

# 2024 UNBC Compost Report



## Executive Summary

The implementation of the new composting program has been a success and a tremendous learning experience. We are currently gearing down for winter break, during which time the rotation rate on the composter will be gradually reduced to adjust for decreasing inputs.

Together, we have diverted over 5.6 metric tons of food waste from the landfill. The composter receives 600 to 700 kg of food waste in a typical week plus bulking materials at a 10:3 weight ratio. A bulk tote of immature compost at the composter outlet is taken out about every five days.

The immature compost is heaped under a tarp in the designated curing area north of the Teaching and Learning Building. Active decomposition continues in the center of the pile, as indicated by temperatures in the high 20s even as outdoor temperatures drop below freezing. The pile should be turned in January to aerate it and promote even decomposition. Ideally this should be done on a day with mild temperatures and low wind to prevent heat loss from the pile.

Many challenges have been encountered. Some have been effectively addressed while others are ongoing. Odor issues have largely been resolved since closers were installed on the recycling room doors. Many weeks of trial and error were required to determine how to use the composter's settings to maintain temperatures in the desired range despite the fluctuating quantity and composition of inputs. I am pleased to say that good temperatures have now been maintained since November 6. Feedstock contamination continues to be an issue, but we have made progress by working with Food Services. The overall care for waste disposal in the recycling room by food staff needs improvement. I also continue to look for ways to improve the efficiency of daily operations, since this frees up time and resources to further expand the composting program.

Public reception to the program has been positive. We have promoted the compost program through several avenues, including signage, web and social media, working with Student Recruitment and Student Life, and through talks and tours. In 2025, I will continue to build public awareness and involvement.

We are also exploring avenues to generate revenue for the compost program. One option which has been successful elsewhere is paid collection of food scraps from local restaurants. Since the food waste generated on campus will drop dramatically in the summer, this would be an ideal time to explore offering a collection service to increase organic waste diversion in Prince George while making our compost program more financially sustainable.

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## Introduction

Many current members of the UNBC community are unaware that UNBC's Prince George campus has had composting for most of its history. From 1995 to 2018, PGPIRG ran the compost program. Under the leadership of a paid part-time Compost Coordinator, student volunteers collected green bins around campus and delivered their contents to a hopper in the recycling room. The contents of the hopper were emptied by maintenance assistants (MAs) into a fenced compound where they were manually turned and moved through a series of wooden bays. Only plant-based scraps were accepted in this system.

The introduction of the mandatory meal plan for most campus residents in 2015 greatly increased the volume of organic waste generated by the dining hall, which put a strain on the existing compost system. Also in 2015, a group of environmental engineering students called the Moosewood Group put together a proposal for an in-vessel composter for their capstone project.

In 2019, PGPIRG discontinued their composting program, citing the increased volume of organic waste generated on campus and their belief that UNBC should provide more institutional support for composting rather than relying on a not-for-profit to coordinate volunteer labor. Between 2019 and 2023, minimal diversion of organic waste occurred. However, things were not as dormant as they seemed. During this period, the Moosewood Group's report was professionally reviewed, modified, funded and finally implemented by Facilities! This brings us to UNBC's present-day composting system, which began operating in September 2024.

Our new composting system has increased capacity and accepts a wider range of materials, including animal products and cooked food. The system has two main components: a rotating in-vessel composter and an outdoor curing area. The most active stage of decomposition occurs in the in-vessel composter, where the heat generated by microbial activity kills pathogens and weed seeds. Scraps loaded into the composter at one end make their way through to a sifter on the other end, where they fall into a bulk tote. The bulk tote is taken out to a compost curing area north of the Teaching and Learning Building. Here, the compost continues to decompose, with the help of occasional turning by a skid steer, until it is ready for use on gardens and lawns around campus.

The following report summarizes plans, learnings, successes and challenges of operating the new compost system so far.

## Winter break management plan

Community green bin collection will cease for the fall semester on December 13, 2024. We will communicate this through signage, the UNBC Sustainability web page and social media.

Dining hall service will cease for the semester on December 16, at which time there will be no further inputs to the composter for this calendar year. At this time, the rotation rate of the composter will be reduced to once per day until the new year. This will keep the contents from becoming anaerobic without pushing too much material out of the composter.

The university will be closed from December 25 to January 1. The bulk tote of immature compost should be taken out just before the closure to ensure it does not overflow while unattended. During this time, temperatures within the vessel are expected to drop. I will bring temperatures back up through the introduction and management of fresh feedstocks in the new year. I will check on the composter when the university reopens on January 2, 2025. Regular operations will resume with the start of classes on January 6.

## Compost Operator Hours Breakdown

My current contract is for 30 hours per week. Basic operations currently take 15+ hours per week. This includes:

- Monitoring compost temperatures (daily in-vessel and once a week outside)
- Sorting out contaminants
- Weighing, loading and washing green bins
- Calculating and loading bulking materials
- Pulling insufficiently decomposed pieces (mostly pineapple tops) from the bulk tote and putting them back in the composter
- Keeping the area around the composter clean (sweeping, mopping, spot cleaning)
- Data entry, analysis and adjustments to composter settings
- Coordinating with MAs and Distributions to maintain the supply of bulker materials
- Coordinating with MAs to have the bulk tote of immature compost taken out
- Snow clearing on the tarp in the curing area as necessary

The allocation of the remaining hours varies throughout the semester. At the beginning of the fall semester, I supported the Sustainability Office's engagement with Orientation to increase student awareness of our programs. I continue to provide support to other Sustainability initiatives as needed, e.g., grant writing, creating social media content, and answering student questions. Throughout the semester, I have been doing research on how to improve our composting process, refining the Compost Operation SOP and conducting public engagement and education for the compost program. Work hours have also been allocated to professional development and knowledge sharing through the Compost Council of Canada and through compost organizations in our region.

## Inputs

### Organic waste

From September 10 to November 29, 5.66 metric tons of organic waste were diverted from the landfill through the in-vessel composting program. This equates to \$555 in saved landfill tipping fees and will be converted into approximately 1.8 metric tons of finished compost.

The breakdown of feedstock types is shown in Figure 1. Between the kitchen and post-consumer food waste categories, about 90% of feedstock comes from the dining hall. The “Community +” category is the sum of inputs from the community green bin outside the Sustainability Office and a few one-off contributions from seasonal events (e.g., apple processing, pumpkin carving). The remaining 2.4% is coffee grounds from Degrees Coffee. The actual percentage of coffee grounds entering the compost system is higher, but coffee from the dining hall is counted under kitchen cafeteria food waste.

Feedstock types as a percentage of total weight

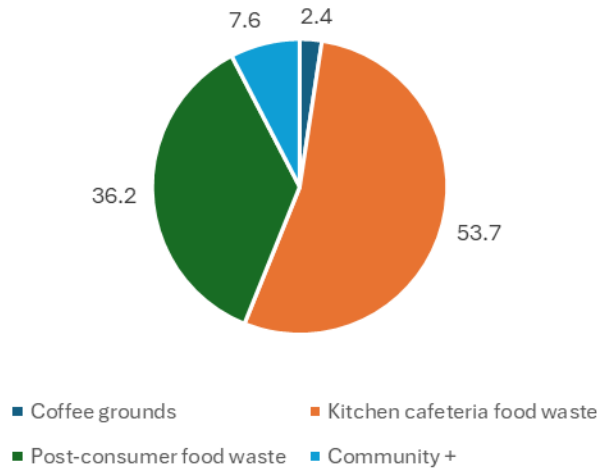


Figure 1: Percentage breakdown by weight of organic waste inputs to UNBC’s in-vessel composter between September 10 and November 29, 2024.

## Bulking material

Dry, carbon-rich bulking materials are added to compost at a 3:10 ratio to the weight of organic waste inputs. The purpose of the bulking material is to balance the moisture content and the carbon to nitrogen ratio of the composter contents, which is necessary for efficient, low-odor aerobic decomposition.

The total weight of bulking materials used from September 10 to November 29 was 1847 kg. Wood pellets comprised 80.5% of the total weight and shredded paper the other 19.5%.

Shredded paper is obtained for free through Distributions confidential shredding. Because of its low density, the volume of the composter limits the proportion that can be loaded at one time without overfilling it. Once it soaks up moisture from food waste, its volume quickly decreases. Although it is a small component of the bulking material, it is still important to our current compost recipe. If wood pellets were to be used exclusively as a bulking material, the C:N ratio of the mixture would be too high, which would slow down decomposition.

Due to the temporary shutdown of the wood pellet plant, and my periods of absence due to conference travel and surgery, we were initially unable to obtain wood pellets through UNBC’s supplier. During this time, 114 40-lb bags of wood pellets were purchased at hardware stores for \$7.99 each plus tax, for a

total cost of approximately \$ 1,020 (more accurate information is needed from purchasing card historical data). I will make every effort to ensure that this type of operating expense is avoided in the future. We have now been able to shift to using spilled wood pellets from the bioenergy plant at a much lower cost.

## Rate of inputs

The rate of inputs to the composter fluctuates from week to week due to catering events, holidays and stochasticity. There was a temporary freeze on inputs to the composter during my conference and vacation travel at the beginning of October (Figure 3). Since entering a more stable period of operations in late October, the composter typically receives 600 to 700 kg of food waste per week.

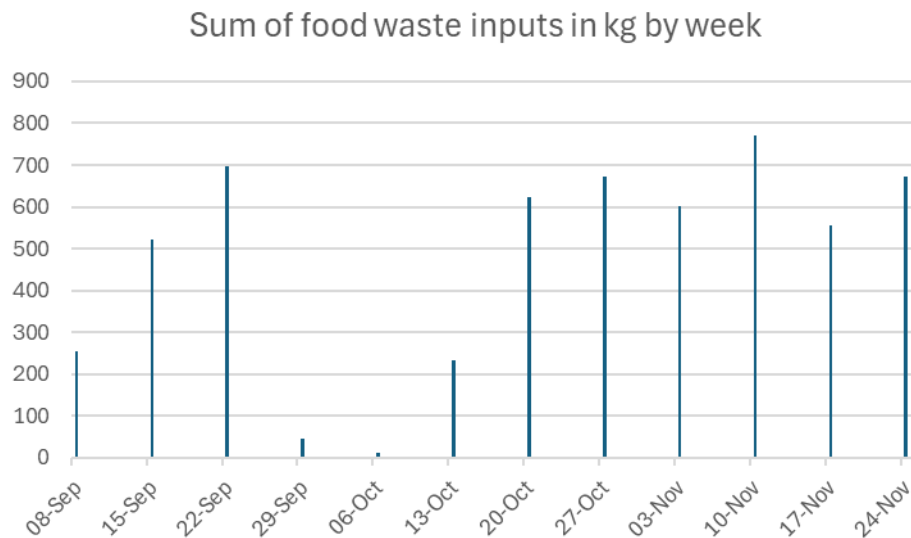


Figure 3: The rate of organic waste inputs in kg per week to UNBC’s in-vessel composter.

The settings of the composter can be adjusted to accommodate varying rates of inputs. Through consultation with the manufacturer, review of relevant literature and trial and error, best practices are being determined. Troubleshooting procedures are detailed in the UNBC Compost Standard Operating Procedures.

## Outputs

From October 24 to November 29, about 6.3 m<sup>3</sup> of immature compost has been taken out to the curing area north of Building 10 to mature and stabilize. This material will undergo further volume reduction of up to 50% as it continues to decompose. While it cures, it is covered with a heavy-duty tarp to prevent precipitation from making it excessively wet and generating leachate (Figures 4 and 5).



Figure 4: Unfinished compost covered by a heavy-duty tarp in the compost curing area.



Figure 5: The compost heap uncovered on November 18, 2024.

Since the bulk tote was first taken out, it has needed to be emptied approximately every five days. The bulk tote has a volume of a little under 1 m<sup>3</sup> but is usually emptied when it is 50 to 80% full depending on the density of the immature compost, timing and availability of the skid steer. Sometimes it is necessary to take it out at a lower fill level before a long weekend to avoid showing up to an overflowing tote the following workday.



## Compost curing and use

Compost operator duties with respect to the curing area include manual snow clearing on the tarp, monitoring and recording temperatures inside the pile, advising maintenance assistants when turning is required and determining when the compost is finished.

The simplest indicator of compost stability is the drop in temperature that occurs when microbes have finished decomposing the easily broken-down fractions of the material and therefore become less active. However, temperature drops can also occur due to anaerobic conditions developing in the center of the pile, which inhibit microbial activity. This can be resolved by turning the pile.

A temperature rise of 8°C or less over ambient temperature (measured after turning) indicates that the compost may be stable. The next step is to perform a bioassay with quick germinating seeds (radish is commonly used). The germination rate of seeds moistened with water is compared to their germination rate with compost tea. If the germination rate in the compost tea is similar or better than the germination rate in the control samples, the compost has matured to an extent that it does not contain phytotoxic decomposition byproducts. At this point, it can be considered relatively safe for general use on lawns and gardens. Once a pile of compost reaches this stage, I will communicate it to the Facilities grounds crew, PGPIRG and SGU.

Lab testing provides more detailed insights into compost quality. Typical compost testing packages include nutrient content, trace element content, pathogens (fecal coliforms and *Salmonella*), foreign matter content, pH, EC and more. I intend to reach out to Introduction to Soil Science senior lab instructor Chris Jackson and to students in the Prince George chapter of the Pacific Region Soil Science Society (PRSSS) to assess interest in compost research and see if lab testing can be performed with research funding.

Different materials decompose at different rates. At maturity, the compost will still contain a portion of relatively large particles, especially woody and fibrous items such as bamboo cutlery, paper plates and pineapple tops. Finished compost is typically screened to ½" and the overs (large pieces that are screened out) are recycled as structuring agents in future compost production. I would like to build a simple rotating trommel for compost sifting such as this one: <https://www.instructables.com/Building-a-Soil-Sifter-Rotary-Trommel/>

## Challenges and solutions

### Recycling room challenges

Dana Hospitality food staff are currently responsible for disposing of grease, cardboard and recyclables from their operations in the recycling room, as well as bringing green bins to the composter. While I believe most food staff do a good job of these tasks, some individuals do not take responsibility.

I have repeatedly observed grease spills on the floor and on the green bins, boxes being left all over the floor for hours before they are loaded into the cardboard compacter, and improper sorting of materials

(Figures 6 to 10). These issues have been brought to the attention of food managers, and we continue to work with them to improve behavior. It took months of reminders to get food staff to stop putting gloves and plastic wrap into the green bins with their organic waste, although this issue has improved.

I understand Facilities Management's aspiration is to eventually have food staff load the composter. I see the financial sense of this idea and I believe it is something worth working toward. However, I urge you to consider the food staff's ability and motivation to take on this task considering their already fast-paced and low-wage jobs. The full green bins can also be quite heavy (Figure 9). As someone who regularly lifts weights, I still find loading the green bins can be challenging. It is not uncommon for full green bins to weigh over 50 lbs.



Figure 6: Boxes strewn on the floor in the Recycling Room. Sometimes the boxes overflow to the extent that it becomes difficult to maneuver a trolley in and out of the room.



Figure 7: Grease spilled on a green bin next to the grease collection tote.



Figure 8: Grease spilled and covered with dry rite instead of cleaning it up.



Figure 9: Example of an over-filled green bin weighing over 50 lbs. While we have got the message across to food staff that they must not fill the bins to the extent that the lid can't be closed, I still encounter bins weighing over 50 lbs almost daily.



Figure 10: Numerous expired but unopened food containers that were thrown into a green bin, likely by a food worker.

Without proper training, compensation and accountability, imposing the loading of the composter on food staff could result in:

- A large increase in the rate of contaminants entering the composter, as food staff do not have time to sort them out.

- Improper tracking of inputs, which could throw off the compost recipe, resulting in improper decomposition, increased odors and possibly unsafe compost if pathogen-reducing temperatures cannot be maintained.
- Organic waste being spilled and not cleaned up promptly, leading to odor and pest problems.
- Injuries to workers from heavy lifting.

## Contamination

Contamination is a challenge for essentially every compost facility, and ours is no exception. When the new composting program was introduced, we spoke with kitchen staff and placed signs in the dining hall dish return hall, which showed what materials are accepted in the green bins. Initial contamination rates were high. The most common contaminants from the kitchen were plastic wrap and nitrile gloves. The most common post-consumer contaminants were condiment packaging (e.g., mustard, mayonnaise, cream packets, butter etc.), coffee lids and metal cutlery.

Through ongoing communication with Dana Hospitality food managers and staff, we have managed to greatly reduce contaminants in the kitchen scraps. Contamination on the post-consumer side continues to be an issue, but the rate of contaminants has also decreased. I believe this has been achieved partly through a reduction in the dispensing of disposable items from the dining hall and partly through the visibility of the compost program. While washing the green bins in the women's bathroom beside the dining hall is not ideal, wheeling the green bins into the hallway each day has made the compost program and the labor that goes into it more visible to those who eat in the dining hall. In the new year, I will work with G-Force volunteers to implement a public awareness campaign to further reduce the rate of contamination from the dish return room.

Contamination on the post-consumer side often includes dishware (mostly cutlery, but also plates, bowls and cups). I have not tracked data on the amount of dishware I have recovered for the dining hall, but anecdotally I would say that I return about a dozen items per week. Recovering these items has improved my rapport with the kitchen staff and is another small environmental benefit provided by the program.

## “Compostable” plastic

There is a lot of consumer confusion around compostable plastic. Some products are greenwashed and make false claims, but even certified compostable products can be troublesome. Certified compostable products meet a set of testing standards for decomposition, and some of these products can be composted in our system without issue, for example bamboo and paper-based products. However, the decomposition timeline of compostable plastics is incompatible with our system. Our feedstocks spend about five days in the thermophilic composting phase (55-70°C), but compostable plastics require weeks or months to degrade at these temperatures. When the finished compost is screened, anything that looks like plastic will be removed and landfilled. Therefore, we do not accept compostable plastics at UNBC, although well-meaning individuals continue to put them in the green bins.

## Maintaining temperatures

It has been a learning curve to be able to maintain the temperature inside the composter in the optimum range for active composting (55 to 70°C). Maintaining temperatures in this range is necessary for efficient decomposition and for the reduction of pathogens that may be present in compost feedstocks, particularly when they contain animal products.

In addition to providing aeration through the internal fan, tracking inputs and balancing the compost recipe to maintain the appropriate moisture level (55-65%) and C:N ratio (25 to 35), sustaining temperatures in the composter requires frequent and careful adjustment to the rotation interval to keep the composter at a fill level of approximately 60% percent.

Unfortunately, this management aspect was not made clear by Brome. The technician who commissioned the unit said that it should not be rotated more than once or twice per day, while the user manual says that under regular operating conditions, the composter should be rotated once an hour. In practice, neither statement is true. To maintain internal temperatures, the rotation interval must be adjusted based on the rate of inputs.

The quantity and composition of feedstocks varies from day to day with catering events, menu changes and holidays. Therefore, there is no true steady state. However, as I have gained knowledge and experience as an operator, I have learned how to maintain the conditions inside the composter by adjusting its settings.

As of November 6, the contents of the composter have been maintained at or close to the optimum range based on the available data (Figure 11). Our 3-foot probe compost thermometer broke recently, resulting in gaps in temperature data collection. I can occasionally borrow one from the Regional District while we wait for a replacement to arrive on December 5.

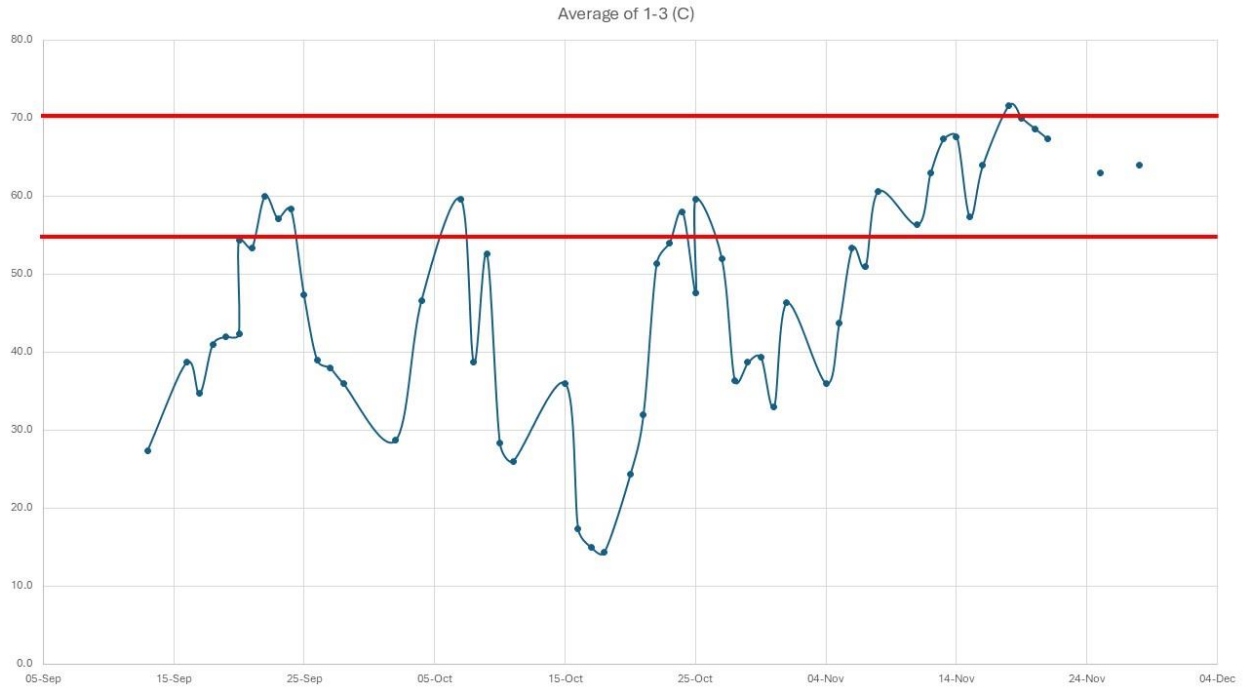


Figure 11. Compost temperature in degrees Celsius over time. The area between the two red bars represents the optimum range (55 to 70°C). Temperatures are taken from the loading door at a depth of 3ft and are the average of 3 readings.

### Complaints

I have been informed of two types of complaints regarding compost operations.

There have been odor complaints, but these have largely been resolved since closers were installed on the recycling room doors. Odor cannot be eliminated from the composting process, but it can be reduced through proper management. By maintaining the appropriate parameters for active decomposition (moisture content, C:N ratio, temperature, ventilation rate, rotation rate), I do my best to prevent the most offensive odors. The fume hood over the outlet of the composter has been effective at creating negative pressure in the recycling room, which keeps odors contained to the room so long as the doors are kept shut most of the time.

There were also complaints about the use of the custodial closet in the women’s bathroom for washing bins. To address this, I make sure the bathroom is vacant, post a sign that the bathroom is out of service and block off the door when washing bins. I have also shifted to washing the bins later in the day (around 3 pm) when there is less foot traffic in the area.

### Public engagement

Public engagement for the new compost program has included:

- Redesigned compost signage and labels with pictographs of which materials are accepted.

- Infographics in the dining hall dish return room and in front of the Sustainability Office explaining how the composter works.
- Filming and promotion of the “Compost is Hot” music video, which was used to introduce new students and residents to the compost program during Orientation.
- Giveaway of 23 (and counting) small compost collection containers for UNBC community members wishing to participate in our green bin program.
- Student Recruitment now features the composter in their talks and tours.
- Updates to UNBC Sustainability page and creation of social media content.
- Showings of the composter to G-Force and Pacific Region Soil Science Society (PRSSS) members
- Compost presentation at ENVS 408 Sustainability Seminar.
- Survey of Sustainability programs will include questions about compost.
- Meeting with University of Fraser Valley Facilities/Sustainability team to discuss our compost system and the potential development of theirs.
- Networking and knowledge sharing with other composters in the region (RDFFG/NorGrow, Making Agriculture Sustainable in the Hazeltons (MASH), REAPS, Cariboo Compost).
- Networking and professional development through attendance of the Compost Council of Canada’s annual conference and completion of Compost Facility Operator Certificate.
- Planned partnership with Adopting Vermicompost Worms as Pets green grant project to expand the availability of composting to the UNBC Community.

## Summer management and potential revenue streams

### Paid green bin collection from restaurants

During the summer semester, food production on campus will drop drastically, and with it so will the generation of food scraps. We would like to explore the feasibility and profitability of collecting food scraps from restaurants and cafes over the summer (and possibly during the school year if capacity allows, to maintain customer relations). In exchange for a collection fee (e.g., \$20/week), we would offer local eateries the opportunity to divert waste and improve their branding in terms of sustainability and community engagement.

Green bins could be lent to participating businesses and collected with the Ford Lighting. Collection would be scheduled to minimize vehicle use conflicts. I am consulting with other small compost collection businesses (e.g., Cariboo Compost in Williams Lake) to determine a pricing structure and get advice on approaching and retaining customers.

I am in the early stages of exploring this option since I wanted to get the green light before investing too much time. However, I do know that there are successful small organic waste collection businesses. Prince George lacks infrastructure to compost food waste, and we have capacity that will be otherwise underutilized in the summer. It would be a win-win if we could get maximum utility out of the in-vessel



composter while generating revenues to sustain the composting program. I look forward to receiving feedback on this idea.

## Worm composting kits

Another opportunity to generate funds for the composting program is the sale of vermicomposting kits. Three-tier worm composting kits currently retail at Home Depot for \$120. I can build worm composting kits with similar dimensions very inexpensively with hardware mesh and salvaged lumber. I have received permission to sell these kits, along with starter worms, at the annual David Douglas Botanical Society plant sale in May.