvement Program grant to conduct a statewide comprehensive compost market assessment. The long-term goal of the study was to identify ways to help increase the volume of manure-based compost purchased by the greenhouse and nursery, landscape, and agricultural sectors of the Michigan economy. The resulting report estimated that the total demand for compost across the three sectors was about 17 million cu yd of compost a year with an estimated value of $200 million. Nearly 90% of the demand potential came from the agriculture sector (Gould, 2005).

Through 2010, data from the compost market assessment report were used in a variety of ways in MSU Extension programming, by MSU researchers, and by others:

- In a four-page MSU Extension summary bulletin that was distributed to:
  - Farmers seeking compost marketing information.
  - Participants in manure management and compost production workshops.
  - About 600 livestock producers and horse owners who attended an educational program or received a farm visit.
  - An Eaton County sheep farmer who used the bulletin to launch a successful composting business. On average he produced (and sold out) 400 cu yd of compost per year. Because of the high quality of his compost, repeat customers were willing to pay $50 for 25-pound bags and $20 for 10-pound bags. The farmer also launched a successful consulting business working with Michigan companies seeking to divert organic materials away from landfills and into cattle feed, compost, or anaerobic digesters.
- On the MSU Extension website.
- In MSU Extension news articles to inform farmers of how they could benefit from the report and where to find copies of it.
- To help determine the viability of marketing compost digester fiber for a 2006 regional anaerobic digester feasibility study.
- To inform a 2008 and 2009 study of the feasibility of multiple regional manure composting facilities.
- In compost marketing efforts by yard waste composting operations.

Agricultural conditions (2018 to now)

Farmers still contend with the issues – tight profit margins, high manure transportation costs, water quality concerns, and more – that motivated researchers to undertake the 2005 study. As they grapple with the financial and other decisions they must make as part of deciding whether to invest in new commercial composting operations, farmers aren't willing to rely on the 14-year-old data from the original study.

(Farmers have also said they are reluctant to invest in commercial composting operations because of possible changes to Part 115: Solid Waste Management of the Public Act 451 of 1994. EGLE has proposed changes that would impose registration, oversight, permitting costs, and inspection requirements on commercial compost sellers. Under the proposed changes, compost producers would

be exempt from the new regulations if they use the compost on their own farms. Farmers' concerns about the proposed changes will need to be addressed before many of them will be comfortable with composting commercially.)

This report provides updated compost market data that current and potential compost manufacturers can use to make informed financial decisions on making compost commercially.

(In this report, the word "consumers" applies to operations in the nursery, landscape and agricultural sectors of the Michigan economy that are currently using compost or that could buy compost.)

Literature Review

Many farmers begin composting agricultural byproducts thinking they will be able to sell what they manufacture. They jump in with both feet, make a lot of compost, and then discover that the consumers they want to sell their compost to either don't want it or don't want to pay enough to cover the cost of producing it. Eventually these farmers stop composting because the expected return on their investment is not there.

Markets for compost are out there, but to succeed in them, farmers must begin with the end in mind. They need to identify and learn about those markets, then produce the type of compost the markets want. Though necessary, time constraints and lack of marketing acumen make this legwork a formidable challenge for many farmers. The findings of this study satisfy this basic market research step by providing information on the demand for and type of compost consumers will purchase at a price that could result in increased farm income.

Eggerth et al. (2007) noted that compost has a variety of potential applications in several market segments:

- Small- and large-scale agriculture
- Landscaping (such as providing top dressing for golf courses, parks and median strips)
- Residential and community gardening
- Greenhouse and nursery operations
- Land reclamation and rehabilitation (of landfills, surface mines, and other sites)
- Erosion control

The researchers point out that marketing studies and surveys conducted in several countries have concluded that some of the most critical elements in the use and marketability of compost products are quality and consistency. Desirable physical characteristics vary by product and intended use and may include color, uniform particle size, earthy odor, absence of contaminants, adequate moisture, concentration of nutrients, and amount of organic matter.

According to Eggerth et al. (2007), reasons for the lack of market penetration varied by market segment and application:

- **Large-scale agriculture –** Lack of compost availability during the application window; inconsistent composition, nutrient content, and toxic substance levels; procedures for bulk application, and acceptance by farmers.
- **Field crops –** Cost of transporting and applying the relatively large amounts of compost needed, and compost not available on a continuous basis.
- **Row crops, orchards, and ornamentals –** Combination of limited supply of high-quality compost and the price demanded for the product.
- **Land reclamation –** Lack of government and industry willingness to pay for the large volume of compost required.

- **Residential market –** Lack of public knowledge of possible uses for and safety of compost; public biases against certain feedstocks such as manure, yard waste, and treated municipal solid waste used to make compost.

"In some countries," Eggerth et al. (2007) notes, "the amount of compost produced each year has increased substantially. This increase has been primarily due to changes in waste management policies and environmental regulations (such as the Landfill Directive in the European Union). These changes have, in many cases, forced the producers to market compost as a replacement for other well-established products. To expand markets for compost it is important to not just replace existing compost products but to expand the usage of and develop new uses for compost."

Eggerth et al. (2007) noted that most compost made from biosolids (defined by Eggerth et al. as the treated, dewatered, organic fraction of municipal solid waste) and from yard waste was marketed in bulk form at no cost or at a relatively low cost of $3.82 to $7.65 per cu yd ($5 to $10 per cu m). (**Note:** All prices are in 2005 U.S. dollars.) High-quality yard waste compost sold in bulk for $10.70 to 12.23 per cu yd ($14 and $16 per cu m). Some bagged yard waste compost and compost from biosolids sold for $21.41 per cu yd ($28 per cu m) or more. Wholesale prices for compost freight-on-board (FOB) the facility varied from $1.53 to $15.29 per cu yd ($2 and $20 per cu m). On the other hand, retail prices (FOB the facility) fluctuated between $3.82 and $19.11 per cu yd ($5 and $25 per cu m).

Finally, Eggerth et al. (2007) pointed out that developing sustainable compost markets requires consistent quality and sustained availability of the product, proper distribution, and sound pricing, in addition to education and sales. They emphasized the importance of a consistent compost product, noting that efficient crop production depends on the use of a soil amendment of known composition and physical characteristics. Inconsistency detracts from the utility of the product and decreases consumer interest in it. It is extremely important that compost meet a fixed set of specifications. The researchers recommended developing quality assurance programs with specifications for various types of compost (Eggerth et al., 2007).

A 2001 study conducted by the Cornell Waste Management Institute found that both home gardeners and agricultural industry users (primarily vegetable growers) wanted to be able to check labels or other written materials about compost they were considering buying (Harrison, 2001). Home gardeners also wanted information from sales personnel and from Cooperative Extension Services.

The study found that industry users and home gardeners had similar concerns and determining factors when choosing compost products: price, the presence of weed seeds, nutrient analysis, chemical contaminants, and pathogens. Industry users were also concerned about product inconsistencies, while home gardeners were concerned about a product's ease of use. Neither group cited feedstock sources as a key factor in choosing a compost product.

Home gardeners and industry users responding to the survey showed a good knowledge of the potential benefits of compost use. Organic matter, use instructions, pH, N-P-K, and pathogens were the top items that home gardeners said they would like to see on a label, while pH and N-P-K were the industry users' top choices.

A follow-up to the 2001 Cornell study was commissioned by the New York State Energy Research and Development Authority to investigate the feasibility of creating a New York State-specific program to monitor and certify the quality of compost products. A 2003 report on the study results (Harrison, 2003) recommended against developing such a program because:

- No state agency was equipped and willing to undertake such a program at the time.
- No money was available to cover the significant advertising campaign needed to make the program effective.

The report recommended instead that compost producers take the following actions:

- Investigate whether an existing seal or certification program would meet their needs.

- Continue to cooperate with the New York State Department of Agriculture and Markets to investigate the potential of including agricultural compost in the “Pride of New York” program.
- Develop promotional and educational programs for various segments of the compost consumer market.

The 2003 report also pointed out that while compost labels help inform consumers about compost products, New York State fertilizer laws and rules placed specific constraints on the content of such labels (Harrison, 2003). The report encouraged state lawmakers and regulators to change New York State laws and rules to allow agricultural compost producers to expand the information they could legally provide about their products. Harrison (2003) proposed that the following information be listed on a label:

- List of feedstocks used to make the compost.
- Contact information for the compost manufacturer.
- The results of an analysis listing pH, N:P:K, pathogens, stability/maturity, seed germination (only if claimed to be suitable for starting seedlings), organic matter content, weed seeds, salinity, % foreign materials, and possibly metals.
- Recommended uses for the compost as designated by the compost manufacturer.

It should be noted that since this report was released state lawmakers and regulators worked together to codify labeling requirements for composts that make plant nutrient claims. Part 153.1 of Article 10 of the New York State Agriculture and Markets Law defines what should be on the label. Three of the four recommendations are embodied in Part 153.1, which is as follows:

1. general characteristics:
    a. feedstock;
    b. maturity;
    c. organic matter;
    d. weed seeds/liter;
    e. density;
    f. solids;
    g. CN ratio;
    h. pH; and
    i. conductivity;
2. nutrients:
    a. total nitrogen (N);
    b. total phosphorous (P);
    c. total potassium (K);
    d. total calcium (Ca); and
    e. total magnesium (Mg);
3. metals:
    a. copper;
    b. iron;
    c. zinc;
    d. arsenic; and
    e. cadmium;

One established compost quality assurance program is the US Composting Council’s Seal of Testing Assurance (STA) Program (https://bit.ly/3g8kP7o). This compost testing, labeling, and information disclosure program is designed to:

- Help compost producers and users get the maximum benefit from using compost.
- Increase customer confidence in compost selection and use.
- Improve compost’s image and marketability.

There are many types of compost, produced from a variety of feedstocks. These products may look and perform differently in particular applications and conditions, so consumers need accurate information that helps them choose and use compost products correctly. The consumer has a right to and the compost manufacturer has an obligation to make this information available to customers (Alexander & Rattie, 2015). Key elements of the STA program are described on the STA program website. Compost manufacturers who produce STA-certified compost can participate in the organization's national marketing campaign (https://bit.ly/3iPCJxz). In Michigan, four compost production facilities produce STA-certified compost and participate in the USCC marketing program.

Harrison (2001) and Harrison et al. (2003) laid the foundation for a 2004 project aimed at providing current and potential market information to farmers who wanted to sell compost in New York State. Key findings from the project, reported by Bonhotal & Harrison (2015), substantiated much of what Eggerth et al. (2007) postulated:

- Understanding compost markets
  - Compost sold for $8 to $35 per cubic yard in the Northeastern U.S.. Product quality, market proximity, type of feedstock, bag or bulk sales, and marketing skills accounted for the price differences.
  - Compost quality requirements for different end uses varied significantly. Targeting a market was critical.
  - Competition among bagged compost products was intense in the home gardener market. Even though farm compost may be a superior product, many other bagged composts sold for only $1 to $2 per 30- to 50-pound bag. The availability of such low-cost alternatives could limit the price that agricultural compost products could command.
  - Compost that has not reached the appropriate maturity level for a specific end use should not be marketed or distributed for that use. Doing so could create problems for users that make them less likely to use compost again.
- Marketing and advertising
  - Potential consumers include:
    - Homeowners
    - Landscapers
    - Construction companies
    - Nurseries
    - Vegetable farmers
    - Local and state highway departments
    - Greenhouses
  - Communication channels include:
    - Local newspapers
    - Local home and garden centers
    - Farmer cooperatives
    - Direct mail to targeted audiences
    - Industry-specific publications
    - Newspaper columns
    - Television shows
    - Trade shows
    - Yellow pages
    - Personal websites
    - Word of mouth
    - Garden clubs
    - Cornell Cooperative Extension lists
- Uses for compost include:
  - As backfill for trees and shrubs

  - As part of container mixes or potting soil
  - In nursery beds
  - In erosion control projects
  - As a topsoil component
  - In turf establishment and maintenance projects
  - In fruit and vegetable crop production
  - In organic crop production
- Compost qualities of interest to consumers
  - Viable weed seed content
  - Soluble salts content
  - Maturity level
  - Minimized pathogen risk
  - pH level
  - Nutrient value
  - Organic matter content

The first MSU Extension compost market assessment report (Gould, 2005) further substantiated what Eggerth et al. (2007) reported. The report noted that Michigan farmers expressed strong interest in identifying and determining the viability of alternative, sustainable manure treatment methods, especially composting, to help them manage manure that could no longer be land applied. The report presented the findings of a study of compost markets in Michigan conducted in 2004. Over 1,000 respondents – from 276 landscape firms, 311 nurseries, and 437 farms – returned completed surveys with usable information. The report's executive summary can be found in Appendix A; its key findings included:

- Landscape firms
  - The three most important product specifications for compost were consistent product quality, no offensive odors, and nutrient availability. Material grade and color were the least important.
  - Over 60% of landscapers indicated interest in using compost purchased from external sources. The average price they were willing to pay was $11.60 per cubic yard.
- Nurseries
  - The three most important product specifications were nutrient availability, consistent product quality, and pH. The aesthetic properties of the compost, such as material grade and color, were the least important.
  - Nearly half of landscapers indicated interest in using purchased compost products. The average price they were willing to pay was $12.17 per cubic yard. One in five said they expected to increase their use of compost.
- Agriculture
  - The three most important product specifications were cost/quality relationship, pH, and nutrient availability.
  - On average, farmers were willing to pay $12.10 per cubic yard for purchased compost. Price ranked third as an obstacle, behind availability and product knowledge factors.
  - Farmers believed that producing compost for sale was not economical for them, but they would have considered using more compost if the economic benefits of producing it could be demonstrated.

While previous willingness to pay studies showed that respondents tended to overstate how much they might have been willing to pay (Breidert et al., 2015), it's interesting that landscape firms, nurseries, and farmers were all willing to pay similar amounts for compost.

The Michigan Department of Environment, Great Lakes, and Energy (2020a) offered the following recommendations to compost operators seeking to develop or expand markets for the compost they produce:

- To advertise composting, yard clippings, and wood collection services, list your business in the EGLE Recycled Materials Market Directory (https://bit.ly/3iPnJzP).
- To offer services to state-owned facilities, register your business as a state vendor with the Michigan Department of Technology, Management, and Budget (https://www.michigan.gov/dtmb/). Click on "Procurement" → "MI Contract Connect" → "How to Register as a Vendor." Call their Vendor Registration Help Desk at 517-373-4111 or toll free at 888-734-9749 for assistance.
- To discuss your services with local recycling coordinators (https://bit.ly/3hb0lfD) or compost operators (https://bit.ly/2YaXoV5) to determine if they can refer people to your operation.
- For starting or expanding a business, EGLE recommends contacting the Michigan Economic Development Corporation (https://www.michiganbusiness.org/). The agency can be reached by phone at 800-946-6829.

As has been mentioned earlier, state policy affects compost markets. According to EGLE (2020b), there were 111 registered compost sites in Michigan in 2020. More composting sites could be developed, but an extensive waste disposal infrastructure, low waste disposal costs, and inadequate policies and resources handicap the development of more composting sites and other alternatives to disposal. A report released by the Michigan Recycling Coalition and Michigan Organics Council deemed the following advocacy and policy priorities necessary to create a sustainable future for Michigan (O'Brien, 2017):

- Uphold the Michigan yard waste ban.
- Modify existing regulations to reduce and ultimately eliminate pricing preference for waste disposal. State policy has inadvertently made it easy and inexpensive to dispose of everything.
- Create and fund a regulatory structure focused on program performance that levels the playing field for composters and provides meaningful assurance for communities. Provide compliance assistance to producers and enforce regulations.
- Create and support a facilitated Organics Management stakeholder workgroup to identify pathways to increase organics diversion and make sustainable organics management an integral part of materials management policy and planning in Michigan.
- Increase food scrap donations by identifying and removing barriers, providing education, protection, and incentives to food processors and the food service industry
- Educate about and incentivize the use of compost to appropriate industries.
- Foster the development of organics management programs through education and grant funding. (p. 2)

In conclusion, the literature seems to indicate that barriers to marketing compost can be overcome by educating consumers on how to use compost and then producing consistent, affordable products consumers will purchase and use. State policies supporting the collection and manufacturing of compost can also help increase compost use.

Objectives

The main goal of this study was to conduct a statewide comprehensive compost market assessment and generate a report that farmers can use to make informed decisions about making compost from manure and other agricultural byproducts to increase farm income by selling compost to consumers. The study and report update a similar effort that was conducted in 2005. Specific project objectives were to:

- Identify existing and potential compost users in Michigan.
- Quantify the current use of compost.
- Identify the product specifications for each user group.
- Estimate the potential future demand for compost.
- Identify the potential barriers to compost market development.

- Identify and quantify potential sources of carbon feedstocks used to make compost.
- Estimate costs of production for different market segments based on perceived product specifications and cost items including the cost of aggregation, drying, standardization, packaging, distribution, and transportation.

Study Limitations

The study represents a snapshot of the current use, beliefs and expectations by respondents of the three sample populations regarding compost in their industries. It is limited by the responses to the survey questions, which were designed to fulfill the research objectives stated earlier. The results of the study are not intended to represent a business or marketing plan for any specific compost manufacturing operation. Rather, the study documents, on a macroeconomic scale, the potential demand for compost in Michigan and Michigan consumer preferences related to compost quality, nutrient values, and price.

Methods

This section discusses the sampling design, research instruments, and data collection and analysis methods used for each study objective.

Objectives 1 to 5

1. Identify existing and potential compost users in Michigan.
2. Quantify the current use of compost.
3. Identify the product specifications for each user group.
4. Estimate the potential future demand for compost.
5. Identify the potential barriers to compost market development.

In this descriptive study, researchers surveyed Michigan equine operation owners, farmers, landscapers, and nursery and greenhouse operators. With the exception of two additional questions, the survey instruments were the same as those used in the 2005 study. The survey instruments included Likert-type, dichotomous, multiple answer, and open-ended questions. Respondents were asked questions related to their operations, preferred compost specifications, compost manufacturing and use, and demographics (Appendices B through E).

An advisory committee that included representatives from the equine, nursery and greenhouse, landscaping, and agricultural industries gave input on the survey questions. The agriculture, landscape, and greenhouse and nursery surveys were pretested among a sample population from those groups, and the surveys were revised based on the results of the pretests. The equine survey was not pre-tested due to time constraints in completing the survey. The final survey instruments were examined by Ramjee Ghimire Ph.D. and deemed reliable and valid. The MSU Institutional Review Board reviewed and approved this study and the data collection instruments.

The research team worked throughout the study to ensure that subjects were participating voluntarily and that the subjects' personal details and survey responses were kept confidential. A description of how each study population was selected and surveyed follows.

We purchased a list of mailing addresses for farms and landscape firms from a commercial mailing list provider. We did not purchase their list of email addresses for the same groups because:
- The list contained a relatively small number of email addresses.

- We decided we could reach more farmers by mail than by email. (Some farmers do not use or do not have access to the internet. Lack of broadband internet access is still a significant issue for farmers and rural residents.)
- We could obtain email addresses for greenhouse and nursery and for landscape operators from a statewide trade association.

REACHING FARMS

The purchased list included large and small farms from every county in the state. Addresses could be sorted by the commodities grown on a farm. We decided that sorting by farms growing corn was the best option because corn was the most widely grown crop. Farms identified as growing corn were also identified in other commodity categories such as dairy, swine, wheat, and soybeans.

The list did not include many farms that were USDA organic certified. To reach more of these farms we collected mailing and email addresses from several industry-related groups in Michigan. Organic farms without email addresses were added to the paper survey mailing list while organic farms with email addresses were added to an online survey email list. Organic farms with email addresses were sent an email containing a link to the survey. Addresses collected from websites were crosschecked against the purchased list of addresses and duplicates removed.

Paper surveys were sent to farms through U.S. mail between April 5 and April 30, 2019. Nonrespondents were each sent two more copies of the survey about seven days apart, followed by one reminder postcard. An email with links to the online survey was sent to organic growers on March 16, 2019. Follow up email reminders were sent out on March 20, 2019 and March 27, 2019 to nonrespondents.

REACHING LANDSCAPE OPERATIONS

Paper surveys were sent to landscape operations using addresses from the purchased list of addresses and from the industry association members who did not list email addresses. An email with a link to the online survey was sent to landscape operations with email addresses.

Landscape surveys and reminders were mailed April 5 through April 30, 2019. Two follow-up surveys, plus reminder cards, were mailed about seven days apart to nonrespondents who received paper surveys. Emails to landscape operations with a link to the online surveys were sent out on March 20, 2019. Nonrespondent landscape firms received a follow-up email reminder on March 27, 2019 and April 3, 2019.

REACHING GREENHOUSE & NURSERY OPERATIONS

Greenhouse and nursery operations were sent an email on January 24, 2020 with a link to an online survey. The list of email recipients was compiled from MSU Extension greenhouse and nursery email lists. Nonrespondent greenhouse and nursery operations received two follow-up reminders to complete the survey on January 29, 2020 and February 2, 2020.

The reason why greenhouse and nursery surveys were sent out some 10 months after the agriculture and landscape surveys were sent out was because they were not accessible during March and April. March and April, when the other surveys went out, are the busiest months of the year for the greenhouse and nursery industry. Following the end of the growing season many operations close for several months for rest and relaxation and are unavailable to contact. Sending the surveys out from March through June would have resulted in a very low response rate.

REACHING EQUINE OPERATIONS

The research team chose to invite potential respondents from the equine industry to the survey through the Michigan Horse Council's Facebook page, which has 2,233 followers, because the organization represents diverse interests across the Michigan equine industry. MHC members and Facebook

followers include fair boards, show organizers, 4-H and school clubs and groups, breed associations, trail riding organizations, equine-related businesses, and equine-owning families and individuals.

An invitation to complete the survey was posted on Facebook on November 6, 2019. A reminder about the survey was posted on December 9, 2019. No other reminders were sent out due to poor time management. The online survey was closed on February 20, 2020.

Objective 6

6. Identify and quantify potential sources of carbon feedstocks used to make compost.

Data from the Michigan Waste Biomass Inventory to Support Renewable Energy Development and the Michigan Forest Biofuels Research websites was to be used to quantify sources of biomass for compost. Neither website was used. See the “Michigan Biomass Production” section later in this report for reasons why they were not used.

Members of the Michigan Horse Council were surveyed to determine bedding use, which is a potential source of carbon for compost production.

Objective 7

7. Estimate the costs of production for different market segments based on perceived product specifications cost items including the cost of aggregation, drying, standardization, packaging, distribution, and transportation).

The research team surveyed farmers who currently produce compost to obtain cost of production estimates. Estimates of the cost of transportation also were generated from survey data to obtain the total cost of compost production.

Later in this report, the value of the compost as a fertilizer or a soil conditioner will be compared to commercially available compost products to help potential compost buyers do the same. These figures also give potential compost producers insight into the market considerations involved in developing an economically sustainable business.

Data Analysis

Data for the agriculture and landscape sectors were compiled from paper and online surveys, while data from the greenhouse and equine sectors were compiled from online surveys.

Data from paper surveys were entered into Microsoft Excel and later exported to SPSS codebooks, while data from Qualtrics (online) surveys were retrieved as .CSV files and exported to SPSS. The data were checked for inconsistencies and errors in responses (including outliers and measure types) and were cleaned as needed. Two data were combined and then analyzed using SPSS software. Quantitative data were analyzed using descriptive statistics and qualitative data were analyzed using coding. The results were collated based on relationships and themes and used to construct this report.

Results

Response Rates

Farms and landscape operations were surveyed in 2019 and greenhouse and nursery operations were surveyed in 2020 to determine the compost market potential in these sectors. Equine operations were surveyed in 2019.

The farm respondent pool consisted of 5,999 unique addresses (5,773 mail and 226 email). Farms returned a total of 1,239 paper surveys with usable data (21% response rate). Email messages to 44 farms were returned as undeliverable and 55 farms completed online surveys with usable data (30% response rate).

The landscape firm respondent pool consisted of 827 unique addresses (618 mail and 209 email). Landscape firms returned 153 paper surveys with usable data (25% response rate). Email messages to 20 firms were returned as undeliverable and 41 firms completed online surveys with usable data (22% response rate).

The greenhouse and nursery firm respondent pool consisted of 621 firms that received emails with survey links. A total of 91 of these firms completed online surveys with usable data (13% response rate).

The equine respondent pool consisted of 2,233 Michigan Horse Council Facebook followers. A total of 395 followers completed online surveys with usable data (17% response rate).

Agricultural Operations

This section offers a breakdown of survey responses from agricultural operations (farms).

BACKGROUND

Producing field crops dominated as respondents' primary farming operation – 467 respondents (45.8%; Table AG1). One hundred four respondents identified "Other" as their primary farming operations. The top three write-in responses in the "Other" category of primary farming operations were retired or no longer farming, raising hay, and renting out their farms (Appendix F).

Respondents were asked to indicate how they use compost in their cropping systems. Just over half of respondents, 636, indicated they use compost in their cropping systems while 603 indicated they do not use any compost in their cropping systems (Table AG2). (**Note:** "N" denotes the number of respondents while "frequency" denotes the number of times respondents have responded or reported.)

Table AG1. Respondents' primary farming operation.

Operation	N	%
Field crops	467	45.8
Dairy	170	16.7
Beef	131	12.8
Vegetable crops	72	7.1
Fruit crops	46	4.5
Swine	21	2.1
Layers, broilers, and turkeys	8	0.8
Other (Specify)	104	10.2
Total	**1,019**	**100.0**

Table AG2. Respondents' use of compost in cropping system.

Use of compost	N	%
I use compost in my cropping system.	636	51.3
I do not use compost in my cropping system.	603	48.7
Total	**1,239**	**100.0**

When respondents were asked how they use compost in their cropping system, 21.9% indicated they use compost as a soil amendment or conditioner, 20.3% use it to increase beneficial microorganism population in the soil, 15.4% use it in place of and in conjunction with a chemical fertilizer, and 10.1% use it for water retention and conservation (Table AG3). (**Note:** Respondents could choose multiple answers for this question.)

Table AG3. Function of compost in cropping systems.

Function of compost	N	%	% of cases
As a soil amendment or conditioner	213	21.9	55.0
To increase beneficial microorganism populations in the soil	198	20.3	51.2
In place of chemical fertilizer	150	15.4	38.8
In conjunction with chemical fertility	148	15.2	38.2
For water retention and conservation	98	10.1	25.3
Control soil erosion	64	6.6	16.5
As a mulch for weed control	58	6.0	15.0
Soil and plant pathogen control	30	3.1	7.8
Buffer and control soil salts	12	1.2	3.1
Other use (Please specify)	2	0.2	0.5
Total	**973**	**100.0**	**251.4**

Note. Multiple responses were allowed.

COMPOST SPECIFICATIONS

Of the 636 respondents who indicated they currently use compost in their cropping systems:

- 214 identified a preference for the form of compost they buy: 89.3% preferred to buy compost in bulk while 10.7% preferred to buy it in bags (Table AG4).
- 200 identified a preference for how compost reaches the farm: 52% preferred to have the compost manufacturer deliver it while 48% preferred to haul it themselves (Table AG5).
- 374 indicated whether they intended to increase compost use on their farms: 49.7% said no, 35.6% said yes, and 14.7% said maybe (Table AG6).

Table AG4. Respondents' preference for buying bulk or bagged compost.

Compost form	N	%
In bulk	191	89.3
In bags	23	10.7
Total	**214**	**100.0**

Table AG5. Respondents' preference for compost transportation method.

Delivery method	N	%
Delivered by compost manufacturer	104	52.0
Self-haul	96	48.0
Total	**200**	**100.0**

Table AG6. Current compost users' intention to increase compost use on farm.

Intention	N	%
No	186	49.7
Yes	133	35.6
Maybe (please briefly explain)	55	14.7
Total	**374**	**100.0**

The top three write-in responses from respondents who indicated they might increase compost use on their farm were:

- If the price is affordable and/or there is monetary benefit.
- I make my own compost.
- I use manure generated on my farm.

The complete list of responses can be found in Appendix G.

Respondents were asked to indicate how important 19 compost specifications were to them if they currently used compost or would be to them if they did not currently use it. Table AG7 lists the 19 specifications from most to least important based on mean score. The top 5 compost specifications were cost/quality relationship, nutrient availability, consistent production quality, pH, and diversity of microorganisms.

Table AG7. Respondent rankings of various compost specifications from most to least important, based on mean score.

Specifications	Not important		Slightly important		Important		Very important		Total		
	n	%	n	%	n	%	n	%	N	M	SD
Cost/quality relationship	46	8.2	32	5.7	158	28.1	326	58.0	562	3.4	0.9
Nutrient availability	43	7.2	30	5.0	224	37.6	299	50.2	596	3.3	0.9
Consistent product quality	49	8.6	43	7.6	233	41.1	242	42.7	567	3.2	0.9
pH	58	10.1	63	11.0	256	44.8	195	34.1	572	3.0	0.9
Diversity of beneficial microorganisms	56	10.5	70	13.2	232	43.7	173	32.6	531	3.0	0.9
Water holding capacity	64	11.7	99	18.1	253	46.3	130	23.8	546	2.8	0.9
Salinity	70	13.4	93	17.7	226	43.1	135	25.8	524	2.8	1.0
Carbon-to-nitrogen ratio	69	12.7	89	16.4	246	45.2	140	25.7	544	2.8	1.0
Moisture content	84	15.1	108	19.5	251	45.2	112	20.2	555	2.7	1.0
No offensive odor	90	15.5	136	23.4	188	32.3	168	28.9	582	2.7	1.0
Ash content	81	15.7	148	28.7	205	39.8	81	15.7	515	2.6	0.9
Density (weight)	95	17.9	121	22.7	239	44.9	77	14.5	532	2.6	0.9
Material grade/size: Medium – ¾"	143	29.7	98	20.4	192	39.9	48	10.0	481	2.3	1.0
Material grade/size: Fine – 1/8"	162	34.5	104	22.2	125	26.7	78	16.6	469	2.3	1.1
Contains biochar	132	29.4	141	31.4	146	32.5	30	6.7	449	2.2	0.9
Material grade/size: Coarse – 1"+	193	44.0	112	25.5	95	21.6	39	8.9	439	2.0	1.0
Color: Dark brown	300	62.9	61	12.8	92	19.3	24	5.0	477	1.7	1.0
Color: Black	298	62.7	58	12.2	75	15.8	44	9.3	475	1.7	1.0
Color: Light brown	315	70.9	74	16.7	43	9.7	12	2.7	444	1.4	0.8
Other (specify)	9	42.9	1	4.8	3	14.3	8	38.1	21	2.5	1.4

Note. Scale: 1 = *not important*, 2 = *slightly important*, 3 = *important*, 4 = *very important*.

COMPOST MANUFACTURING & USE

Respondents were asked to rate their level of agreement from *strongly agree* to *strongly disagree* with seven statements related to compost manufacturing and use. Table AG8 lists the statements by respondents' level of agreement based on mean score. Respondents distinctively agree with two statements:

- "I am willing to use compost with a proven and demonstrated ability to improve soil health."
- "I would consider using compost if the economic value of doing so could be clearly demonstrated to me."

Table AG8. Agricultural respondents' level of agreement with various statements about compost manufacturing and use, listed by mean score.

Statement on compost manufacturing and use	Strongly disagree		Disagree		Agree		Strongly agree		Total		
	n	%	n	%	n	%	n	%	N	M	SD
I am willing to use compost with a proven and demonstrated ability to improve soil health.	7	1.2	56	9.5	383	64.7	146	24.7	592	3.1	0.6
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.	10	1.8	36	6.3	390	68.7	132	23.2	568	3.1	0.6
I don't really know much about the process of making compost.	63	9.2	175	25.5	296	43.1	153	22.3	687	2.8	0.9
I am interested in composting waste materials generated within my own operation.	43	8.5	149	29.5	226	44.8	87	17.2	505	2.7	0.9
My customers are seeking an alternative to chemical only treatments.	34	10.0	113	33.1	128	37.5	66	19.4	341	2.7	0.9
Producing compost for my own use is worth the time and money spent doing it.	44	8.9	176	35.5	198	39.9	78	15.7	496	2.6	0.9
The quality of compost varies greatly enough that I'm reluctant to use it.	55	11.9	214	46.3	168	36.4	25	5.4	462	2.4	0.8

Note. Scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*.

While not a major perception, more than 50% of the respondents agreed or strongly agreed with "My customers are seeking an alternative to chemical only treatments." This may be a muted acknowledgement by farmers of a shift in consumer preferences for how their food is grown. The question is whether this consumer preference will become stronger in the future, thus creating new market opportunities for compost.

Respondents were asked to indicate their level of agreement on how the factors listed in Table AG8 hindered or prevented their use of compost. Table AG9 ranks these factors by level of agreement based on mean score. Respondents had the strongest agreement with the statement "Price is too high." However, respondents seemed to reject the idea that "neighbors' concerns" and "specifications do not meet my needs" were factors affecting their use of compost.

Table AG9. Factors affecting compost use in agricultural operations, listed by mean score.

Factors	Strongly disagree		Disagree		Agree		Strongly agree		Total		
	n	%	n	%	n	%	n	%	N	M	SD
Price is too high.	18	4.4	90	22.1	225	55.3	74	18.2	407	2.9	0.8
Difficult to transport.	23	4.9	152	32.3	235	49.9	61	13.0	471	2.7	0.8
Compost isn't available when I need it.	29	6.3	171	36.9	219	47.2	45	9.7	464	2.6	0.7
Inadequate knowledge of how the compost was made.	42	8.4	169	33.9	241	48.4	46	9.2	498	2.6	0.8
Inadequate knowledge about how to use compost.	54	10.2	181	34.0	242	45.5	55	10.3	532	2.6	0.8
Lack of application guidelines.	36	7.8	188	40.9	204	44.3	32	7.0	460	2.5	0.7
Challenging to land apply.	35	7.3	202	42.3	199	41.7	41	8.6	477	2.5	0.8
Specifications do not meet my needs.	32	7.8	225	55.0	128	31.3	24	5.9	409	2.4	0.7
Neighbors raise concerns.	58	13.1	225	50.8	127	28.7	33	7.4	443	2.3	0.8

Note. Scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*.

As a follow-up to the statements in Table AG9, respondents were asked to identify other factors they felt hindered or prevented their use of compost. The written comments of 103 respondents appear in Appendix H. The top three responses were:

- They have their own manure that they apply on their farms.
- The have concerns about the economics associated with compost.
- They lack knowledge or information about making or using compost.

Respondents were asked to attach a monetary value to compost that had "a proven and demonstrated ability to improve soil health." Out of 483 respondents, 44.3% indicated the minimum value would be less than $25 per cubic yard and 31.7% indicated the maximum value would be $101 to $125 per cubic yard (Table AG10).

Table AG10. Value of compost "with proven and demonstrated ability to improve soil health."

Value of compost per cu yd	N	%
Less than $25	214	44.3
$26 to $50	17	3.5
$51 to $75	57	11.8
$76 to $100	26	5.4
$101 to $125	153	31.7
More than $125	16	3.3
Total	**483**	**100.0**

RESPONDENT CHARACTERISTICS

Of the 1,239 responses submitted with usable data the vast majority (95.5%) were paper surveys (Table AG11).

Of the 1,102 respondents who reported their position, the majority (78.8%) were owners, 15.9% were managers, and others were 5.3% (Table AG12). Of the 59 who indicated "Other" in Table AG12, 44 identified their position on the farm (Table AG13).

Table AG11. Respondents who completed paper or online surveys listed by percentage of responses.

Survey type completed	N	%
Paper survey	1,183	95.5
Online survey	56	4.5
Total	**1,239**	**100.0**

Table AG12. Respondent position in the agricultural operation.

Position	N	%
Owner	868	78.8
Manager	175	15.9
Other	59	5.3
Total	**1,102**	**100.0**

Table AG13. Respondents' written-in comments about their position in the agricultural operation.

Written comment about position	Frequency	%
Retired	12	27.2
Partner, partnership	11	25.0
Renting or leasing land and/or buildings	4	9.0
Operator.	2	4.5
Do most everything	2	4.5
Agronomist.	1	2.3
Been farming here for 25 years.	1	2.3
CEO.	1	2.3
Consultant to farms in MI.	1	2.3
Crew.	1	2.3
Worker.	1	2.3
Labor.	1	2.3
Member of LLC.	1	2.3
No longer have farm – sold.	1	2.3
Part Owner.	1	2.3
Share farm.	1	2.3
Spouse.	1	2.3
Work with son.	1	2.3
Total	**44**	**100.0**

When respondents were asked if they make the compost purchasing decisions for their farms, 60.9% said their farms do not purchase compost and 32.2% indicated they do make compost purchasing decisions for their operations (Table AG14).

Table AG14. Percentage of respondents who make compost purchasing decisions for their operations.

Decision	N	%
Yes	285	32.2
No	61	6.9
Farm does not purchase compost	539	60.9
Total	**885**	**100.0**

Of the 862 respondents who reported their gender, 90% were male (Table AG15). The majority of the respondents were more than 50 years old (Table AG16). About one-third said they have a high school diploma or GED, 25.5% said they have a college degree, 23% said they had earned some college credits but had not finished a degree, 10.4% said they had technical or vocational training, and 5% said they had earned graduate degrees (Table AG17). Survey respondents were overwhelmingly white or Caucasian (95.7%; Table AG18). Only 499 responded to the question on ethnicity; half of them (N = 248) opted not to provide their ethnicity (Table AG19) and 188 of 246 respondents did. The top three responses (Appendix I) were American (42), German American (25), and European (20).

Table AG15. Respondents' self-reported gender, listed by percentage of responses.

Gender	N	%
Male	776	90.0
Female	86	10.0
Total	**862**	**100.0**

Table AG16. Respondents' self-reported age groups, listed by percentage of responses.

Age group in years	N	%
25 or less	52	5.6
26 to 30	6	0.6
31 to 35	26	2.8
36 to 40	26	2.8
41 to 45	29	3.1
46 to 50	38	4.1
More than 50	751	80.9
Total	**928**	**100.0**

Table AG17. Respondents' self-reported highest education level achieved, listed by percentage of responses.

Highest education level	Frequency	%
High school graduate, diploma or the equivalent (for example GED)	303	33.9
College degree (ex: A.A., B.S.)	228	25.5
Some college credits, no degree	206	23.0
Trade/technical/vocational training	93	10.4
Graduate degree (ex: M.A., Ph. D.)	45	5.0
Some high school, no diploma	20	2.2
Total	**895**	**100.0**

Table AG18. Respondents' self-reported race, listed by percentage of responses.

Race	Frequency	%
White or Caucasian	853	95.7
Native Hawaiian or another Pacific Islander	6	0.7
Alaskan Native or American Indian – Tribal affiliation	1	0.1
Asian	1	0.1
Choose not to provide	30	3.4
Total	**891**	**100.0**

Table AG19. Respondents' self-reported ethnicity, listed by percentage of responses.

Ethnicity	Frequency	%
Choose not to provide	248	49.7
My ethnicity is not listed	246	49.3
Middle Eastern or Arab-American	3	0.6
Hispanic or Latino	2	0.4
Total	**499**	**100.0**

Nine hundred three respondents indicated their county of residence. Huron County had the largest number of respondents (n = 72) followed by Sanilac, Tuscola, Bay, and Saginaw with 61, 48, 41, and 40, respectively (Appendix J). One-thousand two hundred thirty-nine indicated the location of their farm. Huron County had the largest number of respondents (N = 58) followed by Sanilac, Tuscola, Bay, and Saginaw with 48, 34, 28, and 27 respectively (Appendix K).

Landscape Operations

This section offers a breakdown of survey responses from landscape operations.

BACKGROUND

Respondents were asked to choose up to three descriptions that most closely described their business or agency. Installation and maintenance landscape contractors represented the majority (76.1%) of respondents who completed the survey, followed by wholesale/retailer soil amendment outlets (6.6%) (Table LS1). Responses from those who indicated "Other" are found in Table LS2. Nine indicated they worked for a landscape architect company, three in irrigation, two each in garden center operation, tree care and removal, and hardscape, and one each for other businesses such as arborist and wholesale grower.

Table LS1. Respondents' primary business or agency type.

Business or agency of employment	N	%	% of cases
Landscape contractor – installation	134	44.5	79.8
Landscape contractor – maintenance	95	31.6	56.5
Wholesale /Retailer of soil amendments	20	6.6	11.9
Topsoil blender/manufacturer	9	3.0	5.4
Excavating company	6	2.0	3.6
Turfgrass grower	3	1.0	1.8
Parks and recreation	2	0.7	1.2
State, County, or Local Natural Resources Department	1	0.3	0.6
Other	31	10.3	18.5
Total	**301**	**100.0**	**179.2**

Note. One respondent could select up to three businesses, therefore the total responses exceeded the total number of respondents.

Table LS2. "Other" business or agency types volunteered by respondents.

Business or agency of employment	N	%
Landscape architect	9	31.0
Irrigation	3	10.3
Garden center operation	2	6.9
Tree care & removal	2	6.9
Hardscaping	2	6.9
Arborist	1	3.4
Fertilization and flower installer	1	3.4
Field nursery tree transplanting	1	3.4
Irrigation/landscape lighting	1	3.4
Public garden/museum	1	3.4
Semi-retired/one job/no employees	1	3.4
Supply yard	1	3.4
Tree grower and transplanter	1	3.4
Utility soft surface	1	3.4
Wholesale field stock grower	1	3.4
Wholesale grower	1	3.4
Total	**29**	**100.0** [a]

Note. Not all respondents indicating "Other" described their businesses, therefore the totals for "Other" in Tables LS1 and LS2 do not match.

[a] Total does not equal exactly 100% due to rounding.

When asked whether their operations generated green waste, 76% said yes (Figure LS1).

The mean annual volume of green waste reported by those who generate it was 6,347 cu yd (Table LS3). Respondents from 95 of the 108 operations reported their annual cost of disposing of green waste, with a mean of $12,869. The mean percentage of operations that compost their green waste was 67.8. Seventy-four of the 108 operations reported their volume of green waste generated, with a mean of 478 cu yd.

Figure LS1. Percentage of landscape operations that reported generating green waste.

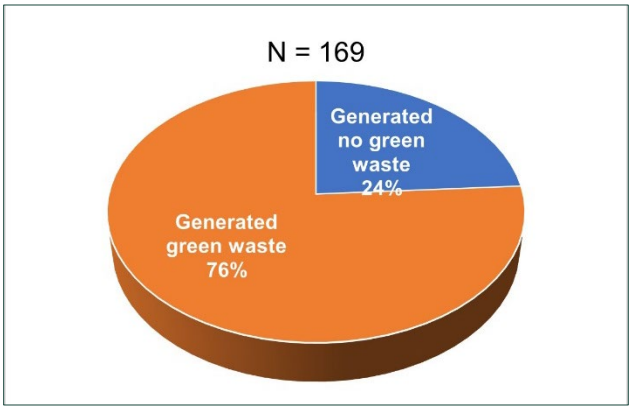


Table LS3. Green waste generation, disposal cost, and compost generation of landscape operations.

Variable	N	Minimum	Maximum	M	SD
Approximate annual volume of green waste generated by your operation in cubic yards.	108	4	55,0000	6,346.96	53,208.57
Approximate annual cost of disposing of the green waste generated by your operation.	95	0	80,0000	12,869.48	84,156.50
Percentage of green waste composted by your operation.	107	0	100	67.87	39.80
Estimated annual volume in cubic yards of compost produced from green waste generated by your operation.	74	0	5,000	478.05	1,140.21

When asked how green waste is currently managed, 65 respondents indicated “Other,” 42 respondents said they compost it, and 19 indicated they pile it up in out-of-the-way sites (Table LS4).

Table LS4. Current green waste management practices of respondents’ operations, listed by percentage.

Green waste management practice	N	%
Other	65	47.4
Composted on site	42	30.7
Piled up in out-of-the-way sites on the premise[s]	19	13.9
Put in a dumpster and sent to a landfill	11	8.0
Total	**137**	**100.0**

Table LS5 lists the written responses to “Other” in Table LS4. Bringing green waste to a composting site was the most prevalent management practice identified by respondents.

Table LS5. Written responses to "Other" present green waste management practices in Table LS4.

Present green waste management practice – other	N	%
Brought to a compost site	35	53.8
Burned	10	15.4
Brush is chipped and reused at nursery	4	6.2
Used to make soil or mulch	2	3.1
On site dump	2	3.1
Hauled away by a third party	2	3.1
Compost spread in fields.	1	1.54
Brush burned, sod scrapes, clipping composted.	1	1.54
Given away for fill.	1	1.54
Mostly sod stripping, compost to topsoil.	1	1.54
Mulched into the turf landscape.	1	1.54
Organic farmer.	1	1.54
Partially composted and then taken away by landscape contractor to finish at their site.	1	1.54
Piled and allowed to decompose naturally.	1	1.54
Topsoil compost, that blend into its topsoil.	1	1.54
Village waste drop off or composted at my home.	1	1.54
Total	**65**	**100.0** [a]

[a] Total does not equal exactly 100% due to rounding.

Respondents who did not compost were asked to briefly explain why. Eleven respondents said they do not have the time or space to compost, six said they burn green waste, and six said they used commercial composting facilities (Table LS6).

Table LS6. Respondents' reasons for not composting green waste.

Written comment	N	%
No time or space to compost green waste.	11	28.2
Green waste/woody material is burned.	6	15.3
Commercial composting facility.	6	15.3
Landfill.	5	12.8
Left at the job site.	3	7.6
I compost all grass clippings and fall leaves.	1	2.6
Municipalities don't like the smell.	1	2.6
I own 20 acres the grass clippings and leaves rotted with the feed burned brush.	1	2.6
Small ROI, high expense.	1	2.6
Some of it can't be recycled.	1	2.6
Stumps are not accepted.	1	2.6
Too much too fast and trash etc. mixed in.	1	2.6
Use as fill and cover grades.	1	2.6
Total	**39**	**100.0**

When asked whether their operations used compost during growing seasons, 65% of 159 respondents said they did (Figure LS2). Respondents also reported that they preferred compost delivered in bulk over compost packaged in bags (Figure LS3).

Figure LS2. Percentage of landscape operations reporting use of compost for any purpose during the growing season.

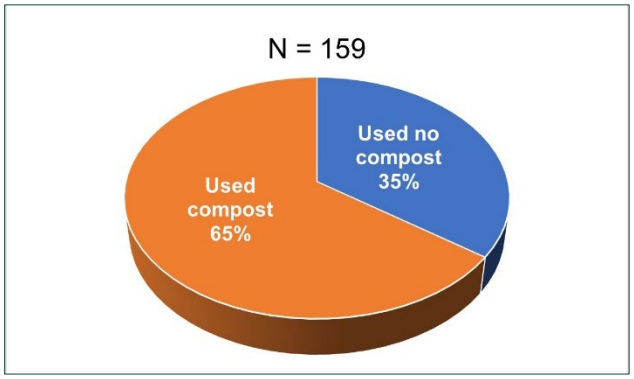
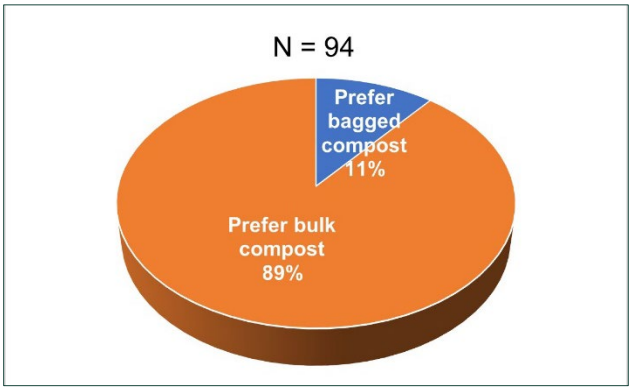


Figure LS3. Percentage of landscape operations reporting a preference for compost delivered in bulk or in bags.



Respondents were asked to estimate the total volume of compost they use annually. The mean amount for 93 responses was 387.5 cu yd. The smallest amount was 5 cu yd and the largest was 4,000 cu yd, with a standard deviation of 727.1.

COMPOST USE

Respondents were asked how they use compost. Responses to this question illustrate the wide range of uses in the landscaping sector and are found in Tables LS7 through Table LS14.

Table LS7. Landscape operations that reported using compost as a soil amendment in new installations.

Compost use	N	%	% of cases
New installation of trees/shrubs	88	40.6	90.7
New installation of planter beds	83	38.2	85.6
New installation of turf/lawns	46	21.2	47.4
Total	**217**	**100.0**	**223.7**

Note. Multiple responses were allowed.

Table LS8. Landscape operations that reported using compost as a soil amendment in maintenance projects.

Compost use	N	%	% of cases
Maintenance of planter beds	44	41.1	78.8
Maintenance of trees/shrubs	38	35.5	67.9
Maintenance of turf/lawns	25	23.4	44.6
Total	**107**	**100.0**	**191.1**

Note. Multiple responses were allowed.

Table LS9. Landscape operations that reported using compost as a mulch in new installations.

Compost use	N	%	% of cases
New installation of planter beds (surface)	46	34.1	83.6
New installation of beds around trees	43	31.9	78.2
New installation of general yard mulch	25	18.5	45.5
New installation of walkways	9	6.7	16.4
New installation of control soil erosion	8	5.9	14.5
New installation of roadside construction projects	3	2.2	5.5
New installation of bioremediation projects	1	0.7	1.8
Total	**135**	**100.0**	**245.5**

Note. Multiple responses were allowed.

Table LS10. Landscape operations that reported using compost as a mulch in maintenance projects.

Compost use	N	%	% of cases
Maintenance of planter beds (surface)	31	38.3	88.6
Maintenance of beds around trees	24	29.6	68.6
Maintenance of general yard mulch	17	20.9	48.6
Maintenance of walkways	5	6.2	14.3
Maintenance of control soil erosion	2	2.5	5.7
Maintenance of roadside construction projects	2	2.5	5.7
Maintenance of bioremediation projects	0	0.0	0
Total	**81**	**100.0**	**231.4**

Note. Multiple responses were allowed.

Table LS11. Landscape operations that reported using compost to improve soil health and structure.

Compost use	N	%	% of cases
Component of a topsoil mix	57	57.6	87.7
Improve poor and/or contaminated soils	42	42.4	64.6
Total	**99**	**100.0**	**152.3**

Note. Multiple responses were allowed.

Table LS12. Landscape operations that reported using compost blends for value-added application.

Compost use	N	%
Incorporation into mulch	18	46.2
Written responses: Add, incorporate, mix, or blend into topsoil and soil	17	43.6
Written responses: Planting mix or media	3	7.7
Written response: Root irrigation	1	2.5
Total	**39**	**100.0**

One hundred five people provided information on where they sourced compost and the season when the greatest quantity of compost was applied. Respondents overwhelmingly purchased compost from

wholesale sources (Figure LS4) and applied compost in the spring (Figure LS5). Written responses on where respondents purchased compost are found in TableLS13.

Figure LS4. Sources from which landscape operations reported buying compost.

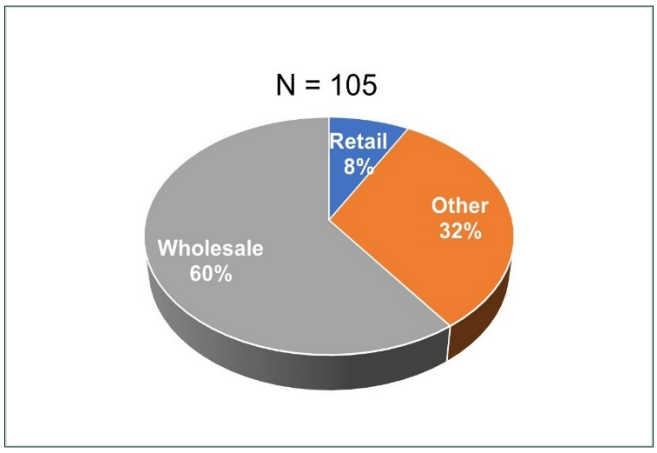


Figure LS5. Season in which landscape operations reported using the greatest quantity of compost.

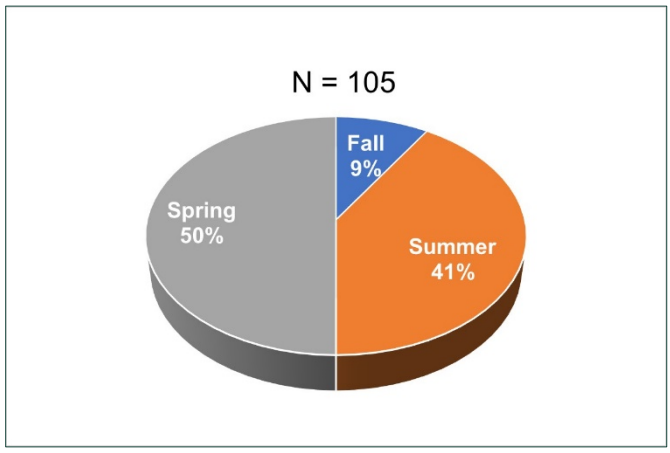


Table LS13. Written responses to where respondents buy compost for their operations, listed by percentage of responses.

Written comment	N	%
Make and use our own.	19	54.2
A little bit of our own.	1	2.8
Advanced disposal.	1	2.8
Christensen.	1	2.8
City of aa.	1	2.8
Compost facility.	1	2.8
Home Depot.	1	2.8
Horse farms.	1	2.8
Landscape operations.	1	2.8
Local farmer.	1	2.8
Manufacturer.	1	2.8
Morgan composting	1	2.8
Recycler.	1	2.8
SOCCRA.	1	2.8
Tree service companies bring it to us.	1	2.8
Veolia compost.	1	2.8
We have a yard waste drop off area.	1	2.8
Total response	**35**	**100.0**

Landscapers were asked if they intended to increase their use of compost. Of the 148 responses, 46% said “No,” 37% said “Yes,” and 17% said “Maybe” (Figure LS6). Table LS14 lists the reasons respondents listed for answering “Maybe.”

Figure LS6. Respondents' reported intentions to increase compost production in landscape operations.

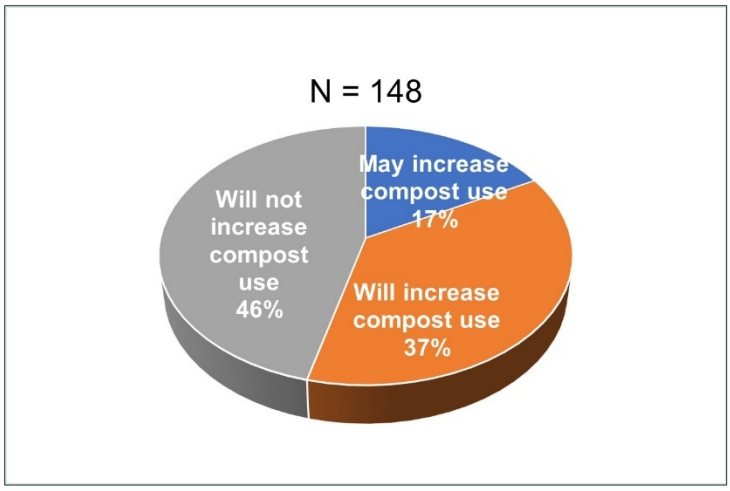


Table LS14. Respondents' written comments about whether they intended to increase compost use in their landscape operations.

Reason for response	N	%
Based on customer needs or job specifications.	5	18.5
As needed.	2	7.4
Retiring.	2	7.4
As business grows but percentages as to how we are doing things will be the same.	1	3.7
As peat moss/potting soil becomes more difficult to get we will likely switch to processed compost.	1	3.7
Cost.	1	3.7
High-quality compost was economical.	1	3.7
I try to use as often as possible.	1	3.7
If it wasn't too costly and we could dedicate space for composting.	1	3.7
New facilities.	1	3.7
On a personal level.	1	3.7
Open to ideas.	1	3.7
Probably will use about the same.	1	3.7
Replace more synthetic fertilizers.	1	3.7
Resale at detail.	1	3.7
Slightly.	1	3.7
Stay time same use on a regular basis.	1	3.7
Use as much as we make.	1	3.7
Varies year to year.	1	3.7
We only resell it.	1	3.7
We try and reuse anything we can.	1	3.7
Total responses	**27**	**100.0** [a]

[a] Total does not equal exactly 100% due to rounding.

COMPOST SPECIFICATIONS

Table LS15 shows how respondents rated the importance of various characteristics of compost. Respondents judged “consistent product quality” to be the most important, followed by “nutrient availability,” “no offensive odor,” and “cost and quality relationship”. The three least important specifications were coarse material >1 inch in size, “other,” and light brown color.

Table LS15. Respondents’ rankings of various compost specifications from most to least important, based on mean score.

Specification	Not important		Slightly important		Important		Very important		Total		
	n	%	n	%	n	%	n	%	N	M	SD
Consistent product quality	15	12.5	15	12.5	30	25.0	60	50.0	120	3.1	1.1
Nutrient availability	14	11.7	16	13.3	41	34.2	49	40.8	120	3.0	1.0
No offensive odor	18	14.8	23	18.9	27	22.1	54	44.3	122	3.0	1.1
Cost/quality relationship	17	14.9	15	13.2	32	28.1	50	43.9	114	3.0	1.1
Moisture content	12	10.3	24	20.5	50	42.7	31	26.5	117	2.9	0.9
Contains biochar	11	9.9	21	18.9	48	43.2	31	27.9	111	2.9	0.9
pH	12	10.2	21	17.8	47	39.8	38	32.2	118	2.9	1.0
Color: Black	21	21.4	17	17.3	22	22.4	38	38.8	98	2.8	1.2
Material grade/size: Fine – 1/8"	15	13.5	24	21.6	36	32.4	36	32.4	111	2.8	1.0
Salinity	12	10.8	24	21.6	45	40.5	30	27.0	111	2.8	0.9
Water holding capacity	11	9.4	28	23.9	50	42.7	28	23.9	117	2.8	0.9
Color: Dark brown	23	22.3	19	18.4	30	29.1	31	30.1	103	2.7	1.1
Ash content	13	12.1	29	27.1	41	38.3	24	22.4	107	2.7	1.0
Carbon-to-nitrogen ratio	11	9.6	33	28.7	52	45.2	19	16.5	115	2.7	0.9
Density (weight)	12	10.7	32	28.6	49	43.8	19	17.0	112	2.7	0.9
Material grade/size: Medium – ¾"	15	14.9	25	24.8	45	44.6	16	15.8	101	2.6	0.9
Diversity of beneficial microorganisms	15	14.7	36	35.3	33	32.4	18	17.6	102	2.5	1.0
Color: Light brown	26	30.2	21	24.4	15	17.4	24	27.9	86	2.4	1.2
Other (Specify)	3	50.0	1	16.7	0	0.0	2	33.3	6	2.2	1.5
Material grade/size: Coarse – 1"+	31	35.6	23	26.4	18	20.7	15	17.2	87	2.2	1.1

Note. Scale: 1 = *not important*, 2 = *important*, 3 = *important*, 4 = *very important*.

A slim majority of respondents indicated they are willing to pay $26 to $50 per cubic yard for compost that has a proven and demonstrated ability to improve soil health (Table LS16).

Table LS16. Respondents' estimates of the value of compost with proven and demonstrated ability to improve soil health.

Compost value per cu yd	N	%
Less than $25	56	45.2
$26 to $50	57	45.9
$51 to $75	9	7.3
$76 to $100	1	0.8
More than $120	1	0.8
Total	**124**	**100.0**

COMPOST MANUFACTURING & USE

Table LS17 provides insights into respondents' level of agreement with various statements related to compost manufacturing and use. The statement "I am willing to use compost with a proven and demonstrated ability to improve soil health" had the strongest mean score. Respondents disagreed the most with the statement "I don't really know much about the process of making compost."

Table LS17. Respondent's agreement level with statements about compost manufacturing and use, listed by mean score.

Statement	Strongly disagree		Disagree		Agree		Strongly agree		Total		
	n	%	n	%	n	%	n	%	N	M	SD
I am willing to use compost with a proven and demonstrated ability to improve soil health.	2	1.5	5	3.8	65	49.2	60	45.5	132	3.4	0.6
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.	1	0.8	5	4.2	74	61.7	40	33.3	120	3.3	0.6
I am interested in composting waste materials generated within my own operation.	9	7.6	20	16.8	57	47.9	33	27.7	119	3.0	0.9
Producing compost for my own use is worth the time and money spent doing it.	12	10.3	30	25.6	42	35.9	33	28.2	117	2.8	1.0
My customers are seeking an alternative to chemical only treatment.	6	6.2	33	34.0	43	44.3	15	15.5	97	2.7	0.8
The quality of compost varies greatly enough that I am reluctant to use it.	19	16.2	60	51.3	34	29.1	4	3.4	117	2.2	0.7
I don't really know much about the process of making compost.	34	25.2	61	45.2	33	24.4	7	5.2	135	2.1	0.8

Note. Scale: *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*.

While not a major perception, nearly 60% of the respondents agreed or strongly agreed with "My customers are seeking an alternative to chemical only treatments." It remains to be seen whether this will become a more important factor in the future and its potential as a market opportunity.

RESPONDENT CHARACTERISTICS

Tables LS18 through LS23 provide demographic information about the respondents.

All but 40 of the 194 participants answered the question about their positions in the companies they worked for. Most (71.1%) said they were managers, 15.7% owners, and 13.2% “other” (Table LS18). Of the 146 respondents who chose to indicate whether they make compost purchasing decisions for their operations, 94.5% indicated they do (Table LS19).

Participants were mostly male (84.8% of 151 respondents) (Table LS20). Of the 155 who reported their education level, 84 said they have a college degree (Table LS21). The overwhelming majority of respondents (97.9%) self-identified as white or Caucasian (Table LS22). Of the 157 who reported their age group, 69.4% were more than 50 years old (Table LS23).

Table LS18. Respondent position in landscape operation.

Position	N	%
Owner	25	15.7
Manager	113	71.1
Other	21	13.2
Total	**159**	**100.0**

Table LS19. Percentage of respondents who reported making compost purchasing decisions for their landscape operations.

Response	N	%
Yes	138	94.5
No	8	5.5
Total	**146**	**100.0**

Table LS20. Respondents’ self-reported gender, listed by percentage of responses.

Gender	N	%
Male	128	84.8
Female	23	15.2
Total	**151**	**100.0**

Table LS21. Respondent’s self-reported highest education level achieved, listed by percentage of responses.

Education attained	N	%
Graduate degree (ex: M.A., Ph.D.)	4	2.6
Trade/technical/vocational training	16	10.3
High school graduate, diploma or the equivalent	19	12.3
Some college credits, no degree	32	20.7
College degree (ex: A.A., B.S.)	84	54.2
Total	**155**	**100.0**

Table LS22. Respondents' self-reported race, listed by percentage of responses.

Race	N	%
White Caucasian	145	97.9
Alaskan or American Native – Tribal affiliation	1	0.7
Choose not to provide	2	1.4
Total	**148**	**100.0**

Table LS23. Respondents' self-reported age group, listed by percentage of responses.

Age group	N	%
26 to 30 years	2	1.3
26 to 30 years	4	2.5
31 to 35 years	3	1.9
36 to 40 years	5	3.2
41 to 45 years	12	7.6
46 to 50 years	22	14.0
More than 50 years	109	69.4
Total	**157**	**100.0**

Of the 93 respondents who answered the ethnicity question, 58 said their ethnicity was not listed and 35 opted not to provide their ethnicity (Table LS24). Only 41 of the 58 respondents who said their ethnicity was not listed provided their ethnicity, however (Table LS26). Ethnicities provided are in Table LS25.

Table LS24. Respondents' self-reported ethnicity, listed by percentage of responses.

Ethnicity	N	%
My ethnicity is not listed (please specify)	58	62.4
Choose not to provide	35	37.6
Total	**93**	**100.0**

Table LS25. Respondents' "other" self-reported ethnicity (written-in comments), listed by percentage of responses.

Ethnicity	N	%	Ethnicity	N	%
White	8	19.5	German/English American	1	2.44
European	6	14.6	German/Polish	1	2.44
American	5	12.2	German/Scandinavian	1	2.44
Dutch	5	12.2	German/Scot	1	2.44
German	2	4.9	Irish/American	1	2.44
Anglo	1	2.44	Italian	1	2.44
Dutch American	1	2.44	Italian/Scottish/German	1	2.44
Dutch/German	1	2.44	Native	1	2.44
East Europe	1	2.44	Polish	1	2.44
Eastern European Jew	1	2.44	Swiss & English	1	2.44
English/Irish/Scottish	1	2.44	**Total**	**41**	**100.00**

Thirty-three respondents identified their county of residence (Table LS26). Oakland has the highest representation (15%) followed by Kent (10.9%), Washtenaw (8.8%), Ottawa (7.5%) and Wayne (6.8%).

Table LS26. Respondents' self-reported county of residence, listed by percentage of responses.

County	N	%	County	N	%
Oakland	22	15.0	Jackson	3	2.0
Kent	16	10.9	Bay	2	1.4
Washtenaw	13	8.8	Eaton	2	1.4
Ottawa	11	7.5	Huron	2	1.4
Wayne	10	6.8	St. Clair	2	1.4
Macomb	8	5.4	Shiawassee	2	1.4
Genesee	6	4.1	Antrim	1	0.007
Saginaw	6	4.1	Barry	1	0.007
Grand Traverse	5	3.4	Cheboygan	1	0.007
Allegan	4	2.7	Lapeer	1	0.007
Clinton	4	2.7	Leelanau	1	0.007
Kalamazoo	4	2.7	Mason	1	0.007
Livingston	4	2.7	Mecosta	1	0.007
Berrien	3	2.0	Monroe	1	0.007
Calhoun	3	2.0	Van Buren	1	0.007
Emmet	3	2.0	**Total**	**147**	**100.0**
Ingham	3	2.0			

Greenhouse & Nursery Operations

This section offers a breakdown of survey responses from greenhouse and nursery operations.

BACKGROUND INFORMATION

Of the 621 greenhouse operators invited to participate in the survey, 91 responded and 83 provided usable data. When asked to identify their primary business type (Table GN1), 41% said "wholesale greenhouse," followed by "retail greenhouse or garden center" (20.5%), and "wholesale greenhouse" (12.1%).

Table GN1. Respondents' primary business type.

Primary business type	N	%	Primary business type	N	%
Wholesale greenhouse	34	41.0	Cannabis cultivation	1	1.2
Retail greenhouse or garden center	17	20.5	Public garden	1	1.2
Wholesale nursery	10	12.1	Vegetable production greenhouse	1	1.2
Retail nursery	5	6.0	Florist	1	1.2
Retail nursery and landscaper	1	1.2	Nursery and landscapes	1	1.2
Organic hoop house farmer	1	1.2	Landscape and garden designer	1	1.2
Wedding venue	1	1.2	Maintenance	1	1.2
Chemical manufacturer	1	1.2	Retail/Wholesale greenhouse	1	1.2
Vegetable farm	1	1.2	Consultant	1	1.2
Custom grow specialty vegetables year around in heated greenhouses	1	1.2	Michigan native plant nursery	1	1.2
Flower farm	1	1.2	**Total**	**83**	**100.0**

When asked if they purchase premixed growing media or mix their own, the majority (75%) of respondents indicated they buy premixed media (Table GN2).

Table GN2. Source of growing media used in respondents' operations.

Answer	N	%
Purchase a premixed media	63	75.0
Mix your own media	11	13.1
I do not purchase or mix a media	10	11.9
Total	**84**	**100.0**

Additionally, respondents were asked to indicate the percentage of components used in their growing mix. As shown in Table GN3, "peat" (61.6%) and "bark, pine" (42.3%) were the most frequently used components in growing mixes.

Table GN3. Components respondents reported using in growing mix, listed by mean score.

Component	N	M	SD
Peat	55	61.6	25.6
Bark, Pine	13	42.3	29.5
Other (written-in response): Sungro SS115 for annuals, and wetting agent	3	37.0	41.5
Wood fiber	5	21.4	9.9
Other (written-in response): Nutrient charge with trace elements	1	21.0	0.0
Bark, Hardwood	8	16.4	15.7
Perlite	46	15.4	9.0
Compost	15	14.9	26.6
Coir	15	14.5	17.5
Field soil	8	11.5	17.1
Sand	8	9.9	8.2
Biochar	10	7.9	20.8

Component	N	M	SD
Rice hulls	6	2.3	3.1
Other (written responses): BM6; Dolomitic clay; Hydrafiber; Limestone; Maple Leaf compost; Natural wood fiber; Premix LC1; Sungro 852 for perennials; Vermiculite	12	N/A	N/A

Respondents were asked if they were familiar with compost as a component of a growing substrate. More than half (57.7%) replied in the affirmative (Table GN4).

When asked if their business generated green waste (such as leaves, plants, and brush), two-thirds answered “Yes” (Table GN5).

Table GN4. Respondents’ familiarity with compost as a growing substrate.

Familiarity	N	%
Yes	41	57.7
No	30	42.3
Total	**71**	**100.0**

Table GN5. Percentage of greenhouse and nursery operations that reported generating green waste.

Green waste generation	N	%
Yes	47	65.3
No	25	34.7
Total	**72**	**100.0**

The estimated volume of green waste respondents estimated their operations generated during a typical growing season appears in Table GN6. The majority (76.7%) of 47 respondents reported generating 1 to 10 cu yd a week.

Table GN6. Estimated volume of green waste generated by respondents’ operations during a typical growing season.

Answer	N	%
1 to 10 cu yd per week	36	76.6
11 to 20 cu yd per week	4	8.5
21 to 50 cu yd per week	1	2.1
More than 50 cu yd per week	0	0.0
Other (written responses): I simply don't know. I would guess a lot! More than 50 cu yd per week but I really don't know how much a cubic yard is either; Chip cull trees; I discard diseased plants. Wouldn’t want to reuse that; 21-50 per spring season; 1-10 cubic a year; .5 cu yd per month	6	12.8
Total	**47**	**100.0**

Respondents were also asked to estimate the annual cost of disposing of the green waste generated by their businesses (Table GN7). The average cost estimate given by 28 respondents who answered this question was $1,750 per year, but the standard deviation was high at $429.10. Interestingly, 21 of 28 respondents reported “Zero,” or not spending any money for green waste disposal. When these responses were taken into account, the average of the remaining seven respondents was $700, with a standard deviation of 632.5.

Table GN7. Estimated annual cost of green waste disposal in respondents' operations.

Annual cost	N	Minimum	Maximum	M	SD
Annual cost of disposing of green waste generated by business.	28	0	2000	1750.00	429.1
Annual cost in dollars ($) of disposing the green waste generated by business (excluding responses with "zero" answer).	7	200	2000	700.00	632.5

To the query about how their operations currently manage green waste, over two-thirds of respondents indicated green waste is composted on-site (Table GN8).

Table GN8. Current green waste management practices of respondents' operations, listed by percentage.

Management practice	N	%
Composted green waste on site.	34	72.3
Send green waste to a landfill.	5	10.6
Spread in open field	2	4.3
Dumped in our woods.	2	4.3
Burned.	1	2.1
Staff take it home to compost themselves.	1	2.1
Recycle to a landscaper	1	2.1
Given to local business.	1	2.1
Total	**47**	**100.0** [a]

[a] Total does not equal exactly 100% due to rounding.

Asked to estimate the percentage of green waste their operations compost, 31 participants indicated on average they compost 81% (SD = 27.7%) of their green waste. Responses ranged from a minimum of 5% to a maximum of 100%. Those who do not compost their green waste cited the following reasons:

- Not enough green waste generated.
- Easier to burn.
- Too difficult to manage.
- Concern about disease.
- Hasn't been a priority of management.

COMPOST SPECIFICATIONS

Table GN9 shows that according to respondents, "consistent product quality" is the most important characteristic in the compost they use, then "pH," "nutrient availability," and "cost/quality relationship." The color of compost does not seem to be important to respondents.

Table GN9. Respondent rankings of various compost specifications from most to least important, based on mean score.

Compost specifications	Not important		Slightly important		Important		Very Important		Total		
	N	%	N	%	N	%	N	%	N	M	SD
Consistent product quality	3	5.5	0	0.0	8	14.5	44	80.0	55	3.69	0.74
pH	3	5.4	1	1.8	9	16.1	43	76.8	56	3.64	0.77
Nutrient availability	2	3.6	4	7.3	13	23.6	36	65.5	55	3.51	0.79
Cost/quality relationship	3	5.7	1	1.9	15	28.3	34	64.2	53	3.51	0.80
No offensive odor	2	3.7	4	7.4	14	25.9	34	63.0	54	3.48	0.79
Salinity	3	5.7	3	5.7	13	24.5	34	64.2	53	3.47	0.85
Water holding capacity	2	3.6	1	1.8	22	40.0	30	54.5	55	3.45	0.72
Density (weight)	5	9.6	4	7.7	26	50.0	17	32.7	52	3.06	0.89
Moisture content	5	9.4	4	7.5	28	52.8	16	30.2	53	3.04	0.88
Diversity of beneficial microorganisms	5	9.6	11	21.2	15	28.8	21	40.4	52	3.00	1.01
Carbon to nitrogen ratio	6	11.8	10	19.6	14	27.5	21	41.2	51	2.98	1.05
Material grade/size – Fine (1/8")	6	11.1	6	11.1	28	51.9	14	25.9	54	2.93	0.91
Ash content	10	18.9	14	26.4	15	28.3	14	26.4	53	2.62	1.08
Material grade/size – Medium (3/4")	12	26.1	4	8.7	22	47.8	8	17.4	46	2.57	1.07
Material grade/size – Coarse (1"+)	19	41.3	10	21.7	10	21.7	7	15.2	46	2.11	1.12
Contains biochar	19	38.0	14	28.0	13	26.0	4	8.0	50	2.04	0.99
Color – Black	32	65.3	6	12.2	9	18.4	2	4.1	49	1.60	0.93
Color – Light brown	30	63.8	6	12.8	9	19.1	2	4.3	47	1.60	0.94
Color – Dark brown	30	62.5	8	16.7	7	14.6	3	6.3	48	1.60	1.0
Other (specify)	17	70.8	2	8.3	2	8.3	3	12.5	24	1.60	1.1

Note. Scale: 1 = *not important*, 2 = *slightly important*, 3 = *important*, 4 = *very important*. Scores for "not applicable" are excluded from the analysis.

COMPOST MANUFACTURING & USE

Table GN10 shows respondents' level of agreement with various statements related to compost manufacturing and use. Respondents agreed with the statements "I would consider using compost if the economic value of doing so could be clearly demonstrated to me" and "The quality of compost varies greatly enough that I'm reluctant to use it." Most disagreed with the statement that "Producing compost for my own use is worth the time and money spent doing it."

Table GN10. Greenhouse and nursery respondents' level of agreement with various statements about compost manufacturing and use, listed by mean score.

Statement	Strongly disagree		Disagree		Agree		Strongly agree		Total		
	N	%	N	%	N	%	N	%	N	M	SD
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.	1	1.6	6	9.8	41	67.2	13	21.3	61	3.08	0.61
The quality of compost varies greatly enough that I'm reluctant to use it.	0	0.0	11	19.6	29	51.8	16	28.6	56	3.06	0.69
I am willing to use compost with a proven and demonstrated ability to improve soil health	3	5.4	12	21.4	28	50.0	13	23.2	56	2.91	0.82
I'm interested in composting waste materials generated within my own operation.	7	12.5	17	30.4	21	37.5	11	19.6	56	2.64	0.94
I don't really know much about the process of making compost.	7	11.1	24	38.1	17	27.0	15	23.8	63	2.63	0.97
Producing compost for my own use is worth the time and money spent doing it.	9	17.0	19	35.8	20	37.7	5	9.4	53	2.40	0.88

Note. Scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*. Scores for "not applicable" are excluded from the analysis.

Respondents were asked to assign a dollar value to a cubic yard of compost that has "a proven and demonstrated ability to improve soil health." Over half of respondents placed the value of such compost at less than $25. No one placed the value of compost at more than $76 per cubic yard (Table GN11).

When asked whether they planned to increase their use of compost, 73.4% of 64 respondents said no (Table GN12). Their reasons fell into three broad categories:

- Do not see an economic value to using compost.
- Not consistent enough for container production or in a cropping system.
- No plans as of now to use compost.

Table GN11. Respondents' estimates of the value of compost with proven ability to improve soil health.

Value of compost per cu yd	N	%
Less than $25	25	51.1
$26 to $50	18	36.7
$51 to $75	5	10.2
$101 to $120	1	2.0
$76 to $100	0	0.0
More than $120	0	0.0
Total	**49**	**100.0**

Table GN12. Respondents' reported intentions to increase compost use in their greenhouse and nursery operations.

Response	N	%
Yes	17	26.6
No	47	73.4
Total	**64**	**100.0**

RESPONDENT CHARACTERISTICS

Two-thirds of respondents identified themselves as the owner of a greenhouse or nursery (Table GN13) and 89.4% indicated they make the growing media purchasing decisions for their operations (Table GN14).

Respondents were asked to indicate how many square feet their operations have in greenhouse production. Twenty-three of 56 respondents (41.1%) indicated their operations had more than 100,000 square feet in greenhouse production (Table GN15).

Of the 25 people who responded to a question about how many acres their operations had in nursery production, 60% said they had five acres or less in nursery production (Table GN16).

Nearly two-thirds of respondents indicated they were over 50 years old (Table GN17) and 80% said they were male (Table GN18).

Table GN13. Respondent position in greenhouse and nursery operation.

Position	N	%
Owner	44	66.7
Manager	11	16.7
Grower	10	15.1
Other: Sales.	1	1.5
Total	**66**	**100.0**

Table GN14. Percentage of respondents who reported making growing media purchasing decisions for their operations.

Purchasing decision-maker	N	%
Yes	59	89.4
No	7	10.6
Total	**66**	**100.0**

Table GN15. Square footage in greenhouse production per operation, listed by percentage of responses.

Square footage of greenhouse production per operation	N	%
Greater than 100,000	23	41.1
25,001–100,000	14	25.0
4,000–25,000	14	25.0
Less than 4,000	5	8.9
Total	**56**	**100.0**

Table GN16. Acreage in nursery production per operation.

Nursery production (acres)	N	%
Less than1 acre	7	28.0
1 to 5 acres	8	32.0
6 to 10 acres	3	12.0
11 to 25 acres	1	4.0
26 to 50 acres	2	8.0
51 to 100 acres	1	4.0
More than 100 acres	3	12.0
Total	**25**	**100.0**

Table GN17. Respondents' self-reported age group, listed by percentage of responses.

Age group	N	%
Less than 25	0	0.0
26 to 30 years	2	3.0
31 to 35 years	5	7.6
36 to 40 years	6	9.1
41 to 45 years	3	4.5
46 to 50 years	7	10.6
More than 50 years	43	65.2
Total	**66**	**100.0**

Table GN18. Respondents' self-reported gender, listed by percentage of responses.

Gender	N	%
Male	48	80.0
Female	12	20.0
Total	**60**	**100.0**

The majority of the respondents (60%) have college degrees while 20% have earned some college credits but have not finished a degree (Table GN19). Of the 64 people who identified their race, 92.2% said they were white or Caucasian and the remaining 7.88% chose not to report their race (Table GN20).

More than two-thirds (67.6%) of the 37 people who responded to the question on ethnicity opted not to report their ethnicity, and 29.7% self-reported their ethnicity. Only one person identified as Hispanic or Latino (Table GN21).

Respondents were asked to identify their county of residence. Of the 64 people who identified their county of residence, 40.6% live in just two counties: Kalamazoo and Ottawa (Table GN22).

Table GN19. Respondents' self-reported highest education level achieved, listed by percentage of responses.

Education level	N	%
College degree (ex: A.A., B.S.)	39	60.0
Some college credits, no degree	13	20.0
High school graduate, diploma or the equivalent (for example GED)	7	10.8
Trade/technical/vocational training	4	6.2
Graduate degree (ex: M.A., Ph. D.)	2	3.0
Some high school, no diploma	0	0.0
Total	**65**	**100.0**

Table GN20. Respondents' self-reported race, listed by percentage of responses.

Race	N	%
White or Caucasian	59	92.2
Choose not to provide	5	7.8
Alaskan Native or American Indian – Tribal affiliation:	0	0.0
Asian	0	0.0
Black or African American	0	0.0
Native Hawaiian or Other Pacific Islander	0	0.0
Total	**64**	**100.0**

Table GN21. Respondent ethnicity, listed by percentage of responses.

Ethnicity	N	%
Choose not to provide	25	67.6
Dutch	2	5.4
European	2	5.4
Caucasian American for over 5 generations from European descent – strange question/request	1	2.7
Dutch Hebrew	1	2.7
European-American	1	2.7
Hispanic or Latino	1	2.7
German/Irish +American	1	2.7
Northern European	1	2.7
Welch	1	2.7
White	1	2.7
Total	**37**	**100.0**

Table GN22. Respondents' self-reported county of residence, listed by percentage of responses.

County	N	%
Kalamazoo	15	23.4
Ottawa	11	17.1
Wayne	5	7.8
Berrien	4	6.2
Kent	4	6.2
Macomb	3	4.7
Oakland	3	4.7
Washtenaw	3	4.7
Allegan	2	3.1
Monroe	2	3.1
Tuscola	2	3.1
Van Buren	2	3.1
Grand Traverse	1	1.6
Hillsdale	1	1.6
Jackson	1	1.6
Leelanau	1	1.6
Muskegon	1	1.6
Newaygo	1	1.6
Saginaw	1	1.6
St. Joseph	1	1.6
Total	**64**	**100.0**

Equine Operations

This section offers a breakdown of survey responses from equine operations.

MANURE & BEDDING PRODUCTION

When asked to identify the primary type of equine business they operate, 153 said boarding horses was their primary business (Table EQ1). Of the 130 respondents who checked "Other," on the question, 122 said they had horses for personal recreational use and the rest because they were veterinarians, ran a camp, boarded police or sheriff mounted horses, ran a rescue operation, boarded rodeo stock, or ran a horse therapy operation.

Table EQ1. Type of equine business.

Primary business type	N	SD
Boarding	153	0.87
Training	92	0.85
Instruction	77	0.85
Specialized horse-sports center (showing, jumping, eventing, polo, etc.)	65	1.00
Breeding	45	1.04
Farming with draft horses	8	0.97
Horse or carriage rental	5	1.47
Racing	2	0.00
Other (please specify)	130	0.53

Respondents were asked to identify the type of bedding they used in their equine operations. Wood shavings were the preferred bedding at 31.7%, followed by sawdust at 28.3%, and wood pellets at 22.7% (Table EQ2). Table EQ3 lists the write-in responses in the “Other” category in Table EQ2.

Table EQ2. Type of bedding used in equine operation.

Bedding type	N [a]	%	% of cases
Wood shavings	170	31.7	45.6
Sawdust	152	28.3	40.8
Wood pellets	122	22.7	32.7
I don’t use bedding	24	4.5	6.4
Wheat straw	20	3.7	5.4
Oat straw	17	3.2	4.6
Paper pellets	8	1.5	2.1
Peat moss	1	0.2	0.3
Switchgrass	1	0.2	0.3
Other (Please specify)	22	4.0	5.9
Total	**537**	**100**	**144**

[a] Respondents could choose more than one bedding type.

Table EQ3. "Other" types of bedding used in equine operations (written-in responses).

Other types of bedding specified by respondents	N	%
Shredded paper	6	27.3
Shredded newspaper	5	22.7
Straw; Wheat straw; Use straw when it is really cold. Other than that I use stall mats	3	13.6
Flax	2	9.1
Sand.	1	4.5
We only use sawdust before shows and in the winter. Rest of the time there is no bedding.	1	4.5
I use a combination of all three in a 1:3 ratio.	1	4.5
Cob bedding.	1	4.5
Bagged shavings	1	4.5
SaniCare hardwood "micro cubes."	1	4.5
Total	**22**	**99.7**

Respondents were asked to rank the factors that affect their choice of bedding from most important (1) to least important (9). "Absorbency" was the highest ranked factor based on mean score (2.3), followed by "horse health" and "cost" (Table EQ4).

When asked how they manage manure and spent bedding, nearly 25% of respondents indicated they spread it on nongrazed land (Table EQ5).

Table EQ4. Respondents' ranking of factors that affect bedding choices, listed by mean score.

Factors	M	N	SD
Absorbency	2.3	159	1.56
Horse health	3.3	120	1.97
Cost	3.5	148	2.14
Easy to use	3.9	135	1.92
Comfort	4.0	129	2.02
Readily available	4.5	138	2.20
Easy to store	4.8	129	1.93
Composts well	5.5	102	2.29
Other responses: Dust; Easy to clean stalls; Effect on soil composition and pH after spreading; Smells good; How it holds up.	N/A	12	N/A

Table EQ5. How respondents' equine operations manage manure and spent bedding.

Management strategy	N [a]	%	% of cases
Spread it on nongrazed land	89	24.8	44.9
Pile and leave it to degrade (this is not the same as composting)	75	20.8	37.9
Compost it	70	19.4	35.4
Spread it on grazed land	45	12.5	22.7
Give it away to nurseries, gardeners, etc.	36	10.0	18.2
Pay someone to haul it away	19	5.3	9.6
Other (Please specify)	14	3.9	7.1
Haul it away yourself	12	3.3	6.1
Total	**360**	**100.0**	**181.8**

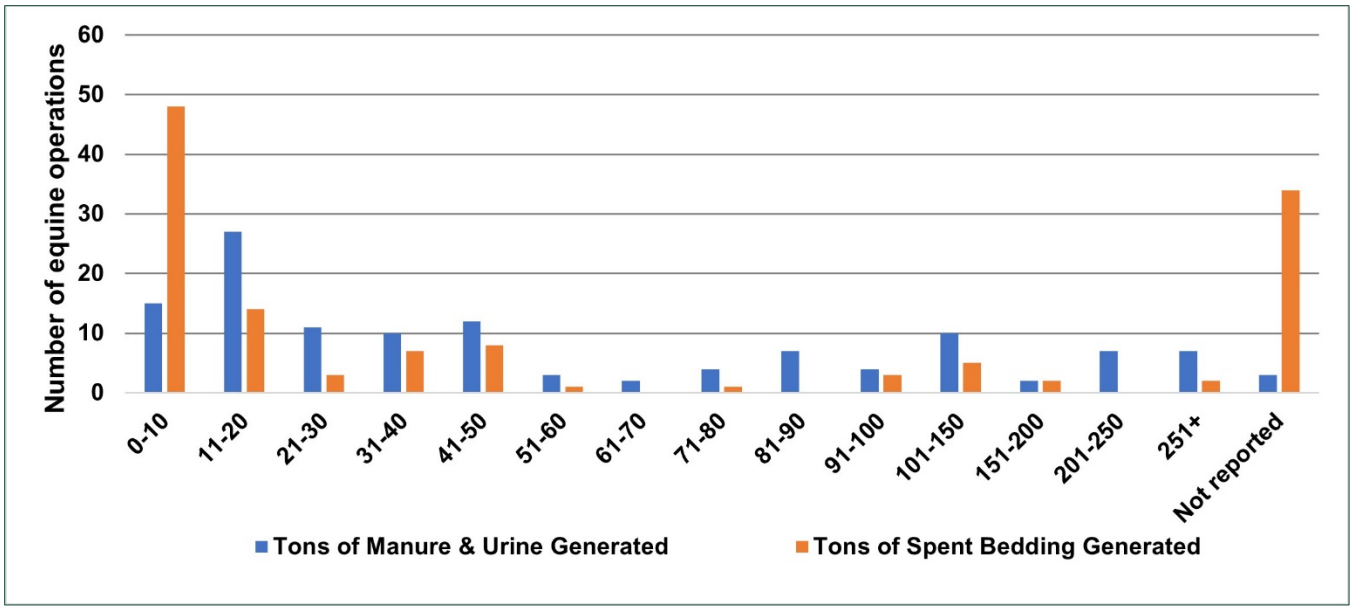
[a] Respondents could choose more than one response.

Of the twelve respondents who wrote in their manure management strategies, four indicated that farmers, neighbors, or friends take it and two said they land apply it. The remaining six responses were:

- Exchange for fill dirt.
- Compost and sell.
- Put directly on garden.
- It sits in a pile part of the year and then hauled away for to a greenhouse.
- Spread it on the lawn.
- Leave it in the pasture.

One hundred twenty-seven equine operations estimated the annual volume (in tons) of manure, urine, and spent bedding generated at their operation based on the assumption that a 1,000-pound horse excretes 50 pounds of manure and urine a day (9 tons a year). Figure EQ1 shows that 49 respondents estimated their equine operations generated up to 10 tons of spent bedding a year, 15 estimated between 11 to 20 tons, and two estimated more than 251 tons. Six respondents said their equine operations generated over 251 tons of manure and urine a year. Four respondents did not report the volume of manure and urine their equine operations generated each year and 34 did not report the volume of spent bedding theirs generated.

Figure EQ1. Approximate annual volume (in tons) of manure, urine, and bedding generated by equine operations.



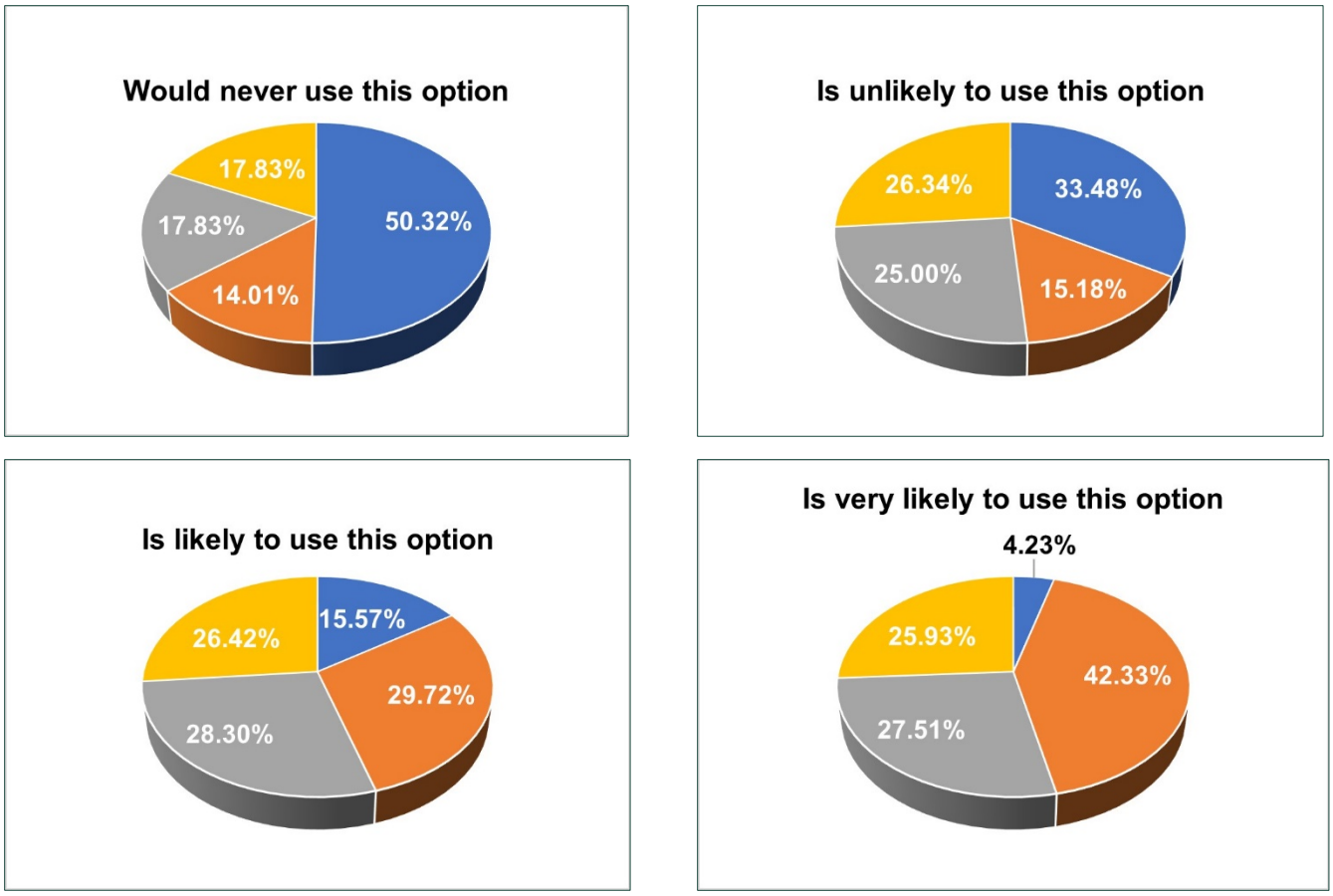
MANURE MANAGEMENT SERVICE OPTIONS

Respondents were asked how likely they would be to use one of the following manure management service options:

- **Option 1:** A system where you would collect manure from your operation and bring it to a central location in a supplied container/bin.
- **Option 2:** A system where someone would come to your operation and pick up a supplied container/bin of manure on a regular or as required basis.
- **Option 3:** A system where someone would come to your operation to clean up and remove manure from a pasture.
- **Option 4:** A system where someone would come to your operation and compost all manure, urine, and bedding on-site.

Table EQ6 and Figure EQ2 both show that a manure management system where a contractor would pick up a supplied container or bin of manure on a regular schedule or as needed was most popular with equine operators. In fact, 42% of respondents said they would be very likely to choose this option. A system in which the horse owner collects manure from the operation and takes it to a central location in a supplied container or bin received little support.

Figure EQ2. Percentage of equine operations reporting their likelihood of using one of four manure management service options.



Option 1: A system where you would collect manure from your operation and bring it to a central location in a supplied container or bin.

Option 2: A system where someone would come to your operation and pick up a supplied container or bin of manure on a regular or as required basis.

Option 3: A system where someone would come to your operation to clean up and remove manure from a pasture.

Option 4: A system where someone would come to your operation and compost all manure, urine, and bedding on-site.

Table EQ6. Likelihood of equine operations using a manure management service option, listed in order of respondent preference.

Manure management service	N	M	SD	Variance
Option 2: A system where someone would come to your operation and pick up a supplied container/bin of manure on a regular or as required basis.	199	3.01	1.01	1.01
Option 3: A system where someone would come to your operation to clean up and remove manure from a pasture.	196	2.69	1.01	1.03
Option 4: A system where someone would come to your operation and compost all manure, urine, and bedding on-site.	192	2.66	1.01	1.03
Option 1: A system where you would collect manure from your operation and bring it to a central location in a supplied container/bin.	195	1.85	0.85	0.71

Note. Scale: 1 = *never*, 2 = *unlikely*, 3 = *likely*, 4 = *very likely*.

Respondents were asked to indicate how much they would be willing to pay monthly for each manure management service option. The highest mean value was Option 2 at $92.50 per month (Table EQ7). This is the same manure management service option equine owners indicated they were most likely to use.

Table EQ7. Estimated monthly fee respondents would be willing to pay for each manure management service option.

Estimated monthly fee for each manure management service	N	M ($)	SD	Min.	Max.
Option 2: Service to pick-up at my operation on a regular/as-required basis ($)	143	92.50	236.77	0	2,550
Option 3: Service to gather and remove pasture manure at my operation ($)	138	87.96	391.39	0	4,574
Option 4: Service to compost manure, urine, and bedding on-site at my operation ($)	135	65.28	132.80	0	1,243
Option 1: Drop-off at a location ($)	140	18.80	46.66	0	234

RESPONDENT CHARACTERISTICS

Tables EQ8 through EQ11 provide demographic information about the 395 equine operators who completed the online survey. A large majority (90%) of the respondents were female (Table EQ8). Over 42% were over 51 years old (Table EQ9) and over 42% said they have a college degree (Table EQ10).

Table EQ8. Respondents' self-reported gender, listed by percentage of responses.

Respondent gender	N	%
Female	171	90.0
Male	16	8.4
Other responses	3	0.6
Total	**190**	**100.0**

Table EQ9. Respondents' self-reported age group, listed by percentage of responses.

Respondent age	N	%
51–60 years	50	25.4
61–70 years	28	14.2
36–40 years	24	12.2
41–45 years	20	10.2
25 years or less	19	9.6
46–50 years	19	9.6
31–35 years	17	8.6
26–30 years	14	7.1
Over 70 years	6	3.1
Total	**197**	**100.0**

Table EQ10. Respondents' self-reported highest education level achieved, listed by percentage of responses.

Answer	N	%
College degree (e.g., A.A., B.S.)	83	42.3
Some college credits, no degree	40	20.4
Graduate degree (e.g., M.A., J.D., M.D., Ph. D.)	39	19.9
High school graduate, diploma or the equivalent (for example: GED)	17	8.7
Trade/technical/vocational training	16	8.2
Some high school, no diploma	1	0.5
Total	**196**	**100.0**

Most respondents (91.9%) identified as white or Caucasian (Table EQ11). Over two-thirds of the respondents chose not to report their ethnicity, while 30.1% said their ethnicity was not listed (Table EQ12). Table EQ 13 lists the ethnicities that people who checked "Other" wrote in.

Table EQ11. Respondents' self-reported race, listed by percentage of responses.

Answer	N	%
White or Caucasian	182	91.9
Choose not to provide	11	5.6
Alaskan Native or American Indian	3	1.5
Black or African American	2	1.0
Total	**198**	**100.0**

Table EQ12. Respondents' self-reported ethnicity, listed by percentage of responses.

Ethnicity	N	%
Choose not to provide	90	67.6
My ethnicity is not listed (Please specify)	40	30.1
Middle Eastern or Arab-American	3	2.3
Hispanic or Latino	0	0.0
Total	**133**	**100.0**

Table EQ13. Respondents' "other" self-reported ethnicity (write-in comments), listed by percentage of responses.

"Other" ethnicity response	N	%
American	7	25.0
White	5	17.8
European	4	14.3
Eastern European	3	10.7
British	1	3.6
Dutch/European	1	3.6
Irish	1	3.6
Polish	1	3.6
Welsh	1	3.6
Norwegian, Swedish	1	3.6
Non-Hispanic	1	3.6
English/Scottish	1	3.6
Heinz 57 variety	1	3.6
Total	**28**	**100.2**

The largest percentage of equine operations represented in the survey were located in Oakland County (6.2%), followed by Washtenaw County (5.7%) and Saginaw County (5.2%) (Table EQ14).

Table EQ14. County location of respondents' equine operations.

County or counties	N	%	County or counties	N	%
Oakland	12	6.2	Grand Traverse	3	1.5
Washtenaw	11	5.7	Gratiot	3	1.5
Saginaw	10	5.2	Jackson	3	1.5
Clinton	9	4.6	Macomb	3	1.5
St. Clair	9	4.6	Montmorency	3	1.5
Ingham	8	4.1	Muskegon	3	1.5
Lapeer	8	4.1	Ionia	2	1.0
Ottawa	8	4.1	Manistee	2	1.0
Shiawassee	8	4.1	Newaygo	2	1.0
Livingston	7	3.6	Ogemaw	2	1.0
Montcalm	7	3.6	Alpena	1	0.52
Eaton	6	3.1	Arenac	1	0.52
Genesee	6	3.1	Barry	1	0.52
Kent	6	3.1	Bay	1	0.52
Berrien	5	2.6	Benzie	1	0.52
Calhoun	5	2.6	Chippewa	1	0.52
Van Buren	5	2.6	Emmet	1	0.52
Allegan	4	2.1	Iosco	1	0.52
Kalamazoo	4	2.1	Iron	1	0.52
Lenawee	4	2.1	Isabella	1	0.52
Monroe	4	2.1	Midland	1	0.52
Antrim	3	1.5	Tuscola	1	0.52
Cass	3	1.5	Wexford	1	0.52
Cheboygan	3	1.5	**TOTAL**	**194**	**99.7**

Michigan Biomass Production

We had originally planned to use the Michigan Forest Biofuels Research and the Michigan Waste Biomass Inventory to Support Renewable Energy Development websites as resources to determine the volume of carbon that could be used to produce compost. Unfortunately, the Waste Biomass Inventory website is no longer supported by Michigan State University due to budget cuts and has been taken down. Data from the Forest Biofuels Research website turned out to be unsuitable for our purposes because it is designed to calculate forest biomass, and trees are not harvested solely to make sawdust and wood chip feedstocks for compost production.

Little information is available about the volume of biomass produced in Michigan that could be used for compost production. However, Steve Safferman, Ph.D., noted in an April 20, 2020, phone conversation with Charles Gould that a 2012 estimate he had derived using data from the Michigan Waste Biomass Inventory is still accurate given the gyration of the economy over the past eight years.

Safferman and Younsuk Dong, Ph.D., sent us a spreadsheet detailing the volume of waste from the 50 largest wastewater treatment plants and schools and from the 49 largest confined animal feeding operations (CAFOs) in Michigan (S. Safferman & Y. Dong, personal communication, April 25, 2020; Appendix L). According to this data, an estimated 2,160,747 dry U.S. tons of waste come from these three sources. (Safferman and Dong are faculty members in the Department of Biosystems and Agricultural Engineering at MSU.)

Compost Cost of Production

A literature search to find the cost of producing compost on Michigan farms did not produce any results. A request to MSU Extension educators for the contact information of farmers who were composting and would share their cost of production data with the authors netted four farms. These farms – an organic vegetable farm, a beef farm, and two dairy farms – provided the authors with the annual costs per cubic yard of their composting activities (Table CP1). (**Note:** The actual cost figures are likely to vary significantly from farm to farm.)

Table CP1. Cost of compost production per cubic yard for four Michigan farms.

Item	Organic vegetable farm cost per cu yd ($)	Beef farm cost per cu yd ($)	Dairy farm 1 cost per cu yd ($)	Dairy farm 2 cost per cu yd ($)
Equipment Costs				
Tractor 1	0.33	5.33	2.58	8.33
Tractor 2	NA	3.20	2.32	NA
Manure spreader	NA	2.24	NA	NA
Skid steer	NA	NA	NA	0.83
Windrow turner 1	NA	NA	NA	3.50
Spreader/truck for offsite collection	10.67	NA	NA	0.33
Bagger	NA	NA	NA	NA
Bags	NA	NA	NA	NA
Trailer for hauling compost	NA	NA	NA	2.67
Operating Costs				
Planning, permitting, administration	1.53	NA	NA	NA
Secretarial/office administration	NA	0.85	NA	0.67
Operating labor	10.67	3.20	NA	5.75
Shipping costs	6.33	NA	NA	NA
Offsite materials	4.33	NA	14.49	NA
Repairs	NA	NA	NA	NA
Miscellaneous expenses	0.60	22.68	NA	1.00
Total Costs	**34.46**	**37.50**	**19.39**	**23.08**

Costs varied from $19.39 per cubic yard for dairy farm 1 to $37.50 per cubic yard for the beef farm. Annual output ranged from 150 cu yd for the organic vegetable farm to 1,452 cu yd for dairy farm 1. Both the beef farm and dairy farm 2 produced 300 cu yd. per year. The fact that dairy farm 1 produced the most compost and had the lowest costs indicates that there might be economies of scale in the production of compost. However, it should be noted that this was the first year of composting for dairy

farm 1 so the operators may not have captured all of their costs. The two dairy farms had lower average total costs than the organic vegetable and beef farms.

The miscellaneous expenses for the beef farm were quite high because the operators considered the nutrient value of the manure used in the compost. Therefore, the beef example should be considered the economic cost while the other three examples should be considered the accounting cost of producing compost. Stated another way, if the value of the manure was included, the cost figures for the other farms – especially the dairy farms – would be higher; while if only cash costs were included, the beef farm cost would be considerably lower.

The beef and organic vegetable farms used all the compost they generated in their own cropping systems. Two farms sold compost. Dairy farm 1 sold 80 cu yd to rural residents for gardens and landscaping purposes and another 125 cu yd to a local farmer. Dairy farm 2 sold all its compost to local landscaping firms. The farms did not bag the compost they produced. It does appear that landscapers and homeowners are willing to buy compost, especially if it is produced locally.

Determining the net profitability of composting is difficult. For example, dairy farm 1 estimated that the nutrient value of the compost was about $20 per cubic yard, which means that composting was roughly a break-even proposition for that operation. Dairy farm 1 also gave compost away to family and charged $40 per 20 cu yd manure spreader load for field-spread compost. The farmer reported selling compost for $2 per cubic yard because he needed to get rid of it and the other farmer was willing to take it off his hands at that price.

Composting has the potential to reduce transportation costs because the weight of the material spread on the fields is reduced while the nutrient value is increased. In addition, this study indicates that some landscape and nursery firms may be willing to pay more than $20 a cubic yard for compost that meets their quality standards. The cost estimates indicate that compost could be sold at a small profit to landscape and nursery firms. One advantage to selling to these firms rather than to home gardeners is that the businesses tend to be less interested in bagged compost.

There is also some potential to sell compost to home and garden centers. However, to reach this market bagging may be necessary. While bagging entails more costs, it also creates a value-added opportunity for farmers. Larger farmers probably have more potential than smaller farmers to reach this market. Organic farmers who can produce organic compost also have an advantage with a select group of consumers. One way to increase the value, reduce overhead costs, and take advantage of economies of scale would be to form a compost producer cooperative. However, for such a co-op to succeed, the costs related to moving the biomass could not be excessive.

Another factor to consider is the increasing opposition to traditional methods of manure application and spreading. By reducing the water content and odor of the manure, farms can reduce some of this opposition. In the future, government regulations and the demands of food processors and consumers may require agricultural operations to compost to stay in business. U.S. society is slowly moving away from accepting “Generally Accepted Agricultural Management Practices” and moving toward demanding “Best Management Practices.”

Conclusions

The survey results reveal that 48% of the agricultural sector respondents identified growing field crops as their primary farming operation, 76% of the landscape respondents identified themselves as installation or maintenance landscape contractors, and 41% of the greenhouse and nursery respondents identified wholesale greenhouse as their primary business. Most respondents (95% of the agricultural respondents, 87% of the landscape respondents, and 83% of the greenhouse and nursery respondents) were either the owner or manager of the operations.

Thirty-two percent of the agricultural sector respondents and 95% of the nursery respondents reported making the compost purchasing decisions for their operations. Eighty-nine percent of the greenhouse and nursery respondents indicated they make the growing media purchasing decisions. These data suggest that the survey reached the segment within each of the three sectors with the most potential to use compost and it was completed by individuals who make compost purchasing decisions.

Table C1 compares the compost specifications considered important (mean score greater than or equal to 3.0, where 3.0 = important and 4.0 = very important) for the agricultural, landscape, and greenhouse and nursery sectors. The compost specification with the highest mean score for landscape and greenhouse and nursery operators is “consistent product quality” and for agriculture it is “cost/quality relationship.”

Table C1. Comparison of compost specifications considered important (mean score ≥ 3.0) organized by agriculture, landscape, and greenhouse and nursery sectors.

Agriculture specification	M	SD	Landscape specification	M	SD	Greenhouse & nursery specification	M	SD
Cost/quality relationship	3.4	0.9	Consistent product quality	3.1	1.1	Consistent product quality	3.1	1.1
Nutrient availability	3.3	0.9	Nutrient availability	3.0	1.0	Nutrient availability	3.0	1.0
Consistent product quality	3.2	0.9	No offensive odor	3.0	1.1	No offensive odor	3.0	1.1
pH	3.0	0.9	Cost/quality relationship	3.0	1.1	Cost/quality relationship	3.0	1.1
Diversity of beneficial microorganisms	3.0	0.9				Consistent product quality	3.1	1.1
						Nutrient availability	3.0	1.0
						No offensive odor	3.0	1.1
						Cost/quality relationship	3.0	1.1
						Consistent product quality	3.1	1.1
						Nutrient availability	3.0	1.0

According to Jeremy Jubenville, an MSU Extension commercial horticulture educator based in Kalamazoo County, the lack of product consistency is always the first thing mentioned when growers in the greenhouse and nursery sector talk about using compost. A common problem in organic transplant production is lack of consistent crop uniformity, making compost use a nonstarter in ornamental horticulture (J. Jubenville, personal communication, n.d.).

In private conversations with the authors over the years, greenhouse growers have shared their personal experiences with using compost that caused root burn in potted plants, which resulted in significant financial losses to their operations. Word of these negative impacts has been spread from grower to grower throughout the industry, making it hard to change perceptions toward using compost in any mix. These reasons may help explain the reluctance of many greenhouse and nursery growers to use compost (as shown in Table C2).

The landscape industry strives to keep lawns and gardens looking their best, and their clients are upset by inconsistent plant growth and color.

The compost specification with the highest mean score for agriculture operators is “cost/quality relationship.” This makes sense because profit margins are so thin for farmers that any input to a cropping system must be able to show a positive return on investment. Farmers must be able extract value from the compost in terms of improved soil health and increased crop yields to justify the price they pay for it.

Producers in all three sectors are willing to consider using compost “if the economic value of doing so could be clearly demonstrated” (Table C2). The agriculture and landscape sectors are willing to use compost “with a proven and demonstrated ability to improve soil health.”

Table C2. Comparison of level of agreement on compost manufacturing and use perceptions considered important (mean score ≥ 3.0) organized by agriculture, landscape, and greenhouse and nursery sectors.

Agriculture statement	M	SD	Landscape statement	M	SD	Greenhouse & nursery statement	M	SD
I am willing to use compost with a proven and demonstrated ability to improve soil health.	3.1	0.6	I am willing to use compost with a proven and demonstrated ability to improve soil health.	3.4	0.6	I would consider using compost if the economic value of doing so could be clearly demonstrated to me.	3.1	0.6
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.	3.1	0.6	I would consider using compost if the economic value of doing so could be clearly demonstrated to me.	3.3	0.6	The quality of compost varies greatly enough that I'm reluctant to use it.	3.1	0.7
			I am interested in composting waste materials generated within my own operation.	3.0	0.9			

It is instructive to compare compost specifications in this report with the compost specifications in the 2005 report (Table C3).

Table C3. Comparison of agriculture, landscape, and greenhouse and nursery specifications between the 2019 and 2005 Michigan compost marketing reports.

Agriculture (2019)	Agriculture (2005)	Landscape (2019)	Landscape (2005)	Greenhouse & nursery (2019)	Greenhouse & nursery (2005)
Cost/quality relationship	Cost/quality relationship	Consistent product quality	Consistent product quality	Consistent product quality	Nutrient availability
Nutrient availability	pH	Nutrient availability	No offensive odor	pH	Consistent product quality
Consistent product quality	Nutrient availability	No offensive odor	Nutrient availability	Nutrient availability	pH
pH	Consistent product quality	Cost/quality relationship	Cost/quality relationship	Cost/quality relationship	Water holding capacity

The message that seems to be coming through very clearly is that the lack of product consistency, and therefore perceived value, constrains compost use in the agriculture, landscape, and greenhouse and nursery sectors more than any other factor. Further evidence of this is the low perceived monetary value of compost with a proven ability to improve soil health (Table C4). Agriculture and greenhouse

and nursery operators estimated the value of bulk compost at less than $25 per cubic yard while landscape operators estimated its value at $26 to $50 per cubic yard.

Table C4. Comparison of estimated value of compost with a proven ability to improve soil health across the agriculture, landscape, and greenhouse and nursery sectors.

Value of compost (per cu yd)	Agriculture ranking	Landscape ranking	Greenhouse & nursery ranking
Less than $25	1	2	1
$26–$50	5	1	2
$51–$75	3	3	3
$76–$100	4	4	0
$101–$125	2	0	4
More than $125	6	0	0

To add perspective on consumer willingness to pay, a study by Schmidt et al. (2019) identified a substantial hypothetical bias of 21% on average in measures of willingness to pay (WTP). Although hypothetically derived WTP estimates are often the best estimates available, they generally overestimate consumers' real WTP. That bias should be taken into account when using hypothetical WTP results to develop a pricing strategy or when setting an innovation's launch price.

To test the conclusion of Schmidt et al., 111 sites (19 landscape supply, 61 municipal, and 31 commercial composting operations) on the EGLE registered composting facilities list were contacted. Price lists were obtained from seven landscape supply, eight municipal, and 11 commercial composting operations. Only the municipal composting operations that charged for compost are listed in this report. Many municipalities do not sell the compost they make, instead using it for community landscaping projects or as landfill cap, or giving it away to residents as a public service. The highest price listed for bulk purchases of compost was $34 per cubic yard and the lowest was $6 per cubic yard (Appendix M).

Delivery charges were extra, and some composting operations offered price reductions if certain conditions were met. It is worth noting that seven of the 26 composting operations listed compost for sale at $30 per cubic yard. Seven landscape supply businesses had compost priced from a low of $23 per cubic yard to a high of $30 a cubic yard. These prices are all within the range that agricultural, landscape, and greenhouse and nursery respondents indicated they were willing to pay. It would appear that the reported WTP does not reflect the bias reported by Schmidt et al.

By way of comparison, the 2005 survey respondents were asked to specify the dollar amount they would be willing to pay for compost that met their specifications:

- 54% of respondents in the agricultural sector were willing to pay $1 to $10 per cubic yard, 28% were willing to pay $11 to $20 and only 18% were willing to pay over $20.
- 51% of the respondents in the landscape sector were willing to pay $1 to $10 per cubic yard, 40% were willing to pay $11 to $20, and only 9% were willing to pay over $20.
- 45% of the respondents in the nursery sector were willing to pay 1$ to $10 per cubic yard, 46% were willing to pay $11 to $20, and only 10% were willing to pay over $20.

In the 2005 survey, "specifications" was not defined and respondents were left to interpret it based on their individual circumstances. In the 2019 survey, the dollar value of compost was tied to compost with a specific quality: "a proven and demonstrated ability to improve soil health." This suggests that even when compost is tied to a specific quality, the perceived monetary value is still low across all three sectors. That said, the comparison between 2005 and 2019 seems to suggest that potential users value compost more now than in the past.

It should be noted that 51% of the agricultural respondents indicated they use compost in their cropping systems (Table AG2). That is inconsistent with how much compost is really being applied on Michigan fields. While a definition of compost was provided with the survey instrument, most farmers include manure in their definition of compost (Appendices G and H), which makes the 51% affirmative response rate for compost use in their cropping systems correct. This suggests there is a strong need for more compost education among farmers.

Table C5 compares 2005 survey respondent's stated intentions to increase their use of compost with that of respondents to the 2019 survey. The number of respondents who said they might increase their compost use dropped from 39 to 14 and 30 to 17 from 2005 to 2019 in the agricultural and landscape sectors, respectively (greenhouse and nursery respondents were not given the option to choose "maybe" in the 2019 survey). This change is reflected in the more definitive "yes" or "no" responses to increasing compost use. This insight suggests that during the intervening years, farmers, landscapers, and greenhouse and nursery operators formed opinions about their desire to use compost in their operations.

Table C5. Comparison of percentage of respondents intending to increase compost use in 2005 and 2019 by agriculture, landscape, and greenhouse and nursery sectors.

Sector	% Yes 2019	% Yes 2005	% No 2019	% No 2005	% Maybe 2019	% Maybe 2005	Reason for "No" or "Maybe" Answers, 2019	Reason for "No" or "Maybe" Answers, 2005
Agricultural	36	17	50	44	14	39	• If the price is affordable and/or there is monetary benefit. • I make my own compost. • I use manure generated on my farm.	• If they have more information on the benefits, use, and production of compost. • If a cheap source of compost is available close by. • If it meets organic specifications.

Landscape	37	36	46	34	17	30	• Customer needs or job specifications.	• Depends on:
								  • The economy and business profitability.
								  • How much using compost increases workload.
								  • If an application or use can be identified.

Greenhouse & nursery	27	20	73	37	N/A	43	• Do not see an economic value to using compost.
							• Not consistent enough for container production or in a cropping system.
							• No plans as of now to use compost.
								• Compost consistency must improve.
								• Depends on:
								  • Demand.
								  • The cost of compost.
								  • Finding the right compost locally.

Note. Greenhouse and nursery respondents were not asked to provide reasons why they might increase compost production.

Other significant agricultural sector findings from the 2019 survey included:
- 23% used compost as a soil amendment or conditioner.
- 20% used compost to increase beneficial microorganism populations in the soil.
- 89% preferred to purchase compost in bulk while 11% preferred bags.

- 52% preferred delivery by the compost manufacturer while 48% preferred to haul it themselves.
- Respondents agreed that the price of compost was a factor in reducing or preventing their use of compost.
- 5% of the respondents' farms were located in Huron County, 4% in Sanilac County, and 3% in Tuscola County.

Other significant landscape sector findings from the 2019 survey included:

- 76% of landscape operations generate green waste.
- The mean annual volume of green waste generated is 6,347 cu yd.
- The mean annual cost of disposing of green waste is $12,869.
- 68% of the green waste generated is composted.
- The mean volume of compost generated from green waste is 478 cu yd.
- 31% of landscape operations compost green waste on site while 52% take green waste to a composting site.
- The primary reasons for not composting green waste were no time or space.
- 89% preferred compost delivered in bulk while 11% preferred compost packaged in bags.
- The mean total volume of compost used annually by respondents was 388 cu yd.
- The preferred uses of compost as a soil amendment for planting or incorporation into the soil were installation of trees and shrubs and maintenance of planter beds.
- The preferred uses of compost as mulch were in new installations and maintenance of planter beds (surface).
- The primary use of compost to improve soil health and structure was as a component of a topsoil mix.
- 50% indicated that they used the most compost in the spring while 41% said they used the most in the summer.
- 60% of compost purchases were from wholesale sources.
- 15% of the respondents were from Oakland County, 11% from Kent County, and 9% from Washtenaw County.

Other significant greenhouse and nursery sector findings from the 2019 survey included:

- Peat and pine bark were the two most common components of a growing mix.
- 58% of respondents indicated they were familiar with compost as a growing substrate.
- 65% of respondents' operations generated green waste.
- 77% generated 1 to 10 cu yd of green waste per week.
- The estimated annual cost of disposing green waste generated by their business was $1,750 per year, but with a high standard deviation of 429. It means there appears to be high variation among greenhouse operators in the cost of disposing of green waste generated by their businesses. Interestingly, 21 of 28 respondents reported "Zero" or not spending any money for green waste disposal, and when this was taken into account the average of the remaining seven respondents happens to be $700 per year, with a standard deviation of 632.
- 68% indicated they compost on site.
- Approximately 81% of green waste generated was composted.
- "Lack of green waste," "easier to burn," "too difficult to manage," "disease concerns," and "not a management priority" were reasons given for not composting green waste.
- 41% reported in excess of 100,000 square feet in greenhouse production and 32% reported 1 to 5 acres in nursery production.
- 23% of the respondents were from Kalamazoo County, 17% from Ottawa County, and 8% from Wayne County.

Estimated Greenhouse & Nursery & Landscape Disposal Costs

Of the landscape firms that returned surveys, 76% reported generating green waste annually. The average amount produced was 6,347 cu yd. By extrapolation, the industry generates an estimated 4.0

million cu yd of green waste a year. This is an increase of 0.7 million cu yd from 2005. The estimated average cost to landscape firms for disposing the green waste was $12,869, which is more than twice the 2005 figure. This suggests that the size of firms and waste disposal fees have increased since 2005. The estimated total cost of disposing of green waste generated by landscaping operations was $8.1 million dollars.

Approximately two-thirds of greenhouse and nursery firms generate green waste. The amount of green waste generated is generally less than 10 cu yd per week during the growing season. Using the average disposal cost per operation reported in this study of $1,750 per year, the industrywide estimate of disposal cost is about $728,000 a year. Combining the figures for greenhouse and nurseries and landscape firms yields an annual cost of about $9 million a year. This is considerably less than the 2005 figure, which suggests that landscape and nursery firms have taken steps to minimize their green waste generation and to find alternatives to landfills.

Estimated Agricultural, Greenhouse & Nursery, & Landscape Compost Production

As reported in this study, 31% of landscapers manufacture compost, up from about 25% in 2005. Average compost production rose from 379 cu yd in 2005 to 478 cu yd in 2019, an increase of 26%. It is estimated that landscape firms generate more than 122,000 cu yd of compost a year.

Generating an estimate of compost production for greenhouses and nurseries is somewhat harder. Most greenhouse and nurseries reported producing less than 10 cu yd of green waste per week. A rough estimate of compost production based on reported green waste generation and the number of operations reporting they compost on site is 124,200 cu yd of green waste. Combining the figures for nurseries and landscape firms yields a total of approximately 246,000 cu yd of green waste a year.

We don’t have enough data to estimate on-farm production of compost. The figures have been extrapolated from landscape and greenhouse and nursery firms responses. As a result, these figures should be considered very rough estimates.

Potential Demand for Compost

Given the small number of survey responses, it is not possible to estimate the potential demand for compost with any degree of accuracy. However, it does appear that the demand is increasing and that compost use could increase if producers could meet buyers’ quality standards at a price the buyers would find competitive. Given the cost of production figures and the willingness to pay that farmers, landscape firms, and nurseries reported, it appears that the use of compost could increase, especially by landscape firms and nurseries. The cost of production estimates make the increased use of purchased compost by farmers unlikely. However, the use of compost produced by the farmer for the farm’s own use could increase. The nutritional value of compost could match that of some purchased fertilizers and soil conditioners at a lower price. Furthermore, the cost of land application for a composted product may be lower and more environmentally sustainable than the direct application of manure, especially in winter.

Equine operations are perceived to be good sources of carbon for compost production. Because of the amount of fiber in horse manure it has a carbon-to-nitrogen (C:N) ratio of 30:1, which means horse manure can compost on its own (assuming moisture, aeration, and other factors necessary for compost production are in place). Thus, horse manure itself should not negatively affect the composting process. Bedding mixed with horse manure increases the C:N ratio, making it a desirable carbon feedstock for compost production.

The survey results identify the equine business generating the most manure and bedding, and the manure management service option equine businesses are most likely to use. With this information, compost operators can put manure collection methods in place at the right equine businesses.

Equine owners were asked how likely they would be to use one of four manure management service options. The system that respondents indicated they would be most likely to use was having someone come to their operation and pick up a manure stored in a supplied container on a regular schedule or as needed (Table EQ7). It is particularly significant that 42% of the respondents said they would be very likely to choose this option (Figure EQ2). The least popular option was equine operators having to collect manure and spent bedding from their property in a supplied container and transport it to a central location.

When equine operators were asked to assign a value to having someone come to their operation to pick up manure in a supplied container, the mean value was $92.50 per month (Table EQ8). This was the highest estimated value for any of the four proposed manure management service options. This suggests that compost operators might want to consider setting containers for manure and spent bedding at equine facilities and picking them up regularly.

Other significant findings from the equine sector surveys include:

- Wood shavings and sawdust represent 60% of the bedding used in equine operations.
- Absorbency was the primary factor that affects operators' choice of bedding.
- The majority of respondents (25%) indicated they spread manure and soiled bedding on nongrazed land.
- 49 equine operations generated up to 10 tons of bedding annually and 25 operations generated up to 20 tons annually. Six operations reported generating over 251 tons of manure and urine and two operations reported generating over 251 tons of spent bedding annually.
- The survey respondents were primarily female (90%), Caucasian (92%), college-educated (62%), and over 50 years old (43%).
- 6.2% of the respondents were from Oakland County, 5.7% were from Washtenaw County, and 5.2% were from Saginaw County.

Recommendations

- Encourage composting operations to adopt a standard set of compost specifications that will enable them to demonstrate they are producing compost with a proven and demonstrated ability to consistently improve soil health.
- Fund basic and applied research projects to prove the relationship between the cost/quality of compost and soil health.
- Conduct basic education with and for farmers, landscapers, and greenhouse and nursery operators to increase their understanding of how to use compost to improve soil health.
- Teach farmers, landscapers, and greenhouse and nursery operators how to manufacture compost that meets their soil improvement needs.
- Study the feasibility of using containers to haul manure from equine operations to central composting sites.
- Explore the feasibility of forming one or more cooperative ventures to produce compost.
- Facilitate communication of potential compost users and producers with officials from the Michigan Department of Agriculture and Rural Development (MDARD), the Michigan Department of Environment, Great Lakes, and Energy (EGLE), Michigan State University, and other stakeholders about possible changes to Part 115: Solid Waste Management of Public Act 451 of 1994. EGLE has proposed legislative changes that would impose registration, oversight, permitting costs, and inspection requirements on commercial compost sellers. Farmers are reluctant to invest in developing commercial compost operations until their concerns about the pending legislation are addressed.
- Ensure effective implementation of state policy so that yard waste, food waste, and other organic feedstocks end up in composting sites, anaerobic digesters, animal feed, and other suitable places rather than in landfills.

- Work with compost manufacturers to develop compost delivery options to agricultural, landscaping, and greenhouse and nursery operations.

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APPENDIX A.
Executive Summary of 2005 Current Practices & Market Demand Potential for Compost Produced by Small to Mid-sized Farms in Michigan: A Market Research Report*

This report noted that Michigan farmers expressed strong interest in identifying and determining the viability of alternative sustainable manure treatment methods, especially composting, to help them manage manure that can no longer be land applied. The report presented the findings of a study of compost markets in Michigan conducted in the spring of 2004. Over a thousand respondents – 276 landscape firms, 311 nurseries and 437 farmers – returned completed surveys with usable information. Key findings from the report include:

- Compost Demand Potential
  - Cost of green waste disposal by landscapers and nurseries is $30 million annually. This is true even though landscapers generate nearly 1 million cu yd of compost using their own green waste, while nurseries generate 151,000 cu yd for a total of about 1.1 million cu yd of compost production within these two sectors.
  - Two-thirds of landscapers indicate interest in purchasing compost, while interest is reflected by about half of nurseries and a slightly lower proportion of farmers. Total demand potential among these three sectors is estimated at 200 million dollars annually or 17 million cu yd. Of this, nearly 90% of the demand potential is in the agriculture sector.

- Landscape Firms
  - About half of Michigan's 9,000 landscape firms generate green waste in their operations, at an average of about 700 cu yd annually. Cost of disposal averages about $6,100 per firm. Just over half of green waste generators currently make their own compost and they produce an average of about 380 cu yd.
  - Over one-third of landscapers are compost users and their average annual usage is about 250 cu yd. The majority prefer to purchase their compost in bulk, rather than bag. While spring is the single most popular time of year for compost use, compost is also used extensively in other seasons.
  - The most popular usage applications of compost are as soil amendment and as mulch on new and existing installations of planter beds and around trees. Use of compost as a topsoil component to improve soil health is another popular application. Over a third of landscapers intend to increase their use of compost.
  - The three most important product specifications for compost are consistent product quality, no offensive odors and nutrient availability. Material grade and color are the least important.
  - Over 60% of landscapers indicate interest in using compost purchased from an external source. Average price they are willing to pay is $11.60 per cubic yard.
  - Landscapers that produce their own compost believe it to be of satisfactory quality. On average, landscapers have a higher potential demand than they produce each year. It is important to note however, that landscapers fear quality variances if they purchase from external sources. Landscapers feel that producing compost for sale would not be economical for them.
  - The educational program of greatest interest to landscapers is compost application and use.

- Nurseries
  - Nearly 60% of Michigan's nurseries generate green waste, at an average of about 364 cu yd annually. Cost of disposal averages about $2,245 per firm. About half of the green waste is composted on site.
  - Three-quarters of nurseries are familiar with compost and about half currently purchase premixed media. The most popular elements of the mix are hardwood, field soil, peat and pine bark.

- The majority of nurseries believe that producing compost for sale is not economical. They would consider using compost if the economic benefits could be demonstrated.
- The three most important product specifications were nutrient availability, consistent product quality and pH. It should be noted however, that twelve product specifications related to quality were roughly equal in importance. The aesthetic properties of the compost, such as material grade and color, are the least important specifications.
- Nearly half of landscapers indicate interest in using purchased compost product. Average price they are willing to pay is $12.17 per cubic yard. One in five say they expect to increase their use of compost.
- Educational programs of greatest interest are compost application and use followed by composting methods.

- Agriculture
  - Thirteen percent of Michigan's 9,200 larger farmers (those represented in this study) currently are compost users. Two-thirds purchase their compost in bulk.
  - The three most important product specifications are cost/quality relationship, pH and nutrient availability.
  - On the average, farmers are willing to pay $12.10 per cubic yard for purchased compost. Price ranks third as an obstacle, behind availability and product knowledge factors.
  - About four in ten farmers estimate they would use an average of 10.5 cu yd of compost per acre. Nearly one in five said they intend to increase their use of compost.
  - Farmers believe that producing compost for sale is not economical for them but they would consider using more compost if the economic benefits could be demonstrated. They do not know much about composting, including the economic issues. They do not consider compost to be their primary nutrient source.
  - The educational program of greatest interest is compost application and use.

APPENDIX B.
Agricultural Operation (Farm) Survey

Please note: *For the purposes of this survey, the term "compost" refers to a high-quality soil amendment resulting from properly managing the biological decomposition of carbon (wood shavings, straw, sawdust, leaves, etc.) and nitrogen (manure, grass clippings, etc.) materials.*

Section I. Background Information

1. Please check (✓) your primary farming operation. (***Please choose only one***)

- ❑ Dairy
- ❑ Swine
- ❑ Beef
- ❑ Equine
- ❑ Layers
- ❑ Broilers
- ❑ Turkey
- ❑ Field crops
- ❑ Vegetable crops
- ❑ Fruit crops
- ❑ Other (***Please specify***) _____

2. How do you use compost in your cropping system? (***Check (✓) all that apply***)

- ❑ As a soil amendment/conditioner
- ❑ In place of chemical fertilizer
- ❑ In conjunction with chemical fertilizer
- ❑ As a mulch for weed control
- ❑ Buffer and control soil salts
- ❑ For water retention and conservation
- ❑ To increase beneficial microorganism populations in the soil
- ❑ Soil and/or plant pathogen control
- ❑ Control soil erosion
- ❑ Other use (***Please specify***) _____
- ❑ I do not use compost (***Please skip down to Question #6 and continue filling out the survey***)

Section II. Compost Specifications

3. How do you purchase compost? (***Check (✓) all that apply***)

- ❑ In bags
- ❑ In bulk

4. If you purchase compost, how is it delivered to your farm?

- ❑ Delivered from compost producer
- ❑ Self-haul

5. Do you intend to increase compost use on your farm?

- ❑ Yes
- ❑ No
- ❑ Maybe (***Please briefly explain***)

6. Please indicate (✓) the importance of each specification listed below as it relates to your particular use of compost. ***If you are not currently using compost***, please indicate the specifications that would be important to you if you were to use compost.

Specification	Very important	Important	Slightly important	Not important
Material grade/size				
Fine – 1/8"				
Medium – 3/4"				
Coarse – 1"+				
Color				
Light brown				

Specification	Very important	Important	Slightly important	Not important
Dark brown				
Black				
Moisture content				
No offensive odor				
Consistent product quality				
Nutrient availability				
pH				
Salinity				
Ash content				
Carbon to nitrogen ratio				
Density (weight)				
Water holding capacity				
Cost/quality relationship				
Contains biochar				
Diversity of beneficial microorganisms				
Other (Specify):				

Section III. Compost Manufacturing & Utilization

7. Following are the statements on compost manufacturing and utilization. Please check (✓) the box that most closely indicates your level of agreement with each statement.

Statements	Strongly agree	Agree	Disagree	Strongly disagree	Not applicable
I don't really know much about the process of making compost.					
I'm interested in composting waste materials generated within my own operation.					
Producing compost for my own use is worth the time and money spent doing it.					
I am willing to use compost with a proven and demonstrated ability to improve soil health.					
My customers are seeking an alternative to chemical-only treatments.					
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.					
The quality of compost varies greatly enough that I'm reluctant to use it.					

8. What value ($/cubic yard) would you attach to compost that has a proven and demonstrated ability to improve soil health?

- ❑ <$25
- ❑ $26–$50
- ❑ $51–$75
- ❑ $76–$100
- ❑ $101–$125
- ❑ More than $125

9. Please indicate (✓) your level of agreement on how the following factors reduce or prevent your use of compost.

Statements	Strongly agree	Agree	Disagree	Strongly disagree	Not applicable
Compost is not available when I need it					
Inadequate knowledge of how the compost was made					
Inadequate knowledge about how to use compost					
Price is too high					
Difficult to transport					
Specifications do not meet my needs					
Neighbors raise concerns					
Challenging to land apply					
Lack of application guidelines					

10. If there are other factors than mentioned in the above table that reduce/prevent your use of compost, please list them here.

_____

11. Please list the crop(s) you grow and the acres associated with each crop, and method used to grow them.

Crop name	Number of acres	Conventional methods (circle yes or no)	Certified organic (circle yes or no)	Following organic practices but not certified (circle yes or no)
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No
		Yes, No	Yes, No	Yes, No

Section IV. Demographic Information

12. Your position on the farm is: ***(Check (✓) all that apply)***

- ❑ Owner
- ❑ Manager
- ❑ Other (***Please specify***) _____

13. Do you make the compost purchasing decisions for the farm?

- ❑ Yes

- ❑ No
- ❑ Farm does not purchase compost

14. Your age is:

- ❑ 25 years or less
- ❑ 26–30 years
- ❑ 31–35 years
- ❑ 36–40 years
- ❑ 41–45 years
- ❑ 46–50 years
- ❑ More than 50 years

15. Your gender is: _____

16. Please indicate the highest level of education you have achieved: ***(Check one that applies to you)***

- ❑ Some high school, no diploma
- ❑ High school graduate, diploma or the equivalent (for example GED)
- ❑ Some college credit, no degree
- ❑ Trade/technical/vocational training
- ❑ College degree (ex: A.A., B.S.)
- ❑ Graduate degree (ex: M.A., Ph.D.)

17. Race (Check one that applies to you)

- ❑ Alaskan Native or American Indian – Tribal affiliation: _____
- ❑ Asian
- ❑ Black or African American
- ❑ Native Hawaiian or Other Pacific Islander
- ❑ White or Caucasian
- ❑ Choose not to provide

18. Ethnicity (Check one that applies to you)

- ❑ Hispanic or Latino
- ❑ Middle Eastern or Arab-American
- ❑ My ethnicity is not listed (please specify)
- ❑ Choose not to provide

19. What county/counties do you farm in?

20. County of residence:

APPENDIX C.
Landscape Operation Survey

Please note: *For the purposes of this survey, the term "compost" refers to a high-quality soil amendment resulting from properly managing the biological decomposition of carbon (wood shavings, straw, sawdust, leaves, etc.) and nitrogen (manure, grass clippings, etc.) materials.*

Section I. Background Information

1. Choose ***one to three descriptions*** (✓) that most closely describes the business or agency you are currently employed by.

- ❑ Landscape contractor – installation
- ❑ Landscape contractor – maintenance
- ❑ Wholesaler/Retailer of soil amendments
- ❑ Turfgrass grower
- ❑ Parks and recreation
- ❑ Sports turf (golf, stadiums, etc.)
- ❑ State, County, or Local Transportation Department
- ❑ State, County, or Local Natural Resource Department
- ❑ Excavating company
- ❑ Topsoil blender/manufacturer
- ❑ Bioremediation (environmental cleanup companies)
- ❑ Other (***Specify***)

2. Does your operation generate green waste, e.g., grass clippings, brush, etc.?

- ❑ Yes
- ❑ No (***If no, please skip to Question #9 below and continue filling out the survey***)

3. Please indicate the approximate annual volume of green waste generated by your operation.

_____ cubic yards

4. How is your green waste presently managed?

- ❑ Composted on site
- ❑ Sent to the landfill
- ❑ Other (please explain) _____

5. What is the approximate annual cost of disposing the green waste generated by your operation? $_____

6. What percent of your green waste do you compost? _____%

7. If you do not compost your green waste, please briefly explain why. _____

_____

8. Approximately how many cubic yards of compost do you generate annually from your green waste? _____ cubic yards

9. Do you use compost for any purpose during the growing season?

- ❑ Yes
- ❑ No (***If no, please skip to Question #15 below and continue filling out the survey***)

10. What is the total volume of compost you use annually? _____ cubic yards

11. In what form is it delivered to you? ***(Check (✓) all that apply)***

- ❑ Bags
- ❑ Bulk

Section II. Compost Use

12. Where do you use compost? *(Check (✓) all that apply)*

A. Use as a soil amendment for planting/incorporation into the soil

New installation of:	Maintenance of:
❑ Trees/shrubs	❑ Trees/shrubs
❑ Planter beds	❑ Planter beds
❑ Turf/lawns	❑ Turf/lawns

B. Use as a mulch

New installation of:	Maintenance of:
❑ Beds around trees	❑ Beds around trees
❑ Planter beds (surface)	❑ Planter beds (surface)
❑ General yard mulch	❑ General yard mulch
❑ Walkways	❑ Walkways
❑ Control soil erosion	❑ Control soil erosion
❑ Roadside construction projects	❑ Roadside construction projects
❑ Bioremediation projects	❑ Bioremediation projects

C. Use to improve soil health and structure

- ❑ Component of a topsoil mix
- ❑ Improve poor and/or contaminated soils

D. Use in compost blends for value-added applications.

- ❑ Incorporation into mulch
- ❑ Other (Please specify) _____

13. When do you use the ***greatest*** quantity of compost? ***(Select one)***

- ❑ Spring
- ❑ Summer
- ❑ Fall
- ❑ Winter

14. Where do you purchase your compost? ***(Please check (✓) all that apply)***

- ❑ Wholesale
- ❑ Retail
- ❑ Other (***Specify***)_____

15. Do you intend to increase your use of compost?

- ❑ Yes
- ❑ No
- ❑ Maybe (***Please briefly explain***) _____

Section III. Compost Specifications

16. What value ($/cubic yard) would you attach to compost that has a proven and demonstrated ability to improve soil health **and** met your specifications in place of some commercial fertilizers in a landscaping job?

- ❑ <$25
- ❑ $26–$50
- ❑ $51–$75
- ❑ $76–$100
- ❑ $101–$120
- ❑ More than $120

17. Please check (✓) the importance of each specification listed below as it relates to your particular use of compost. *If you are not currently using compost,* please indicate the specifications that would be important to you if you were to use compost.

Specification	Very important	Important	Slightly important	Not important
Material grade/size				
Fine – 1/8"				
Medium – ¾"				
Coarse – 1"+				
Color				
Light brown				
Dark brown				
Black				
Moisture content				
No offensive odor				
Consistent product quality				
Nutrient availability				
pH				
Salinity				
Ash content				
Carbon to nitrogen ratio				
Density (weight)				
Water holding capacity				
Cost/quality relationship				
Diversity of beneficial microorganisms				
Contains biochar				
Other (specify):				

18. Following are the statements on compost manufacturing and utilization. Please check (✓) the box that most closely indicates your level of agreement with each statement.

Statements	Strongly agree	Agree	Disagree	Strongly disagree	Not applicable
I don't really know much about the process of making compost.					
I'm interested in composting waste materials generated within my own operation.					
Producing compost for my own use is worth the time and money spent doing it.					
I am willing to use compost with a proven and demonstrated ability to improve soil health.					
My customers are seeking an alternative to chemical-only treatments.					
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.					
The quality of compost varies greatly enough that I'm reluctant to use it.					

Section IV. Demographic Information

19. Your position in the company is: ***(Check (✓) all that apply)***

- ❑ Owner
- ❑ Manager
- ❑ Other (***Please specify***) _____

20. Do you make the compost purchasing decisions?

- ❑ Yes
- ❑ No

21. Your age is:

- ❑ 25 years or less
- ❑ 26–30 years
- ❑ 31–35 years
- ❑ 36–40 years
- ❑ 41–45 years
- ❑ 46–50 years
- ❑ More than 50 years

22. Your gender is: _____

23. Please indicate the highest level of education you have achieved. (***Check one that applies to you.***)

- ❑ Some high school, no diploma
- ❑ High school graduate, diploma or the equivalent (for example GED)
- ❑ Some college credit, no degree
- ❑ Trade/technical/vocational training
- ❑ College degree (ex: A.A., B.S.)
- ❑ Graduate degree (ex: M.A., Ph.D.)

24. Race (Check one that applies to you)

- ❑ Alaskan Native or American Indian – Tribal affiliation: _____
- ❑ Asian
- ❑ Black or African American
- ❑ Native Hawaiian or other Pacific Islander
- ❑ White or Caucasian
- ❑ Choose not to provide

25. Ethnicity (***Check one that applies to you***)

- ❑ Hispanic or Latino
- ❑ Middle Eastern or Arab-American
- ❑ My ethnicity is not listed (***please specify***) _____
- ❑ Choose not to provide

26. County of residence: _____

APPENDIX D.
Greenhouse & Nursery Operation Survey

Section I. Background Information

Please note: *For the purposes of this survey, the term "compost" refers to a high-quality soil amendment resulting from properly managing the biological decomposition of carbon (wood shavings, straw, sawdust, leaves, etc.) and nitrogen (manure, grass clippings, etc.) materials.*

1. Please check (✓) the one that categorizes your primary business. (***Select one***)

- ❑ Retail nursery
- ❑ Retail nursery/landscaper
- ❑ Wholesale nursery
- ❑ Retail greenhouse/garden center
- ❑ Wholesale greenhouse
- ❑ Other (***Specify***) _____

2. Do you purchase a premixed media or do you mix your own? ***(Select one)***

- ❑ Purchase a premixed media
- ❑ Mix your own media
- ❑ I do not purchase or mix a media (***If you choose this answer, please go to Question 4***)

3. Roughly what percent of the components listed below are used in your growing mix?

a. Perlite	_____%	g. Hardwood bark	_____%
b. Peat	_____%	h. Rice hulls	_____%
c. Compost	_____%	i. Coir	_____%
d. Sand	_____%	j. Biochar	_____%
e. Field soil	_____%	k. Other (specify)	_____%
f. Pine bark	_____%	_____	

4. Are you familiar with compost as a component of a growing substrate?

- ❑ Yes
- ❑ No

5. Does your business generate green waste (leaves, plants, brush, etc.)?

- ❑ Yes
- ❑ No (***If no, please go to Question #11 and continue filling out the survey***)

6. What is the estimated quantity of green waste generated by your business during a typical growing season? (***please select one***).

- ❑ 1–10 cubic yards/week
- ❑ 11–20 cubic yards/week
- ❑ 21–50 cubic yards/week
- ❑ More than 50 cubic yards/week
- ❑ Other (***Specify***) _____

7. What is the estimated annual cost of disposing the green waste generated by your business? $ _____

8. How is your green waste presently managed? Please check (✓) all that applies to you.

- ❑ Sent to the landfill
- ❑ Composted on site
- ❑ Other (***Specify***) _____

9. Roughly what percent of your green waste do you compost? _____%

10. If you do not compost your green waste, briefly explain why: _____

Section II. Compost Specifications

11. Please indicate (✓) the importance of each specification listed below as it relates to your particular use of compost***. If you are not currently using compost***, please indicate the specifications that would be important to you if you ***were*** to use compost.

Specification	Very important	Important	Slightly important	Not important
Material grade/size				
Fine – 1/8"				
Medium – ¾"				
Coarse – 1"+				
Color				
Light brown				
Dark brown				
Black				
Moisture content				
No offensive odor				
Consistent product quality				
Nutrient availability				
pH				
Salinity				
Ash content				
Carbon to nitrogen ratio				
Density (weight)				
Water holding capacity				
Cost/quality relationship				
Contains biochar				
Diversity of beneficial microorganisms				
Other (Specify):				

12. Following are statements on compost manufacturing and utilization. Please check (✓) the box that most closely indicates your level of agreement with each statement.

Statements	Strongly agree	Agree	Disagree	Strongly disagree	Not applicable
I don't really know much about the process of making compost.					
I'm interested in composting waste materials generated within my own operation.					
Producing compost for my own use is worth the time and money spent doing it.					
I am willing to use compost with proven and demonstrated ability to improve soil health.					
I would consider using compost if the economic value of doing so could be clearly demonstrated to me.					
The quality of compost varies greatly enough that I'm reluctant to use it.					

13. What value ($/cubic yard) would you attach to compost that has a proven and demonstrated ability to improve soil health?

- ❑ <$25
- ❑ $26–$50
- ❑ $51–$75
- ❑ $76–$100
- ❑ $101–$120
- ❑ More than $120

14. Do you plan to increase your use of compost?

- ❑ Yes
- ❑ No (***Please briefly explain***) _____

Section III. Demographic Information

15. Your position in the company is: (Check (✓) one option that best represents you)

- ❑ Owner
- ❑ Grower
- ❑ Manager
- ❑ Other (please specify) _____

16. Do you make the growing media purchasing decision?

- ❑ Yes
- ❑ No

17. Total area in production:

a. Greenhouse: _____ square feet

b. Nursery: _____ acres

18. Your age is:

- ❑ 25 years or less
- ❑ 26–30 years
- ❑ 31–35 years
- ❑ 36–40 years
- ❑ 41–45 years
- ❑ 46–50 years
- ❑ More than 50 years

19. Your gender is: _____

20. Please indicate the highest level of education you have achieved:

- ❑ Some high school, no diploma
- ❑ High school graduate, diploma or the equivalent (for example GED)
- ❑ Some college credit, no degree
- ❑ Trade/technical/vocational training
- ❑ College degree (e.g., A.A., B.S.)
- ❑ Graduate degree (e.g., M.A., J.D., M. D., Ph.D.)

21. Race (Check one that applies to you.)

- ❑ Alaskan Native or American Indian – Tribal affiliation: _____
- ❑ Asian
- ❑ Black or African American
- ❑ Native Hawaiian or Other Pacific Islander
- ❑ White or Caucasian
- ❑ Choose not to provide

22. Ethnicity (Check one that applies to you.)

- ❑ Hispanic or Latino
- ❑ Middle Eastern or Arab-American
- ❑ My ethnicity is not listed (please specify) _____
- ❑ Choose not to provide

23. County of residence: _____

APPENDIX E.
Equine Operation Survey

Instructions: *For the purposes of this equine industry carbon survey, carbon refers to both horse manure and bedding. Horse manure has a carbon to nitrogen ratio of 30:1, which is perfect for compost production. Carbon is often the limiting factor when making compost on a large scale, so quantifying the potential volume of horse manure and bedding available for compost production is critical if the volume of compost produced in the state is to be increased. Completing the survey is voluntary. You may choose not to participate at all, answer only certain questions, or discontinue your participation without any penalty. You and your operation will never be individually identified. Your privacy and your business's privacy will be protected to the maximum extent of the law. Survey results will be aggregated in the final report. If you have concerns or questions about this study, please contact the principal investigator, Mr. Charles Gould at 12220 Fillmore St, Suite 122, West Olive, MI 49460 or call him at (616) 994-4547 or email at gouldm@msu.edu. Please answer the following questions to the best of your ability.*

1. Please rank the type of equine business you operate according to predominance, with 1 indicating the primary focus of your operation.

_____ Boarding
_____ Breeding
_____ Farming with horses
_____ Horse or carriage rental
_____ Instruction
_____ Racing
_____ Specialized horse-sports center (showing, jumping, eventing, polo, etc.)
_____ Training
_____ Other (Please specify: _____)

2. What type of bedding do you use? (Check all that apply)

- ❑ I don't use bedding (If you choose this answer, skip to Question 4)
- ❑ Oat straw
- ❑ Paper pellets
- ❑ Peat moss
- ❑ Sawdust
- ❑ Switchgrass
- ❑ Wheat straw
- ❑ Wood pellets
- ❑ Wood shavings
- ❑ Other (Please specify: _____)

3. Please rank the factors that affect your choice of bedding, with 1 being your top choice and so forth to your least choice.

_____Absorbency
_____Comfort
_____Composts well
_____Cost
_____Easy to store
_____Easy to use
_____Horse health
_____Readily available
_____Other (Please specify: _____)

4. How do you manage manure and/or soiled bedding on your operation? (Check all that apply)

- ❑ Compost it
- ❑ Give it away to nurseries, gardeners, etc.
- ❑ Haul it away yourself
- ❑ Pay someone to haul it away
- ❑ Pile and leave it to degrade (this is not the same as composting)
- ❑ Spread it on grazed land
- ❑ Spread it on nongrazed land
- ❑ Other (specify: _____)

5. Approximately what is the annual volume (in tons) of manure, urine, and bedding generated at your operation? (For just manure and urine, assume a 1,000 pound horse excretes 50 pounds of manure and urine a day or nine tons per year)

Manure/Urine _____ (tons)

Bedding _____ (tons)

6. Please indicate how likely you would be to use one of the following manure management service options:

Manure management service option	Never	Unlikely	Likely	Very likely
Option 1: A system where you would collect manure from your operation and bring it to a central location in a supplied container/bin.				
Option 2: A system where someone would come to your operation and pick up a supplied container/bin of manure on a regular or as required basis.				
Option 3: A system where someone would come to your operation to clean up and remove manure from a pasture.				
Option 4: A system where someone would come to your operation and compost all manure, urine, and bedding on-site.				

7. Based on your response to each option in Question 6, how much would you be willing to pay on a monthly basis for each manure management service option?

Option 1: Drop-off at a location $_____

Option 2: Service to pick-up at my operation on a regular/as-required basis $_____

Option 3: Service to gather and remove pasture manure at my operation $_____

Option 4: Service to compost manure, urine, and bedding on-site at my operation $_____

8. Your age is:

- ❑ 25 years or less
- ❑ 26–30 years
- ❑ 31–35 years
- ❑ 36–40 years
- ❑ 41–45 years
- ❑ 46–50 years
- ❑ 51–60 years
- ❑ 61–70 years
- ❑ Over 70 years

9. Your gender is: _____

10. Please indicate the highest level of education you have achieved:

- ❑ Some high school, no diploma
- ❑ High school graduate, diploma or the equivalent (for example GED)
- ❑ Some college credits, no degree
- ❑ Trade/technical/vocational training
- ❑ College degree (e.g., A.A., B.S.)
- ❑ Graduate degree (e.g., M.A., J.D., M. D., Ph. D.)

11. Race (Check one that applies to you.)

- ❑ Alaskan Native or American Indian – Tribal affiliation: _____
- ❑ Asian
- ❑ Black or African American
- ❑ Native Hawaiian or Other Pacific Islander
- ❑ White or Caucasian
- ❑ Choose not to provide

12. Ethnicity (Check one that applies to you.)

- ❑ Hispanic or Latino
- ❑ Middle Eastern or Arab-American
- ❑ My ethnicity is not listed (please specify) _____
- ❑ Choose not to provide

13. County of residence: _____

APPENDIX F.
Respondent Written Comments About Primary Farming Operation

Primary farming operation of agricultural sector respondents (write-in responses)	(N)
Retired from farming	25
Hay, corn; Hay; Alfalfa hay production; Alfalfa/Rye; Hay/Pasture; Hay/Ag Tourism	12
Rent or lease land to others	11
Sheep	8
Dairy heifers; Heifer grower; Heifers-dairy; Replacement dairy heifers; Custom heifer grower	8
Garden	5
Cash crop – organic; We are a multi-faceted diverse sustainable farm	3
Cut flowers; Greenhouse-raised beds; Nursery	3
I am a landowner not a farmer.	2
Crop; Raise a few crops and raise a few steeds	2
Corn, soybeans, wheat; Corn, soybeans	2
Ag consultant	1
1/3 beef, 1/3 hogs, 1/3 crop	1
Cats	1
Compost only	1
Conservation Reserve Enhancement Program	1
Diverse blend of plants and mushrooms	1
Food plots	1
Goats and horses	1
Hobby	1
Hops	1
Integrated livestock and vegetable farm	1
Lavender	1
Maple syrup	1
Mint	1
Potatoes	1
Pussy willows	1
Seed corn	1
Sugar beets	1
Timber	1
TOTAL	**101**

APPENDIX G.
Respondents' Written Comments on Intention to Increase Compost Use on Their Farm

General reason	Written comment	Frequency
I. Availability and cost (n = 26)	• If and when more comes available to us by our supplier.	1
	• If I can find an economical supply.	1
	• If it was in my area.	1
	• If manure with straw or shavings is available.	1
	• If local manure no longer available.	1
	• If production justify the cost.	1
	• If we can get it at an affordable price.	1
	• Still weighing relative value to manure.	1
	• I think we get better value from our $ spent growing our own biomass product and we have the live root structure.	1
	• Availability and cost compared to typical commercial fertilizers.	1
	• Might if improvements are noticed.	1
	• Would like to continue if available, $, and make some of our own.	1
	• Would love to I can't afford it.	1
	• Intent to purchase in bulk and delivered if right source could be found.	1
	• Availability, cost, integrity.	1
	• Cost is too high to justify use.	1
	• Cost/benefit, currently using primarily in high value ground under plastic.	1
	• Depending on availability.	1
	• Depends on availability.	1
	• Depends on availability.	1
	• Has to be inexpensive.	1
	• Price.	2
	• Price and spreadability.	1
	• Price, timing.	1
	• Time and price or expense	1
II. Make/utilize own compost on farm (n = 16)	• I compost baled hay that is bad.	1
	• I make my own.	1
	• I make my own compost from generated manure solids.	1
	• I use only self-generated compost.	1
	• Make my own.	1
	• Make own compost.	1
	• We do not purchase compost – we make it ourselves.	1
	• We do not purchase compost, we make it.	1
	• We do our own.	1
	• We compost some of our manure.	1
	• We have a compost pile and increase it each year.	1
	• We use compost from dead animals from our sheep and hog operation. It is a fairly steady amount.	1
	• Do not purchase, have materials from farm.	1
	• Compost we use in from own barn.	1
	• Haul by semi load 28 ton at a time 8 miles sawdust and straw combination.	1
	• As a means to apply blended micros.	1
III. Manure use (n = 14)	• Chicken manure.	1
	• Continue to use manure.	1
	• Use animal byproducts produced on farm.	1

General reason	Written comment	Frequency
	• I spread manure.	1
	• I use manure.	1
	• Use cattle manure.	1
	• Use manure.	1
	• Use on farm manure.	1
	• If you consider using beef manure as compost. That is what I basically do. I haul pen manure and also piled up manure. Spread it thin and no till plant. I am serious about buying chicken manure.	1
	• Use raw manure.	1
	• My compost is liquid manure.	1
	• Only beef manure.	1
	• I buy animal manure.	1
	• Not at this time, use purchased compost – use the manure and bedding from the sheep operation I raise about XXX lambs a year.	1
IV. As recommended by analysis (n = 4)	• As required.	1
	• As soil analysis dictates.	1
	• Depends on needs.	1
	• Only used as needed according to soil tests.	1
V. Other (n = 17)	• Have not done so yet, need to start first.	1
	• I would like nothing more than to apply compost to all crops veg and field.	1
	• We do not crop farm, may try it on pasture ground.	1
	• Still looking into the best way.	1
	• Not sure at this time.	1
	• Have used very little.	1
	• I have farmed since 1960 with only some compost used in my garden at present, I raise asparagus, wheat, corn.	1
	• Just started to use compost.	1
	• I purchase my compost from the city if Saginaw nice quality with fairly coarse material	1
	• The more the better! We also use worm castings.	1
	• Less livestock.	1
	• Sludge from PCA Manistee works very good.	1
	• We don't use compost and have no intention of using it at this time.	1
	• Have no interest in using it.	1
	• Don’t use compost, use cover crop only clover-oats etc.	1
	• Free tree chips.	1
	• Harvest grass and alfalfa from highly erodible land for mulch compost for blueberries.	1
TOTAL		**N = 77**

APPENDIX H.
Respondents' Written Comments on Other Factors Affecting Farm Use of Compost

The following table captures the written comments from Table AG9 provided by 103 respondents who identified factors they felt hindered or prevented their use of compost.

Factor	Written comment
I. Ready supply of manure (n=26)	• 400–500 head of cattle. • Have our own cow manure. • I feed cattle, so I have my own manure. • I haul manure from a feed lot when they are full and leave it set for 10 months before spreading. It still is heating in the pile when I spread it. • I have manure instead of compost. • I have plenty of liquid hog manure for NPK but will do more multi cover crops. • I spread my own cattle manure. • I use dried manure from chicken. • I use manure from beef cattle I raise. • I use manure so I have not had the need for compost. • I use my cattle waste and no need for compost. • I use the basic elements/shit of compost produced by my animals. • I use the manure product on my farm. • Only compost I have is from sheep, manure spread • Only use manure not compost. • We have all the manure we need, no need for compost • We have enough manure from livestock to use. • We have our own. • We have the manure from a 6000 finishing and a lot of chicken manure. • We produce almost enough manure on our farm to meet the nutrient needs of all of our acreage. • We raise grass fed beef raised on our own hay. So, hay is our crop. We just use our own manure as compost/fertilizer on our fields. • We spread manure and straw for 38 years. I question the economics of purchasing compost for a row crop operation, especially if operator is near retirement. • We use raw manure. • We use some cow manure. • We use dry manure would need more carbon to compost. • We use processed chicken manure.
II. Concerns about the economics associated with compost (n=21	• We spread manure and straw for 38 years. I question the economics of purchasing compost for a row crop operation, especially if operator is near retirement. • As a certified organic farm, we have to truck in OMRI compost all the way from Illinois. Trucking is just as expensive as the compost itself. Would LOVE a closer option. • Cost of transportation. • Freight and application cost not sure if this are my best choice for my $. • Availability and affordable costs, biohazard? Any transferable chemicals, antibiotics, and or diseases to environment. • It has to be demonstrated positive ROI not a lot of hot air. • It is all about ag economics. Give me a truck load of compost and I will spread it. • If we can't grow our own, we sure can't afford to buy someone else. • Lack of availability. Spread ability, consistent weight, nutrient consistency, cost. • Place of availability/price. • Price/cost/return investment. • Not up to speed on benefits and cost comparison.

Factor	Written comment
	• We have when told they will be out of food 2010 now 2025 now by 2050 people will be starving (we don't make enough money to do this). • Too much for trucking. • Transportation cost to make bulk purchases probably expenses. • Transportation distance. • Time. • Time to make and investment. • Time, money. • We are not into buying compost. • Small farm.
III. Concerns about the disease organisms, weed seeds, metals, and herbicide residues in compost (n=7)	• Are there any unbroken down herbicides? • Availability and affordable costs, biohazard? Any transferable chemicals, antibiotics, and or diseases to environment. • Concern about spread of diseases from dead animals in the compost. • H1614 carbon compost for disease suppression need to be process and graded better. • I don't trust likely sources (industrial, CAFO) of raw materials used in large scale compost operations and likely toxins. • Heavy metals, pathogens, antibiotics, run off. • Improperly produced compost that contains noxious weed seeds and/or invasive species.
IV. Availability of compost (n=11)	• Availability. • Availability and affordable costs, biohazard? Any transferable chemicals, antibiotics, and or diseases to environment. • Place of availability/price. • Ease of obtaining. • Lack of availability. Spread ability, consistent weight, nutrient consistency, cost.. • Lack of availability, time and ability to get it made. • Long distance to suppliers. • Not sure of local sources. • I have no access. • None available. • Not available up here.
V. Application difficulties (n=7)	• Difficulty to spread with accuracy. • Ease of application. • It takes a long time to cover the application area. • Lack of availability. Spread ability, consistent weight, nutrient consistency, cost.. • Typically, equipment is built for synthetic fertilizers and cannot reach the capacity of compost required without modification. • Similar to manure, bulky, difficult to transport. • None, we have our own spreader.
VI. Ignorance about making or using compost (n=16)	• Don't know very much about it. • General lack of understanding. • Have not used so hard to answer these questions. • I am not sure how to do this on a large scale. • I do not know very little about product and my answers are not very credible • I don't know enough about it. • I don't intend to ever use it; I probably will retire soon. • I don't know enough about compost to use it. • I don't use compost and I don't know much about it. • I know nothing about it. • Uneducated about compost. • I have not looked for compost sources. • More information needed.

Factor	Written comment
	• I really have never looked into it. I do not have the ability to answer some of these questions • Not use compost. • Never used it.
VII. No longer farming/Rent out land (n=5)	• I am retired. • DNA • Do not manage farm anymore. • Ground is rented out. • I rent my land to my neighbor dairy farmer.
VII. Other comments (n=15)	• Compost is acceleration of natural process that wastes resources nitrogen and carbon released to air rather than soil while burning fuel and iron in process • Clay soil stays wet longer. • I use cover crops when possible. • Compost contributing to high soil pH, difficulty getting local compost to comply with organic standards. • Food safety audits are very picky about compost, weight restrictions. • For fruit trees the nitrogen effect is tough to regulate with our wet climate. • Just a different way of thinking of raising crop. • Neighbors complaining of odor. • Not needed for my pastures. • I only use compost from own farm. • We make most of our own compost. We are often limited by how much organic matter we can get to make compost. We produce app 50 yards/year. • Only compost that we may apply is on bare ground with no trees. • Would have to be certified organic. • Sometimes debris is tract and out driveway on road difficult to quickly clean with impatient drivers. • No chemical available in area.

APPENDIX I.
Agricultural Respondents' Self-Reported Ethnicity

Ethnicity	Frequency	Ethnicity	Frequency	Ethnicity	Frequency
American	42	European, German	1	Mixed	1
Anglo	2	European/American	1	Northern European	2
Anglo Scandinavian	1	European	1	Polish American	9
British	1	French, Belgium	1	Scandinavian	1
Caucasian	7	French, English, Polish	1	Scotch, English, Irish	1
Croatian	1	French, German	1	Scottish Irish, English	1
Danish, Norwegian	1	German American	25	Slovak	1
Dutch	2	German, Belgium	1	Swedish American	3
Dutch, English, Austrian	1	German, English	2	Swiss	1
Dutch, German	1	German, French, English	1	Swiss, Dutch, English	1
Eastern Europe	1	German, Irish	2	Swiss/German	2
Eastern European	1	German, Irish, English	1	Ukraine	1
English	7	German, Irish, French	1	Ukrainian French	1
English, Dutch	1	German, Belgian	1	WASP	1
English, Scottish, Dutch	1	German, Irish	1	Western Europe	2
English, German	1	German, Welch	1	White	18
English/Scottish/Irish/ German	1	Hollander	1	White American, Polish	1
European	20	Irish	1	White, German	1
European Mix	1	Irish, American	1	TOTAL	188
European-western	1	Irish, German	1		

APPENDIX J.
Agricultural Respondents' County of Residence

County	Frequency	%	County	Frequency	%	County	Frequency	%
Huron	72	8.0	Genesee	13	1.4	Iosco	5	0.6
Sanilac	61	6.8	Mason	13	1.4	Manistee	5	0.6
Tuscola	48	5.3	Calhoun	12	1.3	Grand Traverse	4	0.4
Bay	41	4.5	Ingham	12	1.3	Oakland	4	0.4
Saginaw	40	4.4	Shiawassee	12	1.3	Ogemaw	4	0.4
Ottawa	30	3.3	Kalamazoo	11	1.2	Otsego	4	0.4
Gratiot	29	3.2	Leelanau	11	1.2	Alger	3	0.3
Kent	28	3.1	Menominee	11	1.2	Cheboygan	3	0.3
Berrien	25	2.8	Midland	11	1.2	Clare	3	0.3
Montcalm	24	2.7	Macomb	10	1.1	Gladwin	3	0.3
Monroe	21	2.3	Oceana	10	1.1	Charlevoix	2	0.2
Allegan	20	2.2	Van Buren	10	1.1	Emmet	2	0.2
Hillsdale	20	2.2	Barry	9	1	Kalkaska	2	0.2
Isabella	18	2	Mecosta	9	1	Livingston	2	0.2
Lapeer	17	1.9	Alpena	8	0.9	Mackinac	2	0.2
Newaygo	16	1.8	Delta	8	0.9	Montmorency	2	0.2
Clinton	15	1.7	Jackson	8	0.9	Oscoda	2	0.2
Ionia	15	1.7	Muskegon	8	0.9	Wayne	2	0.2
St. Joseph	15	1.7	St. Clair	7	0.8	Baraga	1	0.1
Washtenaw	15	1.7	Antrim	6	0.7	Marquette	1	0.1
Lenawee	14	1.6	Eaton	6	0.7	Ontonagon	1	0.1
Osceola	14	1.6	Missaukee	6	0.7	**TOTAL**	**903**	**100.00**
Branch	13	1.4	Presque Isle	6	0.7			
Cass	13	1.4	Arenac	5	0.6			

APPENDIX K.
Location of Farm by County

County or Counties	Frequency	County or Counties	Frequency	County or Counties	Frequency
Huron	58	Wayne	2	Kent, Ottawa	2
Sanilac	48	Baraga	1	Kent, Ottawa, Oceana	1
Tuscola	34	Clare	1	Lapeer, Sanilac	1
Bay	28	Livingston	1	Lapeer, St. Clair	2
Saginaw	27	Luce	1	Leelanau, Grand Traverse	1
Gratiot	25	Mackinac	1	Lenawee, Monroe	2
Berrien	23	Marquette	1	Mackinac, Chippewa	1
Ottawa	22	Ontonagon	1	Mecosta, Isabella	3
Montcalm	21	Allegan, Bay	1	Menominee, Delta	1
Kent	20	Allegan, Kalamazoo, Van Buren	2	Midland, Isabella	1
Allegan	17	Allegan, Ottawa	1	Midland, Saginaw	2
Hillsdale	16	Allegan, Van Buren	1	Missaukee, Wexford, Osceola	1
Ionia	16	Antrim, Charlevoix	1	Montcalm, Mecosta	1
Montcalm	16	Barry, Calhoun	1	Monroe, Washtenaw	1
Washtenaw	16	Barry, Eaton, Kalamazoo, Midland, Bay, Arenac	1	Monroe, Lenawee	1
Isabella	15	Bay, Arenac	1	Montcalm, Clare, Gratiot, Saginaw, Clinton, Isabella	1
Lenawee	15	Bay, Midland	6	Montcalm, Delta	1
Lapeer	14	Bay, Midland, Arenac	1	Montcalm, Gratiot	1
Monroe	14	Bay, Saginaw	3	Montcalm, Ionia	2
Mason	13	Bay, Saginaw, Midland	1	Muskegon, Newaygo	1
Clinton	12	Bay, Saginaw, Tuscola	2	Newaygo, Mecosta	1
St. Joseph	12	Bay, Tuscola	1	Newaygo, Oceana	2
Branch	11	Berrien, Cass	1	None	2
Newaygo	11	Branch, Calhoun	2	Oceana, Mason	2
Osceola	11	Cass, Berrien	3	Oceana, Newaygo	1
Calhoun	10	Cass, St. Joseph	2	Ogemaw, Gladwin	1
Genesee	10	Cass, Van Buren	1	One	1
Macomb	10	Charlevoix, Antrim	1	Osceola, Mecosta	1
Menominee	10	Clare, Osceola	1	Osceola, Missaukee	1
Barry	9	Clare, Isabella	1	Ottawa, Allegan	1
Shiawassee	9	Clare, Osceola, Missaukee, Wexford	1	Ottawa, Kent, Allegan	1
Alpena	8	Clients across state	1	Ottawa, Muskegon	1

County or Counties	Frequency	County or Counties	Frequency	County or Counties	Frequency
Cass	8	Clinton, Gratiot	1	Retired	1
Ingham	8	Clinton, Ionia	2	Saginaw, Bay	1
Leelanau	8	Colfax, Sheridan, Etc.	1	Saginaw, Genesee	1
Delta	7	Delta, Montcalm	1	Saginaw, Midland, Gratiot	1
Eaton	7	Genesee, Lapeer	1	Saginaw, Shiawassee	1
Kalamazoo	7	Genesee, Saginaw	1	Saginaw, Shiawassee, Genesee	1
Oceana	7	Genesee, Shiawassee	2	Saginaw, Tuscola	6
Presque Isle	7	Genesee, Tuscola, Saginaw, Lapeer	1	Saginaw, Tuscola, Bay	1
St. Clair	7	Gladwin, Clare	1	Sanilac, Lapeer	1
Jackson	6	Gratiot, Clinton, Midland, Tuscola	1	Sanilac, Macomb	1
Mecosta	6	Gratiot, Isabella	1	Sanilac, St. Clair	2
Arenac	5	Gratiot, Midland, Isabella	1	Shiawassee, Livingston	2
Iosco	5	Hillsdale, Branch	1	Shiawassee, Saginaw	1
Missaukee	5	Hillsdale, Jackson	1	Shiawassee, Clinton	1
Muskegon	5	Hillsdale, Jackson, Calhoun	1	St. Joseph, Cass, Tuscola, Saginaw	1
Van Buren	5	Huron, Alcona	1	St. Joseph, Hillsdale,	1
Antrim	4	Huron, Sanilac	2	Tuscola, Bay	2
Manistee	4	Huron, Sanilac, Tuscola	2	Tuscola, Bay, Saginaw	1
Midland	4	Huron, Tuscola	8	Tuscola, Bay, Saginaw, Sanilac	1
Otsego	4	Huron, Sanilac	3	Tuscola, Genesee	1
Alger	3	I am retired. Don't farm.	1	Tuscola, Huron	2
Cheboygan	3	I don't farm, I rent my land out.	1	Tuscola, Lapeer	1
Gladwin	3	Ingham, Clinton, Gratiot, Shiawassee	1	Tuscola, Saginaw	3
Ogemaw	3	Ingham, Livingston	1	USA Columbia	1
Charlevoix	2	Ingham, Livingston, Shiawassee	1	Van Buren, Berrien, Cass	1
Emmet	2	Ionia, Clinton	2	Van Buren, Kalamazoo	2
Grand Traverse	2	Isabella, Clare	1	Washtenaw, Monroe	2
Kalkaska	2	Jackson, Ingham	2	Wexford, Grand Traverse	1
Montmorency	2	Kalamazoo, Calhoun, Barry	1	29	1
Oakland	2	Kalamazoo, Van Buren	1	**TOTAL**	**1,239**
Oscoda	2	Kent, Mackinac	1		
Osceola (64)	2	Kent, Montcalm, Ionia (64)	1		

APPENDIX L.
Michigan Biomass Production

The tables in this appendix list the 50 largest wastewater treatment plants (Table L-1), the 49 largest confined animal feeding operations (Table L-2), and the 50 largest school buildings (Table L-3) in Michigan in 2012. It is estimated that these entities produced a combined total of 2,160,747 dry US tons of waste that year.

Table L-1. Volume of waste produced by the 50 largest wastewater treatment plants in Michigan in 2012.

Rank	Wastewater treatment plant	Biomass produced (U.S. dry tons/year)	Rank	Wastewater treatment plant	Biomass produced (U.S. dry tons/year)
1	Detroit	172,708	27	Trenton	1,038
2	Kalamazoo	18,109	28	Mount Clemens	930
3	Grand Rapids	16,893	29	Delta Township	847
4	Wayne County – Downriver	13,114	30	Zeeland	838
5	Muskegon County WWMS Metro	13,056	31	Saginaw Township	835
6	Genesee County – Ragnone	9,605	32	Traverse City	774
7	Wyoming	8,524	33	Mt Pleasant	761
8	Ypsilanti Community Utilities Authority Regional	8,447	34	Buchanan	740
9	Lansing	6,329	35	Owosso Mid-Shiawassee County	739
10	Battle Creek	6,070	36	Midland	706
11	Ann Arbor	5,921	37	Niles	672
12	Warren	5,868	38	Howell	653
13	Holland	4,672	39	Marquette	632
14	Flint	4,646	40	Adrian	600
15	Saginaw	3,992	41	Three Rivers	582
16	East Lansing	3,546	42	Saline	498
17	Monroe Metro	2,926	43	Genesee County #3	481
18	South Huron Valley Utility Authority	2,838	44	Tyrone Township	481
19	Bay City	2,352	45	Alpena	474
20	Port Huron	2,035	46	Reed City	469
21	Pontiac	1,807	47	Coldwater	453
22	Benton Harbor-St Joseph	1,580	48	Dowagiac	449
23	Grand Haven-Spring Lake	1,254	49	Wixom	442
24	West Bay County Regional	1,199	50	Marshall	413
25	Jackson	1,172		**Totals**	**335,265**
26	Grandville	1,095			

Table L-2. Volume of waste produced by the 49 largest confined animal feeding operations in Michigan in 2012.

Rank	Confined animal feeding operation	Biomass produced (U.S. dry tons/year)	Rank	Confined animal feeding operation	Biomass (U.S. dry tons/year)
1	Bischer Farms	83,334	26	Steenblik Dairy Inc.	35,283
2	Wil-Le Farms	74,734	27	Riedstra Dairy	35,063
3	Courter Farms East	51,739	28	Willow Point Dairy	34,661
4	Maple Row Dairy	50,029	29	De Saegher Dairy	34,117
5	Z-Star	45,351	30	Goma Dairy	32,433
6	den Dulk Dairy Farm LLC.	45,131	31	Hass Feedlot Home Farm	31,331
7	Double Eagle Dairy (formerly Weller Dairy)	45,118	32	Meadow Rock Dairy	30,554
8	Red Arrow Dairy	44,833	33	Rathmourne Dairy 2 (formerly Old Iseler Dairy)	30,113
9	Hudson Dairy	44,444	34	Zwemmer Dairy	29,582
10	Medina Dairy	44,444	35	Rich Ro Farms	29,465
11	Scenic View	44,444	36	Briggs Farms	28,169
12	Aurora Dairy	44,094	37	BMF dairy LLC.	27,897
13	Wheeler Dairy LLC.	44,056	38	Ingleside Farms	27,594
14	VDS Farms-Fulton	43,861	39	Rathmourne Dairy 4	26,900
15	Terrehaven Farm	43,047	40	Halbert Dairy	26,770
16	Roto-Z Dairy LLC.	42,760	41	Halliwill Farms	25,941
17	Baur Farms LLC.	41,494	42	de Vor Dairy	25,345
18	Mar Jo Lo Farms	40,687	43	VDS Farms-S Avenue	25,138
19	Stoneman Cattle	40,241	44	New Flevo Dairy	24,904
20	Aquila Farms	39,818	45	Swisslane Farms	24,827
21	Green Meadow Farms 2 & 3	39,456	46	Carys Pioneer Farm Inc.	24,766
22	River Ridge Farms	38,540	47	Kurncz Farms	24,710
23	Green Meadow Farms 1	37,965	48	Cole Riverview Farms Inc.	23,453
24	Ryzebol Dairy	36,190	49	Redstone Dairy	23,362
25	Brookview Dairy (formerly Scenic Vu Freprt)	35,827		**Totals**	**1,824,015**

Table L-3. Volume of waste produced by the 50 largest schools in Michigan in 2012.

Rank	School name	Biomass produced (U.S. dry tons/year)	Rank	School name	Biomass (U.S. dry tons/year)
1	Ronald Brown Academy (Detroit)	47	27	Handy Middle School	28
2	West Ottawa High School Campus (Holland)	41	28	Alpena High School	28
3	Pontiac Northern High School	40	29	Pontiac Central High School	27
4	Grand Blanc Community High School	38	30	Pontiac Academy for Excellence	27
5	Burns Elementary School	37	31	Thorne Elementary School	27
6	Priest Elementary School	37	32	Parker Elementary School	27
7	Davison Elementary School	35	33	Parker Elementary School	27
8	Carman-Ainsworth High School	34	34	Harms Elementary School	28
9	Star International Academy	31	35	Warren Mott High School	27
10	Maybury Elementary School	31	36	White Elementary School	27
11	Harrison Middle School	30	37	East Detroit High School	28
12	Burton Middle School	30	38	Port Huron High School	27
13	Lake City Lower Elementary School	30	39	Jackson High School	26
14	Harrison Middle School	30	40	Howell High School	26
15	Martin G. Atkins Elementary School	30	41	Fleming Elementary School	26
16	Waterford Mott High School	30	42	Muskegon High School	25
17	Plymouth Educational Center	30	43	Loy Norrix High School	25
18	East Kentwood High School	29	44	Surline Elementary School	25
19	Everett High School	29	45	White Pine Middle School	25
20	Bay City Western High School	29	46	Arthur Hill High School	25
21	George R. Carter Middle School	29	47	Wayne Memorial High School	25
22	Carman-Ainsworth Middle School	29	48	Wright, Charles School	25
23	C.L.K. Elementary School (Calumet-Laurium-Keweenaw)	28	49	Lowrey Elementary School	25
24	Kalamazoo Central High School	27	50	Golightly Education Center	25
25	Battle Creek Central High School	28		**Totals**	**1,467**
26	Ogemaw Heights High School	27			

APPENDIX M.
Comparison of Bulk Compost Prices From Commercial, Landscape Supply & Municipal Composting Operations

Data for this table was gathered from websites and personal contact in 2020

Type of composting operation	County	Price per cu yd	Type of compost	Comments
Commercial	Genesee	25.00	Yard waste and manure	Flat price
Commercial	Kent	34.00	Yard waste	Flat price
Commercial	Livingston	30.00	Yard waste	Flat price
Commercial	Oakland	15.00	Yard waste	Load your own
		30.00	Yard waste	1–2 cy loaded for you
		15.00	Yard waste	>2 cy loaded for you
Commercial	Oakland	14.50	Yard waste	Flat price
Commercial	Ottawa	10.00	Yard waste	Flat price
Commercial	Washtenaw	18.00	Yard waste	< 100 yards
		12.00	Yard waste	100–500 yards
		8.00	Yard waste	>500 yards
Commercial	Jackson	26.00	Yard waste	Loaded for you
		30.00	Yard waste	Load your own
Commercial	Genesee	25.00	Screened Compost	Call for delivery pricing
Commercial	Muskegon	14.00	Screened Compost	Flat price
		12.00	Screened compost	Contractor Price $12.00
Commercial	Genesee	25.00	Screened Compost	Delivery charge depends on load size and distance
Landscape supply	Genesee	28.00	Yard waste	Flat price
Landscape supply	Ingham	23.50	Yard waste	Flat price
Landscape supply	Kalamazoo	24.50	Yard waste	Flat price, delivery additional charge
Landscape supply	Macomb	30.00	Yard waste	1–10 cy
		29.00	Yard waste	>10 cy
Landscape supply	Oakland	30.00	Yard waste	Flat price
Landscape supply	Wayne	23.00	Yard waste	Flat price
Landscape supply	Wexford	30.00	Yard waste	Flat price
Municipal	Emmet	20.00	Yard waste	Load your own
		30.00	Yard waste	Loaded for you
		20.00	Yard waste	>20 cy
Municipal	Grand Traverse	6.00	Yard waste	Flat price
Municipal	Saginaw	Free	Yard waste	Load your own (residents)
		14.00	Yard waste	Loaded for you (residents)
		14.00	Yard waste	Out of city residents

Type of composting operation	County	Price per cu yd	Type of compost	Comments
Municipal	Washtenaw	12.00	Yard waste	Flat price
Municipal	Wayne	8.00	Yard waste	Plus $15 loading fee
Municipal	Montcalm	14.50	Yard waste	Loaded for you
Municipal	Roscommon	Free	Yard waste	Flat price to residents
		25.00	Yard waste	Flat price to nonresidents
Municipal	Lucas (OH)	15.00	Yard waste	Flat price to residents