Experimental Johnson-Su Composting Bioreactor

A collaboration between the Grafton Community Gardens and the Bowen Island Food Sovereignty Group

Regenerative Agriculture relies on nature's barter system between plants and soil microbes instead of fossil-fuel based fertilizers and pesticides.

An important step is to restore the soil microbes by inoculating the damaged soil or dirt with compost that contains a healthy balance of indigenous microbes.

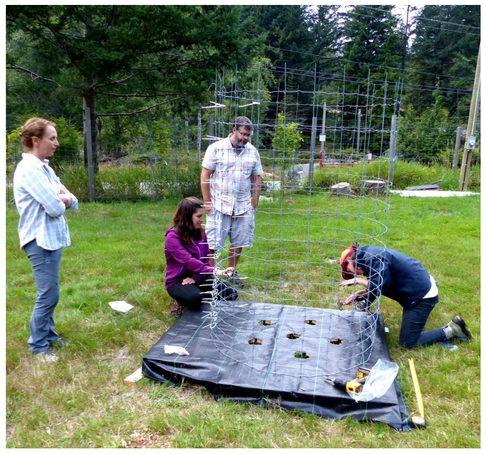
Research by Dr. David Johnson at New Mexico State University indicates that compost with a higher fungal to bacterial ratio (> 0.4) can achieve a remarkable yield increase (up to 8 times for chile peppers).
https://holisticmanagement.org/wp-content/uploads/2015/05/Quivira_Johnson1.pdf

The Johnson-Su bioreactor is a new composting system he developed with his wife that can achieve a much higher fungal to bacterial ratio compost with a very diverse microbe population. It is a no turn composting procedure that has a short thermal phase (T > 131°F, 55°C), followed by a worm composting phase. It requires a full year to complete.
Johnson-Su Bioreactor https://www.dropbox.com/s/11oxvznptcd3f7c/Johnson-Su%20Bioreactor.pdf

Completed layer cake of ingredients before loading bioreactor
Our team (left to right): Meribeth Deen, Jessica Mitts, Denise Richards, David Griffith, Julie Sage, Phil Gregory

During the thermal phase (1st week) heat was produced by bacteria rapidly reproducing in the high nitrogen environment. Steam emerged from the holes left from pulling out the PVC pipes. Red wiggler worms were added once the temperature fell below 80°F, 26°C. Black landscape cloth creates a dark enclosure for the worms. An automated irrigation system sits on top to control the moisture in the pile.

4 temperature probes at a variety of locations. During the thermal phase our highest temperature recorded was 161°F, 71°C



Attaching the wire frame to pallet. The 6 holes will hold the PVC pipes.

Attaching the PVC pipes to metal frame mounted on top of bioreactor cage. The pipes are pulled out 24 hr after loading, leaving behind 6 air channels to provide oxygen to the rapidly reproducing bacteria.

Grass cut the day before loading. When assembling the layer cake, layers of mash & grass should be kept thin to avoid going anaerobic.

Cutting holes for 4" PVC tubes that create 6 air channels into the compost pile.

Compost Recipe

10% high nitrogen (Carbon to Nitrogen ratio 10:1) = 8 buckets
(beer mash =spent organic barley, brewery waste product)

30% greens (C:N ratio 30:1) (grass) = 24 buckets

60% browns (C:N ratio 200:1) = 47 buckets
(31 buckets organic straw + 15 buckets leaves + 1 sawdust)

Total = 79 buckets

(1 bucket is 5 gallons)

Bucket sized piles of straw, leaves, grass and beer mash, help to achieve the right proportions of ingredients when assembling the compost layer cake. When loading into the bioreactor the materials get randomly mixed together. The orange buckets contain fresh beer mash acquired on loading day.

Loading the bioreactor

Poster Created by Phil Gregory, Professor Emeritus, University of British Columbia
https://www.phas.ubc.ca/~gregory/papers/FarmersPosterJohnsonSuBioreactorGregory1.pdf
"The Magic of Soil" https://www.youtube.com/watch?v=AWILIYSf5ts