CT RC&D Compost Tea Equipment Mobile Unit
2025 Educational Pilot Project
Summary Report

By

Domingo Medina, Peels and Wheels Composting and Monique Bosch, CT NOFA

Abstract

Compost tea is promoted as a biological amendment to improve soil health and crop productivity, though field evidence is inconsistent. This study evaluated compost tea effects through on-farm trials at five organic farms in Connecticut, USA. A randomized paired-comparison design compared aerobically brewed vermicompost tea with amendment-only controls across tomato, kale, and cucumber crops over one growing season. Yield responses were variable, with statistically significant increases observed in only one tomato trial. Compost tea treatments consistently increased soil microbial biomass, soil organic matter, and soil micro-aggregation, indicating soil health benefits independent of short-term yield responses.

The Project

The CT RC&D Compost Tea Equipment Mobile Unit 2025 Educational Pilot Project was done in cooperation with CT NOFA. Funding for this project was paid for by the Climate Smart Farming: Agriculture and Forestry Grant. Funding awarded and administered by the Connecticut Department of Agriculture. The project aimed at introducing CT farmers to the use of compost tea as an organic tool with multiple benefits through on-farm experimental trials on 5 selected farms. The farms selected participated in an application process open to all operating farms statewide. Participating farms included Reservoir Community Farm in Bridgeport, Common Ground High School in New Haven, Lathrop Farm and Sweet Acre in Lebanon, and Artza Mendi Farm in Baltic. The trials were conducted using methods described in the FARMERS GUIDE TO CONDUCTING ON-FARM RESEARCH by the Organic Farm Research Foundation. UCONN microbial soil ecologist Prof Mia Maltz and Amelia Magistrali, Extension Soil Health Specialist, provided support and guidance in the experimental design, data collection and interpretation.

Compost Tea as an agriculture organic method

Compost teas and extracts are organic methods being used to inoculate soils and plants with beneficial microbes, found in soils and in high quality compost and vermicompost. The microbes are known to facilitate nutrient cycling, suppress diseases, decompose organic

matter, promote plant growth and support soil health and bioremediation. These methods are used as a soil health practice and to help farms to transition into reducing their dependency on fertilizer applications. Training and testing of these methods are key for their adoption by farmers.

The trial, research questions and methodology

The trial used a paired comparison design with 4 replications and randomized control and treatment plots in blocks (see example Figure 1). This experimental design is a way to test the effect of the compost tea minimizing variation and bias by making the farm testing more structured and its results more reliable. Paired comparison is used when only two treatments are being compared in the design, the control (business as usual) and the new treatment being tested. In this case the application of compost tea (a brew of water, vermicompost plus food amendments) vs. control (water plus food amendments).

Plots for the trial and crops were selected by farmers in agreement with the field researchers. The trial set to test statistically if 5 compost tea applications per season would result in higher yields in selected crops. Moreover, whether such applications would help prevent or minimize disease and pest pressure. Other observations in the trial included changes in the percentage of organic matter, soil structure, soil microbial biomass, soil nutrient availability and nutrient uptake by plants.

Baseline data from each farm was collected which included water quality (Logan Labs), soil compaction and soil and paste analysis (Logan Lab). The latter two analyses were collected also at the end of the treatments. Tissue analysis (Penn State U) was performed mid-season to assess nutrient uptake by plants.

The Compost Tea Mobile Unit included a trailer, a 50-gallon canonical brewer, a 55-gallon 3-point PTO spray rig, a 4-gallon backpack sprayer, a compost tea filter and amendments. The source of the vermicompost used for brewing tea was supplied by Wiggle Room LLC and the supply of amendments included humic acid, fish hydrolysate and liquid kelp. These amendments are known as bacterial and fungal foods with essential minerals, amino and fatty acids. Each farm received a control and tea treatment every 3 weeks for a total of 5 applications that ran from June to September.

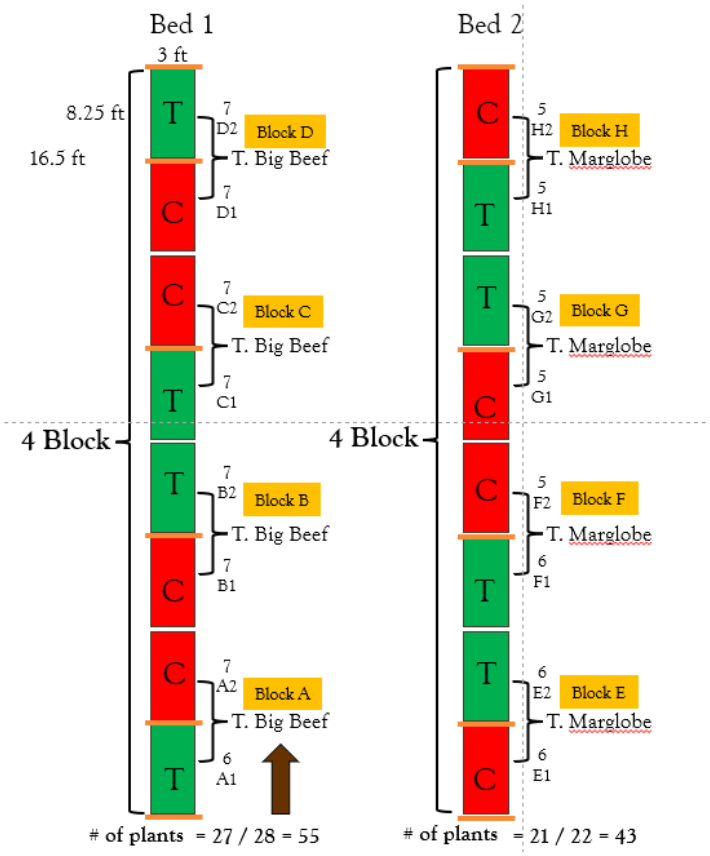

Figure 1. Example of two pairwise experimental designs for Sweet Acre Farms showing control (C) and treatment (T) plots.

Control plots received foliar and root drench applications of a prescribed measured recipe of fish hydrolysate, kelp and humic acid only. Compost Tea plots received the same recipe of amendments, plus vermicompost (worm castings), aerobically brewed for 24 hours in the conical brewers (see Table 1).

Table 1. Amendments recipe used for Compost Tea in the trial

Brewer/Sprayer Gallons	Kelp oz	Fish Hydrolysate oz	Humic Acid oz	TOTAL	Food / water ratio	Vermi compost	Vermi Compost / water ratio
50	8.00	2.00	1.50	11.5	0.23	10.00 lbs	0.20
7	1.00	0.33	0.08	1.41	0.20	1.25 lbs	0.18
4	0.50	0.17	0.04	0.71	0.18	0	

Efforts were made to maintain the most optimal ranges of temperature (>65 F) and dissolved oxygen (>6 ppm), to favor the growth of microbial biomass in each batch of compost tea.

Each batch was evaluated for its microbial biomass and fungal to bacteria ratio (F:B) levels using the *microbiometer* and by microbial qualitative assessment with a field microscope. Given the distance between farms and logistics purposes, the 55-gallon brewer was left at Lathorp Farm to brew tea batches for Lathorp, and nearby Sweet Acre and Artza Meni farms, and a 7-gallon brewer was left at Common Ground High School to brew tea batches for the school and for Reservoir. Tea recipes were adjusted to make sure food to water ratio and vermicompost to water ratio were the same for each brewer size. 4 Gallon backpack sprayers with proper nozzles were used to apply all the treatments (control and tea applications) to facilitate the spraying and to use the same equipment in all trials.

RESULTS

Baseline data

- Soil compaction tests for all the farms were fair with soil being uncompacted between 9 and 12 inches deep conducive for root development and water infiltration.
- Water irrigation parameters were all normal other than low Iron and Boron ppm in all farms. Likewise, hardness ppm was low in all farms other than in CGHS. No concern about negative impacts on the viability of soil biology.
- Soil analysis data showed few deficits in exchangeable cations in some farms (Potassium, Magnesium and Calcium) with overall balanced soils in terms of base saturation before the trials.
- Soil paste analysis, that refers to available nutrients in the soil solution, resulted in low ppm of soluble cations such as calcium, magnesium and potassium for most farms and well as unbalanced ratios between these cations in terms of their percentages.
- Pre and post soil and paste data needs further review. Yet minimal change in saturated paste nutrient values is expected to be observed because of the treatments applied in this trial. We should expect little to no immediate measurable change in saturated paste nutrient concentrations. Any changes are typically indirect, gradual, and mediated by enhanced microbial mineralization rather than direct nutrient addition.

Compost tea data

- The vermi-compost used in the preparation of the teas had microbial biomass above average to excellent in 50% of the tea batches yet presenting in all cases F:B ratios higher than the optimal of 1:1. The microbial biomass for the compost tea applications were average to excellent in 80% of the tea batches correlating positively with water temperature and negatively with high dissolved oxygen levels.

Yield data

- Yields (lbs per sq ft) from 5 varieties of tomatoes in 7 trials were tested in 4 farms (Table 2). Yield was relatively higher for tea treatment in 4 out of the 7 tomato trials.
- The difference between *Control* and *Compost Tea* with respect to the dependent variable Yield was statistically significant in only 1 out of 5 experimental trials that had 4 replicas to compare. This was the case with Lathrop farm (Two tailed t-test for independent samples with equal variances, $t(6) = -2.564$, $p = .043$, 95% confidence interval [-10.202, -0.238].

Table 2. Yield Data: Tomatoes (lbs/sqft)

FARM	Reserv.		Reserv.		Reserv.		Lathrop		S. Acre		S. Acre		Artza Mendi		TOTAL	
Treatment	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea
Sq ft	64	64	16	16	16	16	150	150	99	99	99	99	108	108	552	552
Crop	Hungarian		Muskovitch		Celebration		Big Beef		Big Beef		Marglobe		Big Beef		All T.	
# plants	20	20	5	5	5	5	16	16	28	27	21	22	12	12	107	107
# Harvest	21	26	7	6	6	6	32	32	82	82	87	87	60	60	295	299
Yield lbs	70.7	79.2	8.8	9.3	16.6	11.6	58.9	79.7	88.9	86.6	190.2	195.2	118.2	107.6	552.2	569.3
lbs/sqft	**1.10**	**1.24**	**0.55**	**0.58**	**1.04**	**0.73**	**0.39**	**0.53**	**0.90**	**0.88**	**1.92**	**1.97**	**1.09**	**1.00**	**1.00**	**1.03**

- Yields (lbs. per sq ft) from 3 varieties of kale in 6 trials were tested in 2 farms (Table 3). Yield was relatively higher for tea treatment in 3 out of the 6 Kale trials. The difference between *Control* and *Compost Tea* with respect to the dependent variable Yield was not statistically significant in any of the Kale experimental trials.

Table 3. Yield Data: kale (lbs/sqft)

FARM	CGHS		CGHS		CGHS		Reserv.		Reserv.		Reserv.		TOTAL	
Treatment	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea	Ctrl	Tea
Sq ft	105	105	52.5	52.5	52.5	52.5	32	32	32	32	32	32	306	306
Crop	Curly		Lozanato		Russian		Curly		Lozanato		Russian		All K.	
#plants	67	69	35	35	35	35	27	26	26	25	27	25	217	215
#Harvest	30	25	8	8	9	13	3	5	7	5	4	4	61	60
Yield lbs	169.1	130.9	39.4	41.1	53.1	88.1	11.5	15.4	11.7	6.7	13.4	11.3	298.1	293.5
lbs/sqft	**1.61**	**1.25**	**0.75**	**0.78**	**1.01**	**1.68**	**0.36**	**0.48**	**0.37**	**0.21**	**0.42**	**0.35**	**0.97**	**0.96**

- Yields (lbs. per sq ft) were relatively higher for *Compost Tea* treatment in the only Cucumber trial we had (Table 4). The difference between *Control* and *Compost Tea* with respect to the dependent variable Yield was not statistically significant in the cucumber experimental trial.

Table 4. Yield Data: cucumber (lbs/sqft)

FARM	Lathrop	
Treatment	Ctrl	Tea
Sq ft	150	150
Crop	C. Marketmore	
# plants	48	48
# Harvest	16	16
Yield lbs	117.6	126.9
lbs/sqft	0.78	0.85

Other results

- **Increase in Microbial Biomass:** Pre and Post treatments resulted in an increase in Microbial Biomass in all farms (Figure 2) for both the control and tea applications. This increment was expected due to the seasonality of microbial activity in the soil. Yet the percentage of change was significantly higher (Figure 3) for tea treatments in 3 farms (Artza Mendi, Lathrop and Sweet Acre). A probable explanation is that these 3 farms used well water for tea brewing and for irrigation compared to Reservoir and CGHS that use city water. The issue with City water is that it may be treated with chlorine and or chloramine. Untreated city water can significantly suppress compost tea microbial populations. Well water is often preferable, provided mineral levels are not extreme. These parameters were not covered in the water baseline test.
- **Increase in % Organic Matter:** Pre and Post treatments resulted in an increase in the percentage of organic matter in all farms (Figure 4) for both the control and tea applications but not in the control plots of Reservoir Community Gardens. Interestingly, the percentage of change was higher in 4 out 5 farms *Compost Tea* treatment plots (Figure 5) suggesting that the microbial activity in the *Compost Tea* plays a role in the percentage of organic matter in the soil. This data correlates with the increase in microbial biomass by *Compost Tea* treatment outlined above.

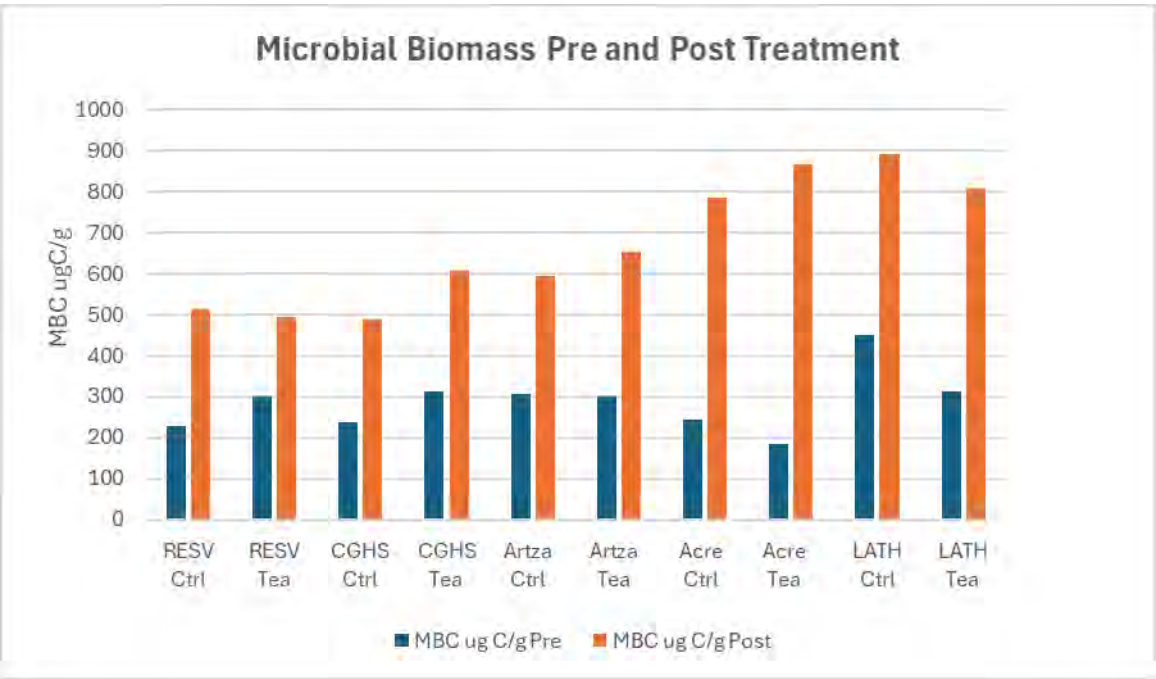

Figure 2

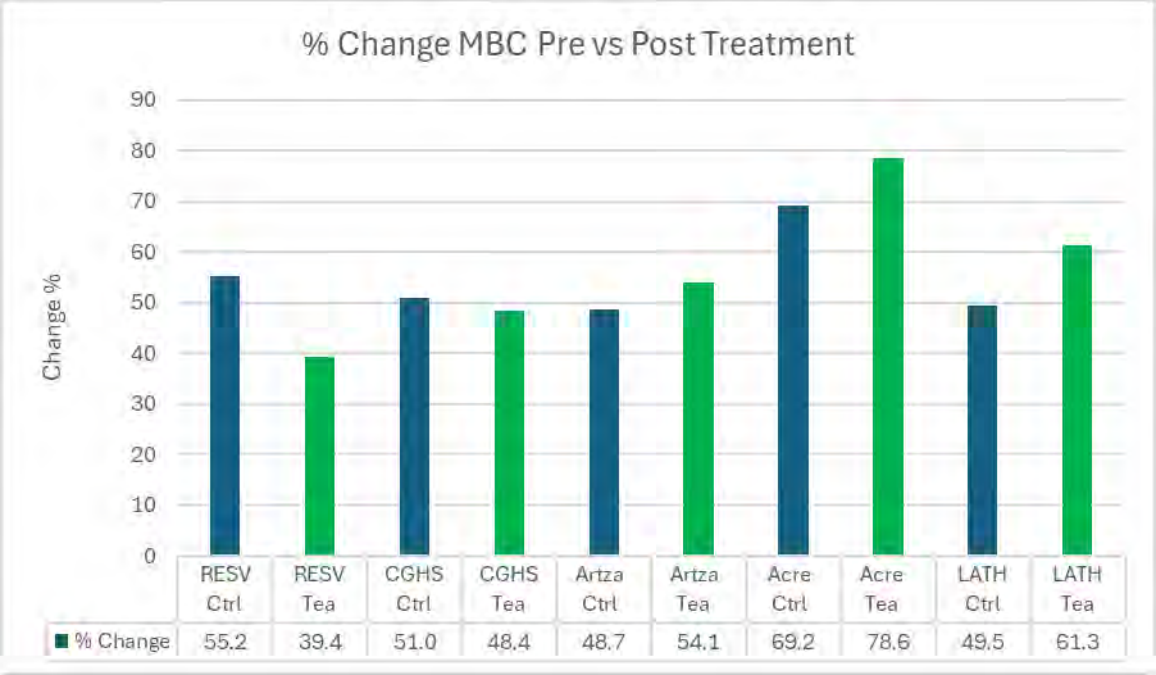

Figure 3.

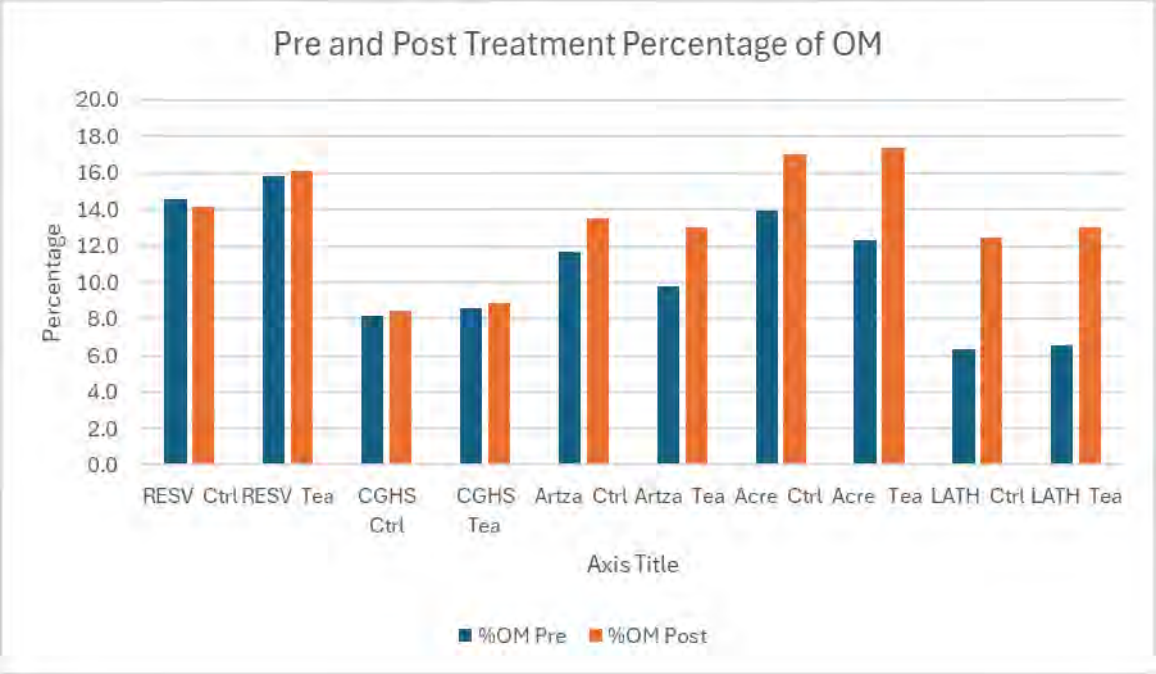

Figure 4.

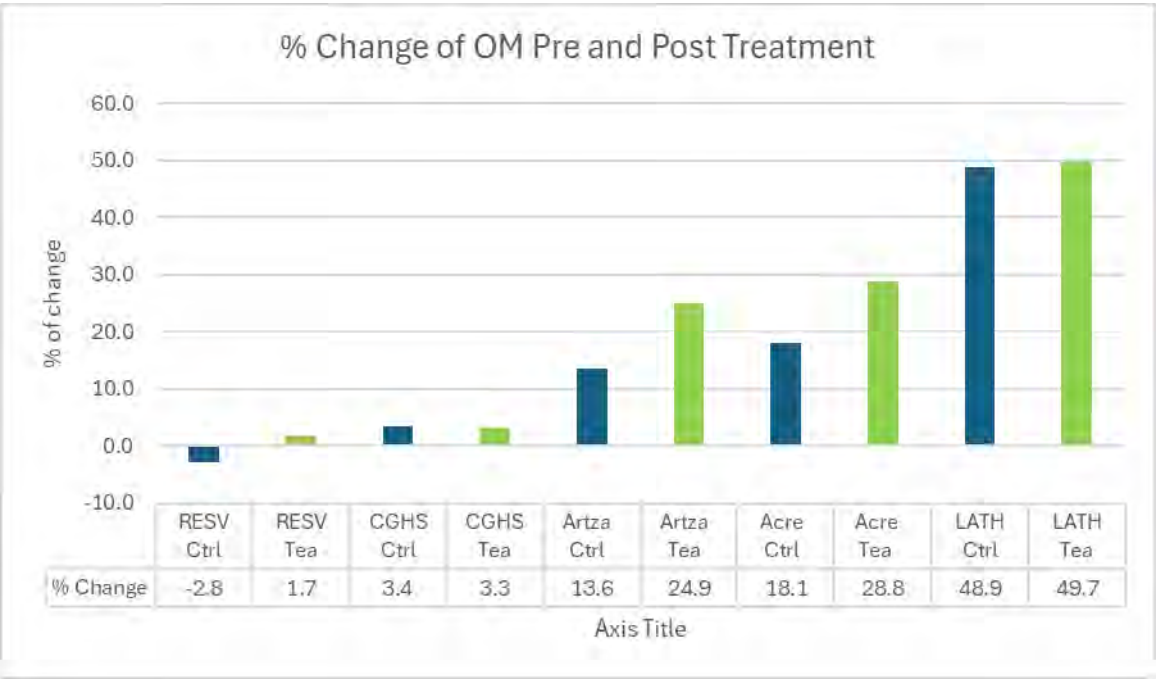

Figure 5.

- **Changes in Soil Aggregation:** Pre and post soil samples were compared per treatment through the microscope. There is a clear difference in soil micro-aggregation in *Compost Tea* treatments vs *Control* as observed under microscopy assessments (Figure 6). Such observations correlate with the organic matter changes observed.

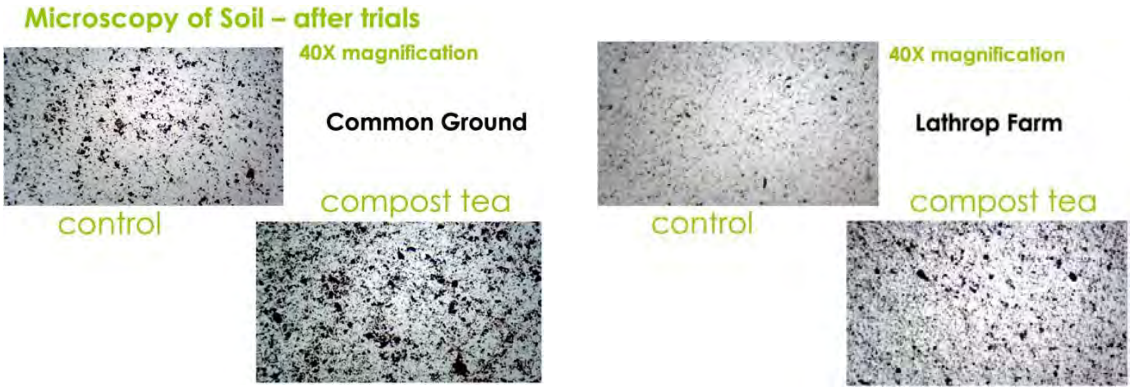

Figure 6.

- **Tissue Analysis:** Aggregated (composite) leaf samples were taken from Big Beef Tomatoes plants from each treatment trial plots from all the farms and from Kale in CGHS. The only nutrient deficiency observed was with Copper in the Kale trial for both *Control* and *Compost Tea* treatment and with Zinc from the Big Beef tomato plants in the tea treatment plots in the Artza Mendi Farm. The rest of the nutrients were at acceptable normal levels. Further analysis of this data is required to evaluate if nutrient is the soil are already sufficient, crop demand is not limiting, application rate of tea is low, soil buffering is strong and whether there is a good baseline biology already present.

- **Pest and disease incidence:** Although planned for, no systematic comparative pest and disease incidence were collected due to the many farm tasks farmers carried out during the trials. However, observations were made by farmers about the presence of pests, identification of diseases and their perception of their impact. Overall, pests and diseases were at low risk. Yet flea beetles affected the young, transplanted eggplants in the Artza Mendi Farm trial to the point that plants were lost and the experiment could not continue. At Lathrop Farm, the Big Beef seedlings for the trials already had symptoms of early blight before being transplanted into the field plots. Two plants in a control plot were lost but were replaced promptly to keep the experiment going. Likewise, the majority of the Marketmore cucumbers seedlings at Lathrop Farm had symptoms of Anthracnose fungal disease before being transplanted into the field plots. The cucumbers were productive, but their season

was short-lived given the attempt of the farmers to control the disease with chemicals.

Conclusions

The application of compost tea in this trial had mixed results in terms of the yield data. We were able to observe slightly higher yields for tomatoes but only one of these trials showed a statistically significant effect. Same slightly higher yields in half of the kale trials and in the one cucumber trial. These results are promising in the context of other findings such as the increase in microbial biomass in the soil, increase in the percentage of organic matter and the increase in soil micro aggregates due to compost tea treatments. These are all indicators of soil health. The adoption of compost extract and tea as a soil health practice by farmers will depend on having more consistent positive impacts on production and soil health parameters, meaning relatively good yields with less dependency on fertilizer applications and less time and resources invested in pest and disease control. More trials need to be done addressing some of the challenges and shortcomings of this project by incorporating the following lessons learned and recommendations during the trials.

Lessons learned and recommendations

- High quality compost tea requires consistency in tea preparation; paying attention to water temperature, microbial biomass and diversity in compost used, optimal dissolved oxygen levels, brewer efficiency, pH, diversity of microbe foods and food water ratio.
- Tea foliar applications need to cover above and below leaf surfaces.
- If teas are used in soil drench applications, their application rates need to be enough to reach plant roots.
- Time of application of compost tea is key to keeping microbes viable. Early morning or late evening is recommended when temperatures are cooler and evaporation is minimized.
- The relative shorth length of growing and harvest season may have played a role in the results of a trial. A complete harvest season could have provided more data to observe differential effects. This would entail a season that covers everything from seedlings preparation up to the end of the flowering, fruiting and harvest period. This length would also cover insect and disease pressure that emerges at different times of the cycle. The season might also be determined by the soil and ambient temperature optimal for microbial activity.

- Compost tea applications should consider plant growth stages instead of regular time intervals.
    - Seedlings: inoculate the root zone with beneficial microbes before planting.
    - Transplanting and early growth: 1-2 weeks during the early growth to support seedlings and establish healthy root systems
    - Flowering and Fruiting: to enhance nutrient uptake and improve fruit quality
- Harvest events for control and tea treatment need to be done together by paired blocks to minimize unequal number of data points that may affect comparisons.
- Initial seedling plant diseases before a trial need to be avoided for a fair experiment.
- There is a potential "Drift/Migration" effect if control and tea plots are too close to each other. Physical separation and the use of barriers can help minimize such effects. We used corrugated plastic walls in this trial to sperate treatment plots while spraying. Ideally it would be to avoid having control and experimental plots contiguous in the same row. They need to be completely separated in space if the soil conditions remain relatively the same.
- Farm management practices such as the use of fertilizers, chemicals for disease suppression, intercropping and companion planting, pruning, etc. can affect the results of the trial if they are not applied evenly in treatment plots.
- Recording yields can be a burden for farmers in a trial, which can affect data collection, consistency and quality. Include stipends in future proposals as an extra incentive for farmers to systematically collect data.
- Results may be more differentiated in new trial plots than in plots in farms with a relatively long history of organic farming and soil health practices. Tea tends to show its strongest tissue signal in Low-OM soils, compacted soils, systems with suppressed biology and early season cool soils.
- Rate of treatment application across farms needs to be consistent (i.e., 20 gallon/ acre). In this study it varied among farms given the different size plot that ranged from 198 sq ft to 450 sq ft and the amount of liquid treatment applied remained the same.