Green Waste Management Through Composting at Cal State Dominguez Hills

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Acknowledgements

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Executive Summary

The focus of this internship was to see how the University's green waste could be kept on-site and turned into compost. The compost could then be used on the campus to reduce the amount of water that was being used in the landscape, as well as eliminate the amount of green waste that has to be sent to landfill each year. This project gave me the opportunity to use an abandoned greenhouse and turn it into a living lab and research facility that is now available to the entire campus. As part of the WRPI internship, I am the main operations manager for the new Cal State University Dominguez Hills Campus Urban Farm (Farm) that also occupies the site.

Project Objective

As an intern for WRPI I have been able to study and focus on creating a system and protocol for turning the university's green waste into compost and to transform an abandoned greenhouse area into the Farm, a living laboratory for faculty and student research related to urban agriculture. The United States Department of Agriculture has given me the opportunity to explore areas of research that can help transform arid environments into water wise and sustainable regions. In support of these goals I have been able to mobilize and manage community volunteers, students, and fellow interns in daily tasks to ensure green waste is prepped to minimize the composting turnaround time and eliminate the maximum amount of waste.

Project Approach

In order to begin the compost piles, I was able to work with CSUDH campus facilities staff and the campus recycling coordinator to set up a system that designated an area for all university green waste and some recycled product such as cardboard, and shredded paper for use in the composting systems. Facilities would drop off the green waste as well as some recyclable material inside the Farm, where the Farm volunteers and I would sort it accordingly to the material that was received. Bins were designated, with one bin for green waste, one bin for woody branches, one bin for cardboard, one bin for shredded paper such as documents, one bin for strappy leaves which are leaves that take a greater amount of time to decompose, green waste such as grass clippings, and one bin for fibrous plant material such as plants that have thick green stocks. Woody material was shredded by our wood chipper. Strappy and fibrous material had to be cut into smaller pieces by our volunteers using clippers and scissors to ensure faster

decomposition. After the material was sorted into bins and cut down into 2" (5.08 cm), the volunteers were instructed on how to layer the material to start each compost pile.

Several compost piles were set up in order to see which system would benefit the campuses' volume of green waste by breaking down the greatest volume in the shortest amount of time. A 45 cubic feet (1274.3 L) hot compost bin was set up. The hot compost bin was made of chicken wire, filled with green waste, recycled material, and brown waste. The hot compost bin heats up by decomposition of organic material that uses oxygen to break down the material. The bacteria that is created is what breaks down the plant material to create carbon dioxide and heat. Once it reaches temperatures of 120- 170°F (49-77°C), the pile is then turned by separating the pile in to sections. The top is section A, the middle is section B, the heat source which is in the center core is section C and the bottom is section D. The top section becomes your middle, Section C and B become the bottom and, D becomes the top. By turning the pile it maximizes the decomposition time.

Wooden pallets were used to construct a compost bin measuring 4 cubic feet (113.3 L). The compost bin uses manual turning, with the weight of the compost heap to aid in decomposition. Three mounds were created for the volume of green waste that accumulated daily. The first and largest pile was designated pile A, measuring 8.16 cubic yards (6238.8 L). Pile A was created to store the green waste over the course of the year to see how long it would take for decomposition. Pile B was designated into two smaller piles; B1 and B2, each measuring 4.9 cubic yards (3746.3 L), which allowed for proper manual turning practices. Each pile had to be watered twice a week, in order to retain as much moisture as possible.

Due to the campus maintenance schedule, which revolves around campus sporting events, I was given only Carbon (C) to add to the compost piles in the beginning of the semester. Carbon based material includes, but is not limited to, brown material such as woody branches, fallen leaves, paper, cardboard, and hay. This did not allow for proper carbon: nitrogen ratios to help in the decomposition process. As such the hot pile did not heat up and the pallet pile did not decompose. Since Pile A was stagnant, due to its volume and lack of Nitrogen (N), there was no decomposition. Piles B1 and B2 were created at the very end of the semester, which is when I received over 8 cubic yards (6116.4 L) of N, in the form of grass clippings. The N was then distributed over all the compost heaps, which then allowed the piles to finally begin the decomposition process.

I also started working with campus dining services to help eliminate food waste. I was able to help eliminate some of the table waste in the form of fruits and vegetables and incorporated that into compost pile A, which allowed some decomposition to begin. A worm composting bin was also established, which helped in the decomposition of fruits and vegetables. A drop-off food waste composting system for the CSUDH campus community was also established, the first of its kind. These systems have helped eliminate green waste and provided a form of N, in form of fruits and vegetables.

The Farm has given me the space and time that was needed to do my research. The Farm's main goal was to feed the campus with low cost to no cost produce and provide a living laboratory for all student, teachers, and faculty to explore issues pertaining to healthy food. The Farm has opened up avenues that had not been available to the campus previously. The Farm allowed professors to bring their classes outdoors for hands on experiences, and allowed students to volunteer and learn about crops, soil, composting, and sustainability. This gave the Farm a platform to build a classroom, where everyone can come any enjoy the outdoors in a learning environment.

Project Outcomes

Through the course of this project the type of material that became available to be used in the compost piles came in at rates that did not provide the proper C and N ratio. By having the proper C and N ratios, this would allow for proper decomposition, which will then allow the recycled organic matter to be turned into available Nitrogen, Phosphorus (P), and Potassium (K) in the form of compost. The recycled NPK would then become available to all the existing plants on campus, once applied to the top soil. Since the ratio was not correct, a soil inoculant was then used to aid the decomposition. The biggest setback to the compost piles was the lack of moisture. Since the area is semi-arid, the compost piles were unable to stay moist, which is a key component to decomposition. In order to maintain moisture, shade cloth was then applied to one pile to see if this could aid in moisture retention. Manually turning the compost piles was also a challenge. One pile, due to the volume, made it almost impossible to be turned by hand. During the course of the spring semester at CSUDH, I was able to troubleshoot and make necessary changes to help eliminate waste on campus.

Conclusions

Composting allows us to utilize the waste we have created. Although we are not an agricultural school, this should not keep us from doing our part to help eliminate waste. The goal for this project was to turn the green waste on campus into compost. Unfortunately, we had no compost produced in the few months we had to do this project. However, we were able to help reduce the volume of waste overall and begin the composting process. Due to the limited time of this project, the lack of proper N and C from the waste provided, and lack of moisture our compost piles are still in process.

My project over the next semester, beginning fall 2018 is to use potable and non-potable water to help keep the compost pile moist. There are very small amounts of microbial activity in our piles, and I would like to increase the amount by adding more moisture. I plan to use inoculants, as well as different composting methods to see how we can eliminate and recycle the green waste on our campus. I see now that a lot more work needs to be done if we want to reduce waste. The USDA is always looking for ways to aid in sustainability and reduce waste, and I believe we are on the right path. Working with the USDA and helping them find more ways to reduce and reuse waste is part of my professional goals. I look forward to seeing the next phase of this project and learning all I can about sustainability, composting, and waste management. To be able to restore our urban environment and eliminate waste, will not only help urban areas, this will allow all our waste to be recycled and reused. The USDA has made great strides in this area and I would like to be a part of this learning process. Composting can create more than just great soil, it can help build the foundation to which we need to survive.

APPENDIX

Compost Piles	Start date	Size (cubic yards)	Clean/ Unclean	Em-1 Microbial Innoculant Used	Turned	Times Turned	Notes
Hot pile	3/31/2018	1.6	clean	no	yes	24	No fruit or vegetables
Pallet Pile	3/31/2018	2.4	clean	no	yes	24	No fruit or vegetables
Vermicompost bin **	3/15/2018	0.0247	unclean	no	no	0	Fruit and vegetables
Pile A	3/15/2018	8.16	unclean	no	yes	4	Fruit and vegetables
Pile B1	5/23/2018	4.9	clean	yes	yes	10	No fruit or vegetables
Pile B2	5/23/2018	4.9	clean	yes	yes	10	No fruit or vegetables, shade cover added for moisture retention
** Vermicompost bin was only fed food scraps from the drop off composting bin and the campus kitchen							
Clean: no rodents present in compost bin							
Unclean: rodents are present in compost bin							

Table 1- Summary of experimental compost piles created and methods used

Figure 1- Farm entrance and drop-off bin for food scraps available to campus (right)

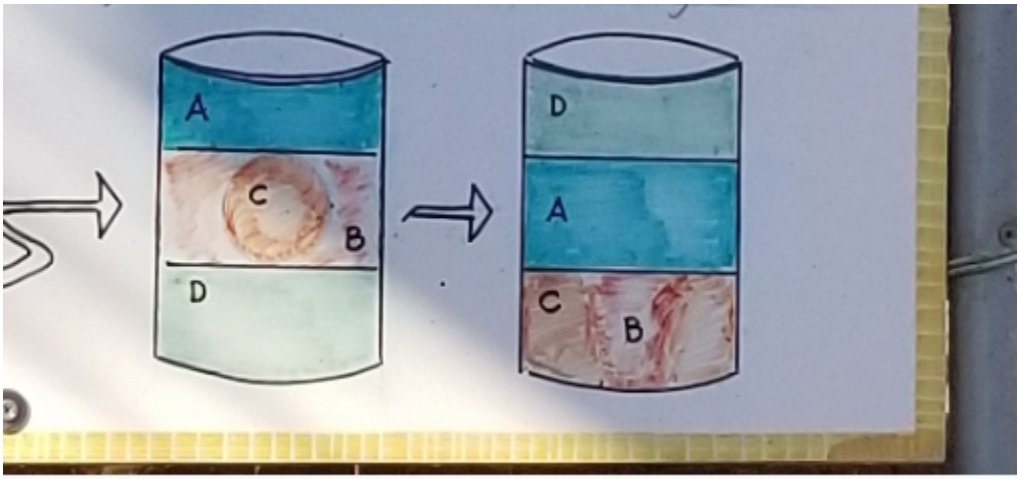

Figure 2- Instructional diagram for compost pile layering and manual turning for Farm volunteers