Further Resources

Johnson-Su Bioreactor Information

Materials for purchase from Valencia Soil and Water Conservaition District

Instructional videos and documents

https://regenerationinternational.org/bioreactor/

https://www.csuchico.edu/regenerativeagriculture/bioreactor/bioreactor-instructions.shtml

The 5 Healthy Soils Principles Information

https://www.nmhealthysoil.org/2019/09/07/principles/

New Mexico Healthy Soils Program

https://www.nmda.nmsu.edu/nmda-homepage/divisions/apr/healthy-soil-program/

Become a Healthy Soils Champion!

https://www.nmhealthysoil.org/category/champions/

Public Funding Sources for Growers/Ranchers

VSWCD Assistance Program

https://www.valenciaswcd.org/assistance-programs/

NRCS Programs

https://www.nrcs.usda.gov/wps/portal/nrcs/site/nm/home/

Local Cover Crop Seed Vendors

- Old Mill Farm & Ranch Supply
- Chical Haystack
- Plants of the Southwest
- Curtis & Curtis

VALENCIA SOIL & WATER CONSERVATION DISTRICT

(505) 864-8914
www.valenciaswcd.org

Johnson-Su Bioreactor Compost & 5 Healthy Soils Principles

Best Practices From the Field

Image Catherine Ulitsky, USDA/Flickr

Healthy soil creates higher quality crops, requires less fertilizer and pesticides, conserves water, reduces weeds, creates natural nutrient cycling, reduces pests and diseases and reduces erosion and leaching.

VALENCIA SOIL & WATER CONSERVATION DISTRICT

The Johnson-Su Bioreactor Composting Method

What is it?

This is a composting method that creates a microbial diverse and fungal dominant compost. The purpose of the compost is to add the microbia and fungi to a soil and restore these populations in the soil. Since there is such an abundance of microbia and fungi in the compost, only a small amount of the compost is needed, like an inoculum. It can be added directly to soil, as a slurry sprayed on or by inoculating seeds before they are planted.

Why Microbia and Fungi?

Microbia and fungi create relationships with plants to convert nutrients to become available for plants to uptake as well as build soil structure and improve water absorption.

Filling a bioreactor at Valencia Community Garden

Benefits of Combining Healthy Soils Methods:

- Improve crop yield;
- Reduce need for fertilizers, thus increase profits;
- Increase nutrient uptake from soil;
- Restore normal balance between microbes and plant roots;
- Improve soil structure;
- Conserve water;
- Help soil to sequester more carbon from theatmo-sphere.

The 5 Healthy Soils Principles

The 5 Healthy Soils Principles are recognized by the New Mexico Department of Agriculture as part of their Healthy Soils Program (HSP). The purpose of the HSP is "to promote and support farming and ranching systems and other forms of land management that increase soil organic matter, aggregate stability, microbiology and water retention to improve the health, yield and profitability of the soils of the state" and was signed into law in 2019.

1. Keep Soil Covered
   Cover crops, living plants and mulch protect the soil from erosion, compaction, evaporation, lower soil temperatures, add organic matter to the soil and provide habitat for insects and microorganisms.
2. Minimize disturbance
   Tilling the soil, overgrazing, or adding excessive fertilizer and herbicides can disrupt natural processes, break down soil structure or decrease biological activity in the soil.
3. Maximize biodiversity
   Plant diversity is vital to supporting a diversity of insects and microorganisms in the soil.
4. Maintaining Living Roots
   Living roots all year round in your soil provide fuel and habitat for a thriving population of soil organisms and fungi.
5. Integrate animals
   Practices that support birds, pollinators, worms and livestock helps to add and cycle nutrients while restoring natural soil properties.

Case Studies from the Field

Valencia Soil and Water Conservation District studied the changes to crop yield and soil composition in 2020 among 10 different growers that applied Johnson-Su Bioreactor Compost and different variations of The 5 Healthy Soils Principles. Project funded by the New Mexico Department of Agriculture through a Healthy Soils Program Grant, 2020.

Sublime Pastures, operated by Kirsten and Nate Coueves, is 4 acres of pasture for grassfed beef products in Tome using all 5 Healthy Soils Practices. They practice rotational grazing and no-til, planted a diversity of pasture crops, and do not use chemicals. They applied the bioreactor compost using the slurry method on the pasture seed. Bacteria and fungi increased as well as ground cover. They had substantial moisture in the soil in mid-October, 1 month after irrigation stopped (see photo).

Valencia Community Gardens (VCG) in Tome tested the compost on their tomatoes (see photo) and beans by adding the compost directly to the soil in the spring. Their practices include using compost, digging soil not tilling, allowing chickens, creating abundant habitat for perennials and pollinators, and having a grass cover all year between beds. Both plots showed increases of fungi and bacteria with the Johnson-Su compost and their total fungi and bacteria were well into the desired range in the fall.

Roots Farm is a 1.3 acre organic farm in Tome owned by Ron Moya. Living roots and diversity are attainted by using cover crops and rotating crop plots. The soil around crops is covered wit a white plastic reducing weeds and conserving water. Roots Farm had significant increase in crop size of peppers, melons and tomatoes this season and they partially attribute this to adding bioreactor compost as a slurry to seeds and transplants. Fungi and bacteria levels were at desired levels at the end of the season.

El Cerro Mission and Meadow Lake Community Gardens are 1/4 acre community learning spaces coordinated by VSWCD on the East Mesa. Using leaf and wood mulch to cover soils, cover crops in the winter, rotating crops, no-till practices and drip irrigation, there showed increased total and active bacteria and fungi in both sweet corn and onion crops with obvious increase in corn growth after applying the compost directly to soil with mulch.

Adobe Farm, in Belen, is a food forest, vegetable gardens and pasture where Jeff Goebel and Myrna Castro (Soil Health Champions)practice all 5 Healthy Soils Principles. Bacteria and fungi increased - after spraying the bioreactor compost as a slurry - more in areas with more perennials or ground cover and consistent moisture. Fungi was especially high near the perennial trees. Emphasis on goat grazing, no-till and pollinator diversity may also have contributed to overall increases.

Best Practices from the Field

There was a general increase of bacteria and fungi by applying the Johnson-Su Bioreactor Compost. Higher increases occurred in areas practicing Healthy Soils Principles. Specifically integrating the following management practices showed the highest levels and crop improvements:

- Cover Cropping
- Mulching
- No-till Practices
- Incorporating animals
- Consistent moisture
- Incorporating perennials

Roots Farm

Cover Crops are planted during the off season or if a grower is leaving a plot fallow for a season and on a large or small scale. Planting cover crops maintains living roots in the ground, supports a soil biological life, as well as retains moisture and reduces erosion. A diverse cover mix supports a greater biological diversity in the soil. Cover crops can be mowed, crimped, smothered with mulch or tilled or disked into the soil before planting the next crop.

Rocket Punch Farm

Mulching is another way to cover the soil but without maintaining living roots. Leaves, grass clippings or wood mulch added 3 inches or deeper significantly reduces soil temperatures, evaporation and weeds in soil and harbors beneficial habitat for bacteria and fungi. Cardboard or paper without colored ink can be added under the mulch for an added layer (see photo).

No-Till Practices are used to reduce the amount of distubance to the soil which breaks down structure and habitat for bacteria and fungi. Local growers achieve this without disturbing bacteria and fungi by:

- Incorporating livestock or poultry to push back weeds and cover crops;
- Smothering weeds/cover crops with heavy mulch;
- Solarizing weeds/cover crops with clear plastic;
- Crimping cover crops with a tractor attachment;
- Seeding cover crops and pasture w/ a no-till drill.

Whitifield Wildlife Conservation Area

Sublime Farms

Incorporating Animals can be practiced by raising livestock, having free-range chickens or periodically grazing goats. Rotational Grazing is used to concentrate livestock in one more populated area to graze on pasture evenly and then move them on quickly to a new area before the pasture is grazed too low. This is achieved often by having smaller paddocks for the animals with a moveable fencing system.

Perrenial Plantings can be incorporated into crops or gardens by interspersing things like perennial fruit bearing or pollinator plants. Based on this study, fungi populations were much higher in these areas of plantings.

Consistent Moisture can be achieved while still conserving water by using drip irrigation, mulching, maintaining living roots, increasing organic matter and/or using a weed barrier.

El Cerro Community Garden