Aerated Static Pile Project

Santa Clara University
School of Engineering

UC CE

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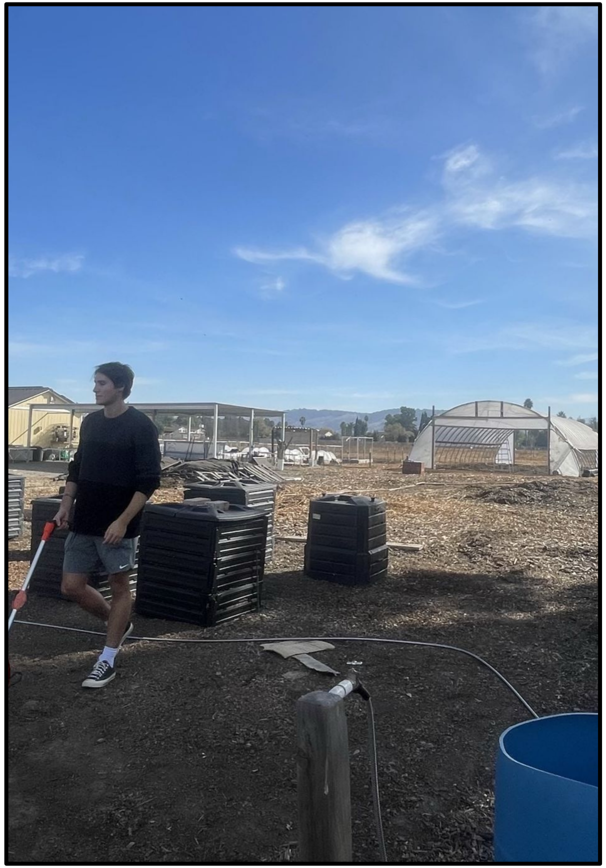
Partner: University of California Cooperative Extension

Our Partner

Mission: Engage UC with the people of California to achieve innovation in fundamental and applied research and education that supports

- Sustainable food production
- Economic success
- A sustainable environment
- Science literacy and youth development programs



Customer Profile

(Credit: Open Space Authority Santa Clara Valley)

Gains

- Reduced manual labor
- Composting system to be copied into more places

Critical Customer

Students, homeowners, and farmers

Needs

- Durability
- Irrigation system for ASP piles
- Easily stored and replicated
- Minimal supplies
- Efficient
- Reach all corners of the pile, not just the top

Pains

- Squirrels breaking into tubing
- Effectively engaging the community with the project
    - Measuring the Community Output
- Materials cost
- Water cost/waste

What is an Aerated Static Pile (ASP)?

- Aerated meaning air is being pushed through it
- Static means it the piles don't move and won't need to be turned
- Air blower, perforated pipes, composting material
- Piles need moisture in order for microbes to survive
- Efficient

(Credit: LSU Ag Center)

Problem & Objectives

Problem Statement

The UCCE needs an ASP irrigation system for efficient watering to streamline their composting process and support educational programs

Objective

Optimize the ASP system for enhanced sustainability, user engagement, and educational outreach while ensuring continuous improvement and innovation.

Problem & Objectives

Current solution and key differences

Success Metrics & Goals

Partner Interview (Wk 4) → Design Matrix Criteria

What factors would indicate a successful product?

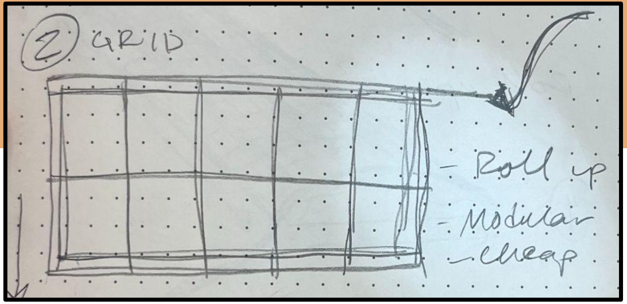
- Portable/storable
- Automated (time)
- Durable
- Replicable (simple)
- Affordable

Criteria	Weight (1-5)
Replicability/DIY	5
Durability	5
Effectiveness	5
Cost efficiency	4
Simplicity	3
Ease of use	3
Sustainability	3
Scalability	2
Storability	1

Initial Design Process

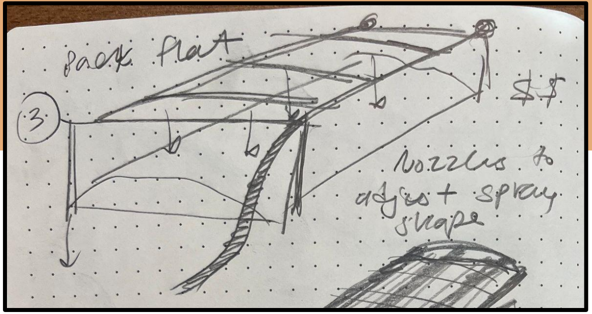
1. Customer Profile → Success Metrics
2. 5 design concepts
   a. Based on needs
3. Evaluate internally
   a. Based on success metrics
4. UCCE Feedback
   a. Incorporate into final decision

Design Sketches



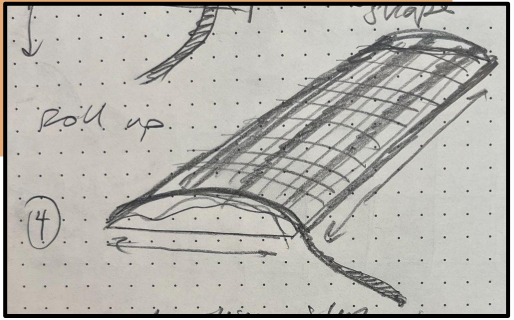
Design 2

Drip irrigation in a flexible, modular grid



Design 3

Elevated frame to hold drip irrigation



Design 4

Drip irrigation mounted on a mesh

Design Decision & Partner Feedback

Design matrix based on success metrics and customer profile

From our initial evaluation and analysis of our design matrix, we chose **Design 2**.

Sent all designs to UCCE

Criteria	Solution 2		Solution 3	
	Rating	Weight Score	Rating	Weight Score
Replicability/DIY	4	16	3	12
Durability	3	9	5	15
Effectiveness	4	16	5	20
Cost efficiency	3	9	3	9
Simplicity	5	25	3	15
Ease of use	5	25	4	20
Sustainability	4	16	3	12
Scalability	5	25	4	20
Storability	5	25	2	10
Total	33	141	30	123

However we switched from Design 2 → **Design 3** based on UCCE preferences, site visit, and feasibility.

Civic Issues

Educational Role

Awareness about composting benefits.

Culture of sustainability, engaging community, students, and farmers.

UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

4-H Youth Development Program

Environmental Impact

Promotes composting adoption, reducing landfill waste, and supports soil fertility.

Social Equity

Open-source design for widespread access.

Benefits diverse communities, promoting inclusivity in sustainable practices.

First Site Visit – Scope

Measure size of the pile	~17.5 ft L x 10 ft W x 3-5 ft H
Find water sources	Separate spigots away from compost areas and hose timer
Inventory available supplies	T connectors, drip irrigation tubing

Building our Prototype

Analysis:

- Its big!
- Very flexible
- How to attach drip irrigation?
- Center spine?
- Side supports?

Approximate cost: $96-$100

Second Site Visit - Revision #1

Design Change	Effect
Glue	Stability
Drip Irrigation	Moisture on the pile
Hose connector	Ease of access + automation with timer

Analysis:

- Stability is still an issue
  - Vulnerable to wind
  - Drip irrigation is sagging
- Timer not working properly

Third Site Visit – Revision #2

Design Change	Effect
Horizontal Supports	Stability
Tightened irrigation	Decreased amount of pooling water
Hose connector	Ease of access + automation with timer

Analysis:

- Much more stable
    - Less prone to wind
- Even coverage of water

Final Product

Challenges

Key Challenges we faced:

- Water bowl debacle
- Time / Resource Management
    - Lots of home depot trips for materials
    - Site visits
- Weather factors
    - Wind and sun exposure
- Testing Moisture levels

Recommendations for the Next Group

Moisture

Evaluating the moisture levels of the new model + effectiveness on a full pile

Stability

Creating a more stable base to combat weather and other factors

Conclusion – Did we succeed?

Partner Criteria	Success?
Portable/Storable	Yes (4/5)
Automated	Yes (5/5)
Durability	Yes (3/5)
Affordable	Yes (5/5) (total cost ~$150, under budget)

Criteria	Final Product	
	Rating	Weight Score
Replicability/DIY	3	12
Durability	5	15
Effectiveness	5	20
Cost efficiency	4	12
Simplicity	3	15
Ease of use	5	25
Sustainability	3	12
Scalability	4	20
Storability	2	10
Partner Satisfaction	4	16
Total	32	157

+12 point increase based on design revisions

References

About Us. About Us - ANR Research and Extension Centers. (2023).

Moeira, Juan, et al. "Composting Series: Building an Aerated Static Compost Pile." *LSU AgCenter*, 27 Apr. 2022

Santa Clara County. (2023)

UCCE programs. UCCE Programs - Santa Clara County. (2023). https://cesantaclara.ucanr.edu/Programs/

University of California, D. of A. and N. R. (2023). *About UC Cooperative Extension*. Agriculture and Natural Resources - University of California

Churchill, Steve, director. *150º Compost the "Easy" Way with Aerated Static Pile or ASP Composting*. *YouTube*, YouTube, 22 May 2021

Thank You!

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Questions?