



A Control Experiment
Buried Fermented and Buried Non-Fermented Food Waste
Soil Interactions

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What happens to food waste just buried in the soil?

It is a perfectly reasonable question. One wonders does it make a difference to pre-treat the food waste with microbes before it is placed in the ground. It is easy to run the control experiment and as is evident in the images and measurements shown there is a profound difference in the rate of food waste degradation related to how the waste is treated before it goes into the ground.

Study Purpose:

There were two objectives in this semi-quantitative study. The first was to show the differences one can expect to see in the degrading processes when food waste is just buried in soil and left to degrade as opposed to bokashi fermenting food waste before burying it in the soil.

We want to show that it is possible to use a large planter box filled with soil to degrade fermented food waste efficiently. It is not known how much soil is needed to rapidly degrade a fermented sample of waste material in a period of about 2 weeks.

In this experiment a volume of soil 5 times greater than the beginning load of fermented food waste was tested to determine if that was a sufficient amount of soil to completely within the month decompose the wasted material. Experience has shown that an average couple generating food waste will in a month produce approximately 1 cubic foot of fermented waste material.

If this can be done, then it is then possible for high-rise or condominium dwellers to use the bokashi fermentation system at home providing they use a planter box on the balcony or roof to process food waste that is at least 5 times the volume of food waste that will be generated each month.

Findings:

Buried Food Waste:

Food waste that is buried in the ground without a pre-treatment remains in the ground attracting flies and animals and does not rapidly degrade. A strong odor of rotting waste material is apparent as one approaches the burial site and it is more evident as one disturbs the soil where waste had been buried. Approximately 90 % of the buried food waste is recovered even at 8 weeks after it had been buried.

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Buried Bokashi Fermented Food Waste:

Food waste pretreated by bokashi fermenting and buried in soil in a garden container with a 5:1 volume soil to fermented food waste material rapidly degrades. There are no flies or vermin attracted to the site. There is no apparent rotting odor even when the burial site is disturbed. Most of the fermented food waste (estimated at 90% of the initial volume) is transformed into nutrient rich soil within 7 days from the time it is placed in the soil in the garden container. Woody (grape stems, etc.) and bony materials take longer to degrade but appear well on the way even at 7 days. Grape stems and larger bones show evidence of decomposition at 3 weeks and are the only residuals recovered at the end of the month.

Experiments and Images:

Two different experiments were done. In both experiments the soil was taken from the same area in the garden. Five gallons of collected food waste was buried in the soil mixing it and covering it then with soil to a depth of 8 inches. In one experiment the food waste was buried and then recovered after 8 weeks to determine how much decomposition had taken place.

In the second set of experiments food waste was fermented using the bokashi fermentation process and then buried in soil that had been placed in a garden container that was opened for inspection weekly to determine how much degrading of material had occurred.

Photo-images of Buried Food recovered after 8 weeks:

The food waste material in the experiment involving no pretreatment was allowed to remain in the ground for 8 weeks before it was screened to see how much material was degraded.

Non-degraded food waste was recovered by digging up soil at the burial site and filtering all the soil from the site through a ½ x ½ inch mesh screen. All particles that could be identified as food waste material were set aside and then collectively washed with water to remove loose dirt. The material that had been in the soil 8 weeks was then placed in the original container to measure the recovery volume. It could then be estimated based on the volume recovered relative to the volume that had been buried how efficiently the degrading process was for buried food waste.

It was apparent (images as shown below) that food waste that was not fermented changed very little during the 8 week period it was in the soil. A strong odor of decaying food waste was evident when the soil was disturbed and there were many insects and flies near the surface where the food waste had been buried.

Virtually all of the non-fermented food waste was easily recovered. The photo images show bright red raw tomatoes and vegetable matter in the recovered material. Meat products were also easily identified. Measurements of the washed material recovered

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from the soil reveal a volume recovery of approximately 90%. Decomposition was hardly detectable. The strong odor of rotting food waste was very evident. These findings are shown in the photo images.

Photo Images of Non-fermented Food Waste Recovered After 8 Weeks in the Soil



Food waste Recovery after 8 week burial
Non-fermented food waste buried 1 foot in soil and examined each week for 8 weeks recovered by filtering through 1/2 x 1/2 mesh wire screen
Initial volume = 5 gallons



Food waste Recovery after 8 week burial
rocks and food waste retained

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Food waste Recovery after 8 week burial
rocks and food waste retained on mesh screen
ready for wash down



Food waste Recovery after 8 week burial
Food waste still evident with little decomposition
even after 8 weeks in the soil

Note there are abundant raw vegetable and meat particles observed even after the waste material had been in the soil for 8 weeks.

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Food waste Recovery after 8 week burial
Close up reveals raw vegetables, meat products
and peels hardly degraded mixed with soil



Food waste Recovery after 8 week burial
Contents of non-degraded food waste from recovery
placed in fermenting chamber with wheat bran
bokashi culture mix

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Bokashi Fermented Food Waste:

In the second set of experiments the same volume of food waste (5 gallons) was allowed to first ferment using bokashi culture mix (www.bokashicycle.com). Fermenting of food waste was done for at least 7 days in the closed fermenter before it was placed in the soil.

A 25 cubic foot garden container was filled with screened soil as shown in the image collection. A 5 gallon (1 cubic foot) container of fermented food waste was then mixed with the soil and covered with at least 8 inches of soil over the top of the fermented food waste and it was then allowed to remain undisturbed for a period of 1 week (July 21 to July 28, 2009).

The contents of the garden container were then transferred to a wheel barrow and with careful screening using the ½ x ½ mesh wire screen residual material was collected and washed so it could be identified and measured accurately.

Screen filtered soil was added to a garden container (shown below) that had approximately 4 inches of soil at the bottom. The volume of soil relative to the volume of added food waste was 5:1.

The 5 gallon fermented food waste material was added to the container and more soil was mixed into it before filling to the top of the container. Fermented food waste was allowed to stand undisturbed for 7 days. After 7 days all of the soil in the container was removed and filtered to identify any residual non-degraded food waste. Retained food waste was sorted, washed and then photographed to get an accurate estimate of amount of fermented food waste that had not degraded at 7 days.

Photo-images of recovered fermented food waste at 7 days:

As can be seen, most of the food waste (estimated at 90%) has already been converted to nutrient rich soil within the week in which it was buried. The waste that was retained was generally speaking bones, pits, and woody grape stems. A few badly discolored and shredded leaves, a grape and a jalapeno pepper were at 7 days not completely degraded (image as shown)..

These residual non-degraded at 7 day items in the fermented food waste were suspended in the soil to give it more time to degrade.

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25 cubic foot capacity garden container



Screened soil prepared before filling garden container

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Screened soil placed in garden container to be mixed with fermented food waste following bokashi fermentation



Fermented food waste in bottom of garden container

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Buried fermented food waste in soil July 21, 2009



Soil with buried food waste taken out of garden container on July 28, 2009 and screened for residual food waste

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Most of food waste is converted to soil at 7 days. A few bones, woody grape stems, and pits and egg shell fragments and shredded banana plant leaf partially degraded evident after screening soil.

Photo-images of recovered fermented food waste at 14 days:

All of the recovered fermented food waste obtained at 7 days was suspended in the same soil taken from the container to be opened, screened and photographed at 14 days . A few shredded banana plant leaves, grape stems and bones were found but all other fermented food waste was indistinguishable from soil by day 14.



Shredded Banana tree leaf remnants

Bones recovered at 2 weeks

Grape stems degrading

Waste recovered at 2 weeks - Woody materials and bone fragments.

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Photo-images of recovered fermented food waste at 27 days:

All of the recovered material at 14 days was placed back into the container with the same soil and allowed to further decompose. The contents of the container were examined at 27 days from the time of burial. Only the larger bones and a half dozen grape stems were identified. The bones were discolored and showed evidence of decomposition as shown in the photographs below.



**Soil recovery at 27 days
from 25 cu ft plantar box
with a few bones and grape
stems residual screened**



**Soil recovery at 27 days
from 25 cu ft plantar box
with a few bones and grape
stems residual placed back
in the box**

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Six grape stems partially decomposed and larger bones in process of decomposition



Magnification showing apparent fungal organisms invading bony cortex

Conclusions:

Food waste simply buried in the ground will not rapidly degrade and remains virtually unchanged for weeks. A foul rotting smell is easily detected in the vicinity of buried food waste; flies are evident and animals dig in the soil where the waste is buried. It appears that 90% of the food waste can be recovered even at 8 weeks after burial.

Bokashi fermented food waste buried at the same depth in a garden container with a soil to waste volume of 5:1 rapidly transforms into a rich nutrient soil. No earth worms were present in the soil used to degrade the fermented food waste in this experiment.

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No flies or foul rotting smells were observed in the attempt to recover buried waste material. It appears that woody and bony items require more than 7 days to completely degrade.

More than 90% of the buried fermented food waste was degraded within 7 days after being placed in the soil. Only woody (grape stems, etc.) and larger bones are recovered after 2 weeks and they appeared discolored and well into the degrading process.

With a larger planter box on the balcony or roof top, the food waste could be buried in the soil with the expectation that it will be properly and rapidly converted to nutrient rich soil that could then be used to support and feed plants in other planter boxes.

Normally fermented food waste would be buried once every 4 – 5 weeks which appears based on these findings to be sufficiently adequate time for a transformation of waste to soil that is rich in organic nutrients and microbes..