

# COMMERCIAL FOOD WASTE COMPOSTING RESEARCH REPORT 1997-98

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## Program Goals

To initiate a food compost pilot project to demonstrate the on-site handling and composting of source-separated compostable food wastes at a large event, a restaurant, and at two institutional cafeterias. The purpose of the project was to encourage on-site separation of organic wastes and to demonstrate composting food waste in an in-vessel composter.

- Conduct on site waste audits before & during vessel usage
- Coordinate and assist in locating and monitoring composter
- Coordinate site demonstrations
- Collect data on performance of composter

## Background

Based upon a waste characterization study conducted in May 1996, 42.8% of the Sonoma County commercial waste stream is compostable and includes 13.7% (19,600 tons) commercial food spoils. This portion of the waste stream has been recently targeted by the Sonoma County Waste Management Agency (SCWMA) to reduce landfill inputs.

An increasing number of communities nationwide are considering composting as an essential part of a comprehensive waste management strategy. The fastest growing composting projects include commercial and institutional "organics". Surveys in 1997 and 1998 by BioCycle magazine indicated a dramatic increase in composting projects accepting commercial and institutional food waste. In 1997 there were 220 projects nationwide which rose to 250 in 1998. This project was included as one of the projects in a list of pilot programs in BioCycle, August, 1998.

The purpose of this project was to encourage on-site source separation of organic wastes and to demonstrate composting food waste in an in-vessel composter. A part-time assistant (10%), in cooperation with Horticulture Advisor, Paul Vossen, and selected commercial and institutional sites conducted the in-vessel food waste project.

The in-vessel composter selected for this research and demonstration project was the Green Mountain Technologies' Comp-Tainer/Earth Tub. Its retail cost is approximately \$6,500, which is affordable to many businesses. The machine is round with a diameter of

89 inches and is 48 inches high. It weighs 300 lbs. and is constructed of plastic and foam insulation. Its capacity is 3.5 yards<sup>3</sup> and can be filled with 100 to 200 pounds per day of organic materials.

The machine has a motorized auger mounted to a rotating lid that is turned by pushing the lid around in a circle. The auger mixes the lower materials with the upper materials and is set in place on a sliding metal sleeve within the lid that allows it to be moved toward the center, middle, or edge of the circular tub. When we turned the mixture we usually did it three times, once for each of the three positions of the auger. The unit has two clean out ports, on opposite sides, for access to clean out the finished compost.

## Summary of Objectives Achieved

An in-vessel composter from Green Mountain Technologies called the Comp-Tainer (later re-named the Earth Tub) was rented for one year and used to compost food waste at the 1997 & 1998 Chickenque outdoor 4-H fund-raiser, Mistral Restaurant, SRJC Cafeteria, and the Food For Thought Store in Santa Rosa. Research was conducted to determine the volume of material composted, temperatures reached in the process of composting, needs for source separation, electrical hook-up, and labor needed to operate.

Three demonstrations were held to notify potential users of a composting machine like this in order to facilitate the reduction of food wastes going into the landfill. Notices were sent to approximately 800 on a list of restaurants and food handling institutions developed from the phone book yellow pages, CA Grocer's Assn. Food Industry Directory, and from the Restaurants Association of the Redwood Empire (RARE). Mailings were also sent to selected individuals interested in food waste composting. Listed below in Table 5 is the time schedule for various phases of the project.

**Table 5. Timeline followed for the In-vessel composter.**

<b>ACTIVITY</b>	<b>BEGINNING DATE</b>	<b>ENDING DATE</b>
Recruit Participants	3-3, 1997	4- 6, 1997
Waste Audits Mistral & SRJC	4-13, 1997	4-1, 1998
In-vessel Composter	Received 5-3, 1997	Returned 6-29, 1998
Demo of Comp-Tainer	Chickenque 5-4, 1997	NA
1997 Chickenque Event	Started filling 5-5, 1997	Unloaded 7-24, 1997
Mistral Restaurant	Started filling 12-2, 1997	Unloaded 2-12, 1998
Demo of Comp-Tainer	Mistral 2-9, 1998	NA
SRJC Cafeteria	Started filling 2-17, 1998	Unloaded 4-1, 1998
Food For Thought & Chickenque 1998	Started filling 4-1 6, 1998	Unloaded 6-25, 1998
Demo of Comp-Tainer	Food For Thought 6-11, 1998	NA

**Chickenque 1997 and 1998:** For the past 37 years during the month of May, the Sonoma County 4-H Program has hosted their annual Bar-B-Q (Chickenque) as a fund-raiser at the County Fairgrounds. The event typically attracts 7,000 people. During the 1996 Chickenque, a waste audit was conducted for this event and revealed that 75% of the waste is organic and could be composted. A majority of the remaining material could also be recycled with only minimal landfill waste.

In 1997 and 1998, UCCE was instrumental in working with 4-H leaders to create an event recycling program and took the lead role in developing educational materials and recruiting volunteers. 4-H, which oversees the garbage collection during Chickenque, provided staff and separated the wastes. After the event, chicken discards were taken by a regional tallow company and remaining food spoils (paper plates, rolls, lettuce, etc.) were composted in the in-vessel composter.

A detailed written report was already given to the Sonoma County Waste Management Agency regarding the 4-H Chickenque recycling project for 1997. In summary, an estimated 10.5 cubic feet or 626 lbs. of compostable materials (mostly paper plates, paper napkins, salad, cake, and coffee grounds) were composted in the in-vessel composter over a 64 day period from May 10 to July 14, 1997. The compost was unloaded and screened by 4-H'ers and used in the gardens at the 4-H Center in Rohnert Park.

In 1998, the same program of source separation at the Chickenque took place with the waste chicken meat and bones taken to a tallow company, the cans and bottles recycled, and the paper products, along with salad, cake, and coffee grounds, composted in the in-vessel composter. Unfortunately, the lease for the composter required that it be emptied and returned to Green Mountain Technologies before all the compostable waste from Chickenque could be composted.

The ultimate results of this project is that, for two years, the Chickenque was a recycling event and the youth are especially excited about the fund-raiser continuing as something that is environmentally positive. A total of 78.5 % in 1997 and 89.1% in 1998 of the waste generated at the Chickenque was diverted from the landfill. See Table 6 for 1998 Chickenque diversions.

**Table 6. Recyclable Items and Trash Separated at Chickenque in 1998**

Solid Waste Materials	Weight in pounds	Volume in cubic yards
Paper plates	275.5	8.0
Other compostables	203.7	2.2
Glass		1.3
Plastic bottles		0.75
Milk cartons		3.0
Chicken & bones	1,682	
Cardboard & paper bags		20.0
Trash		6.0

**Mistral Restaurant:** An average of 40 lbs. of kitchen prep material and leftovers were added per day for 60 days. One yard of wood chips was initially added to the Comp-Tainer to provide aeration and act as a bulking agent. Based on a food waste audit, the restaurant was adding:

- vegetable parts
- egg cartons
- paper scraps
- fruit
- rolls
- shrimp
- pasta
- lemon rinds
- lobster shells
- pork and beef bones
- chicken meat & bones

The temperature log for the composter was:

- 12/15 - 58° F
- 12/19 - 53° F
- 12/23 - 58° F
- 12/24 - 58° F
- 12/28 - 130° F
- 12/31 - 60° F
- 01/03 - 117° F
- 01/06 - 120° F
- 01/09 - 140° F
- 01/12 - 110° F
- 01/16 - 105° F
- 01/20 - 110° F
- 01/23 - 162° F
- 01/25 - 85° F
- 01/28 - 125° F
- 01/30 - 155° F
- 02/01 - 155° F
- 02/04 - 145° F
- 02/07 - 130° F
- 02/09 - 140° F

Sawdust was added periodically to absorb moisture and add aeration to the composting mix. A total of 165 gallons of sawdust was added during the two-month composting period. The Comp-Tainer was emptied on February 12 and the compost was screened to separate out the non-compostable contaminants. The contaminants included: 25 glossy magazines, 30 plastic straws, several pieces of saran wrap, aluminum foil tea bags, one plastic coke bottle, a few pieces of silverware, several rubber bands, a few wire twist ties, some wax cheese covering, one glass soda bottle, one pair of large sneakers, several plastic bags, several plastic honey packets, and several rubber gloves amounting to approximately 50 lbs. Three yards<sup>3</sup> of usable compost was given to a person who heard about it through the newspaper.

The in-vessel composter at Mistral Restaurant successfully composted the input from the business with little effort once the staff learned how to separate out non-compostable materials and run the machine. The composting process began with heat emission as soon as there was enough bulk and nitrogen containing material added to the wood chips (2 weeks). We estimated that at that rate of input it would take over one year to fill the composter to capacity, at which time it would have to be emptied.

The estimated cost savings from reduced trash pick-up for one year would be \$ 2,400. At that rate it would take approximately three years to pay for the cost and operation of the machine.

Electrical hook-up was difficult in the area behind the restaurant because of limited access to electricity, an out-of-state landlord and property management requirement for justification, and specifications from the composter requiring a 30 amp 110 volt circuit. We later discovered that the more common 20 amps was sufficient. The electrical hook-

up difficulty was similar to other potential sites considering installing an in-vessel composter.

Heavy winter rains in combination with a warped lid on the demo model in-vessel composter caused water to pool on top and enter the bin, creating a wet mixture and leachate. The leachate had to be pumped out (5 gallons after each rain) and dry sawdust added as a moisture absorbent. The manufacturer has since made changes to the lid of the composter to eliminate rain water inflow.

The warped and sagging lid also caused the auger to drop down and hit the floor grate that was in place to provide aeration in the bottom of the composter. The auger tore up part of the plastic grate and had to be replaced. A portion of the auger was then cut off to prevent it from hitting the grate and a reinforcement bar was added to the lid to prevent further sagging. Again, the manufacturer has corrected this feature on new models.

At one point, approximately 50 lbs. of lobster carcasses were added to the composter. This created an ammonia smell that was objectionable in the immediate area of the machine. Lime and sawdust was added and the mixture was turned several times. Within three days the shells composted and the smell was gone.

Some contamination with non-compostable materials was from passers-by in the area behind the restaurant looking for a place (dumpster) to put some trash. It took approximately 2-3 weeks for the restaurant staff to learn the separation technique in order to fully eliminate contamination with restaurant materials.

On February 9, a demonstration was held for businesses interested in food waste composting, at the restaurant. Just over 350 announcements were sent out to restaurants in the area and 12 people attended. We demonstrated the operation of the machine and had the restaurant staff talk about the separation process of waste products in the kitchen. The Press Democrat wrote an article in the paper on 2/17/98 covering the story.

**The Santa Rosa Junior College Cafeteria (SRJC):** The in-vessel composter was located at the rear of the SRJC cafeteria right next to the back door and adjacent to Elliot Street. It remained there for 36 days. Based on the waste audit, the staff was adding an average of 45 lbs. per day of kitchen prep scraps and leftovers. Food waste included:

- coffee grounds
- vegetable parts
- fruit
- bread
- soup
- gelatin
- cheese
- cake
- paper napkins
- paper sugar packets
- egg shells
- pasta

The temperature log for the composter was:

- 2/20 - 85° F
- 2/27 - 72° F
- 3/2 - 90° F
- 3/5 - 120° F
- 3/6 - 110°
- 3/12 - 130° F
- 3/15 - 120° F
- 3/18 - 140° F
- 3/20 - 138° F
- 3/23 - 130° F
- 3/25 - 140° F
- 3/28 - 140° F

A total of 150 gallons of wood chips and 100 gallons of sawdust were added periodically to absorb excess moisture. Twelve gallons of leachate were pumped out four different times due to rainfall intrusion into the composter and the addition of very wet materials into the compost mixture. Very few (2 lbs.) contaminants were found in the compost when screened and used in the SRJC landscape around the roses.

The composting process within the machine worked very well. It took two weeks for the mixture to begin composting and heating up. High temperatures were maintained throughout the process until it was cleaned out and moved to the next location.

The site location was too small to locate the in-vessel composter and several problems arose due to lack of space. Access to the trash dumpster was impeded so the kitchen staff had to manually move it back into place after each dump. The trash hauler also hit the bio filter adjacent to the composter minimizing its ability to filter the composting odors. It was also located very close to the rear door of the cafeteria where the staff took smoking and lunch breaks. Odors from the composter easily flowed into the kitchen and cafeteria eating area.

The compost at this location got too wet from rainfall intrusion and from the addition of wet materials. At one time, the kitchen staff added over five gallons of old soup. Anaerobic odors developed for a few days before dry sawdust was added and the mixture was turned.

The composter was moved away from the cafeteria area prematurely due to the odor problem and a lack of commitment from the new contractor at the cafeteria. They complained that they had seen a rat in the area and were fearful that the composter was attracting rats. They had also received odor complaints from a department head and the President's secretary about the smell.

**Food-For-Thought Grocery Store:** On April 13 the in-vessel composter was moved to a location behind the Food-For-Thought grocery store in Santa Rosa. One yard of wood chips were initially added as a bulking agent and the staff and store manager were trained in food waste separation and in operating the machine. They added an average of 30 - 40 lbs. of produce trimmings per day for 67 days. This was only one third of their waste that was generated every day.

The following temperatures were logged for the operation:

- 4/19 - 100° F
- 4/25 - 160° F
- 4/27 - 120° F
- 5/4 - 140° F
- 5/7 - 145° F
- 5/11 - 60° F
- 5/12 - 120° F
- 5/14 - 80° F
- 5/15 - 100° F
- 5/18 - 110° F
- 5/20 - 60° F
- 5/21 - 60° F
- 5/22 - 60° F
- 5/25 - 85° F
- 5/27 - 90° F
- 5/31 - 100° F
- 6/5 - 120° F
- 6/8 - 125° F
- 6/15 - 120° F
- 6/17 - 130° F
- 6/20 - 140° F

By spring there was less rainfall and little remaining problem with the compost getting too wet and leachate needing to be pumped from the bottom of the composter. Leachate was removed on one occasion and 120 gallons of sawdust was added during the composting period. The composting process went very well until 120 gallons of paper from the Chickenque recycling effort were added over the week of May 8 to May 14. On May 21, 80 lbs. of chicken manure (nitrogen source) was added to get the compost actively working again. It took three days to see a temperature increase and an additional week to really get the composting process going again.

One unique research aspect at this site was the need to dispose of waxed cardboard. Waxed corrugated cardboard is a liability because it can not be recycled. We contacted an industrial shredder company, shredded a stack of waxed boxes, and added them to the composting mix in a plastic mesh bag. By the end of the composting process, there were no remnants of the waxed cardboard remaining.

Only one pound of contaminants was removed from the compost at screening. The machine was emptied on June 26 and returned to Green Mountain Technologies on June 29. The compost was used in the landscape around the Food-For-Thought store.

There were security problems at the site. The extension cord used to power the biofilter was stolen three times and the power line to the auger motor was also cut and stolen. The tarp covering the motor and lid was stolen. Some ammonia odor was evident when the compost could not be turned. The smell went away when the electrical cord was fixed and the mixture was again aerated.

On June 11<sup>th</sup> we held a morning demonstration of the in-vessel composter for interested business people to attend. Over 400 announcements were sent out to our mailing list of restaurants, institutions, and grocery stores in the county. Eight people attended. Several were interested in purchasing some type of composting machine for their business.

**Publicity Received for Food Waste Composting:** As described earlier we conducted three demonstrations of the in-vessel composter. Publicity for those events was sent, along with information describing the Comp-Tainer, to potential businesses interested in

the concept of food waste composting on site. We also received publicity from several media articles and one radio program as follows:

- Select Sonoma County Select Marketing News 2-3/98
- Select Sonoma County - Ag Insider 2-3/98
- PD article 2/17/98
- Mistral Newsletter - 2/98
- KSRO Radio Program 3/98
- Environmental Impact Reporter / in Food For Thought column- 5-6/98
- Business Environmental Alliance - newsletter write up in Oct. 98

## **Conclusions & Recommendations**

The in-vessel composter machine from Green Mountain Technologies that we tested during FY 1997-98 was the most practical machine on the market with some track record, reasonably affordable price, fairly compact size, and available for demonstrations. The machine was an early "demo" model with some basic problems, primarily the warped lid that led to rainwater intrusion and the auger hitting the bottom screen.

The actual composting process of adding a small amount of bulking agent and food scraps periodically was not complicated and the mixtures began composting within two weeks and heated up to rapidly decompose reasonable quantities of organic materials. The time requirement in separating out compostable materials was not a burden for the participating businesses nor was the time required to periodically turn the mixture.

Some care needs to be taken not to get the mixture too wet, not to add excessive quantities of either high carbon materials or green materials all at once. When large quantities are added, additional care must be taken to make sure the composting process is proceeding adequately. The temperature needs to be monitored periodically, especially if something is suspected. Clean out of finished compost is fairly easily achieved, by hand with a scoop shovel, through the two ports located on either side.

Not all locations are right for this type of machine. It may need to be covered or enclosed in a locked fenced area to prevent vandalism. Electrical hook-up needs to be taken into consideration before purchase; hard wiring the unit would ultimately be the best solution to electrical wiring problems. A drain located nearby with a direct hook-up for leachate would be the best way to handle excess moisture that accumulates. Storage of some dry sawdust next to the unit to add immediately if the mix gets too wet is a good idea. When rainfall is kept out, there should be little to no leachate created. .

For businesses with an environmental commitment and an ability to properly locate one of these machines on their property, the in-vessel composter offers an opportunity to dispose of food waste material in a cost-effective beneficial manner that could ultimately provide some "green" publicity for the business.

## **Future Considerations for the Project**

The first goal should be to facilitate the greatest possible diversion of food wastes from the landfill by encouraging individual food businesses to purchase and operate an in-vessel composter at their site. The second is to provide technical support to foster the success of waste separation and breakdown of food wastes in the composting/vermicomposting process to avoid potential problems.

Last year we received \$6,450 to demonstrate the potential for composting food waste at a special event, food businesses, and institutions. We learned a great deal from the pilot project and machine itself. The results were both positive and negative. The Comp-Tainer does a good job of composting, yet the “first off the assembly line” model we leased had some hook-up requirements and mechanical flaws that have caused problems. The concept of composting food waste on site with a small-containerized mixing machine such as this has merit and was well received by several food businesses in the county.

At a cost of approximately \$6,500, the composter could pay for itself in lower trash hauling fees in about three years. Some food businesses expressed a genuine interest in purchasing some type of composting machine and operating it near their trash bins. Most felt that the initial cost was prohibitive. A 1998 survey, however, of seventeen businesses interested in composting their food wastes indicated that an incentive of \$1,000 to \$3,000 was necessary to get most of them to purchase an in-vessel composter.

One method to reduce machine costs is to provide a rebate incentive to individual food businesses that purchase and operate an in-vessel composter. Also, provide technical support from the University of California Cooperative Extension for one year to assist with food waste separation and composting. The rebate incentive should encourage the purchase of approximately ten machines in the county. If different types of machines are purchased and operated, it would give us a chance to evaluate the performance of those machines rather than try to test one machine each year over a period of years.

The food businesses should be responsible for the electrical hook-up, energy costs, permits, and operation of the in-vessel composters. Equipment manufacturers should be responsible for technical support of machine operation.

## **Summary of Project Failures**

The following points are mistakes that we made or problems encountered in this pilot program. The greatest failures were just lessons in learning where to locate and how to operate the in-vessel composter. Lessons learned:

- Don't locate the machine close to where people are dining, the kitchen or in areas of heavy traffic. There is some odor generated; some people find it unpleasant

- Make sure there is enough room to operate the machine without disruption of trash collection in the remainder of the disposal area
- Protect the machine from vandalism within a locked, fenced area if possible
- Hard wire the electrical components in conduit, and if possible, connect the leachate drainage tube directly to the sewer system
- Take care to monitor the composting process on a regular basis with temperature measurements and visual inspection for moisture content
- Don't add too much dry carbon material or wet green material all at once (follow manufacturers' guidelines)
- Don't allow rainfall to enter the composter and don't get the mixture too wet





## **Tonnage Diversion Estimates and Costs Per Ton**

There are several ways to figure the costs per ton of food waste diverted from the landfill depending on which base figures are used and what those costs are compared to. This pilot project was really a research effort to see how well the Earth Tub would work and if the businesses and food event coordinators could easily separate food waste and other compostables from the trash. Consequently the costs are higher than they would be if compared to the costs to a business based on the cost of the composter. When the costs to the businesses are calculated it is a significant saving compared to their garbage pick-up fees.

### **Costs Based on the Waste Management Agency Contract with UCCE**

- Contract = \$ 6,450
- Composted 3.74 tons (7,470 lbs.) of food waste from Chickenque 1997 and Chickenque 1998, Mistral restaurant for 60 days, SRJC for 36 days, and Food For Thought for 67 days.
- Total = \$ 1,725 / ton

### **Costs Based on Lease Price and Operation of the Comp-Tainer for One Year**

- Lease = \$ 1,200 per year
- Average of 40 lbs. / day composted per year = 7.3 tons \*
- Total = \$ 164.4 / ton

### **Costs Based on Mistral Restaurant Garbage Pick-Up**

- Garbage Pick-up = \$ 4,800 per year for 14.6 tons / yr.
- 7.3 tons (40 lbs. / day)\* was estimated to be 1/2 of garbage = \$ 2,400 / year
- Total = \$ 329 / ton

### **Costs Based on Purchase of an Earth Tub - Spread Over Several Years**

- Purchase price = \$6,500
- Divert 7.3 tons per year at a rate of 40 lbs. / day
- One year - \$ 890.41 / ton
- Two years - \$ 445.20 / ton
- Three years - \$ 296.80 / ton
- Four years - \$ 222.60 / ton
- Five years - \$ 178.08 / ton

*\*The Earth Tub has a potential to compost 150 lbs. per day according to manufacturer specifications.*