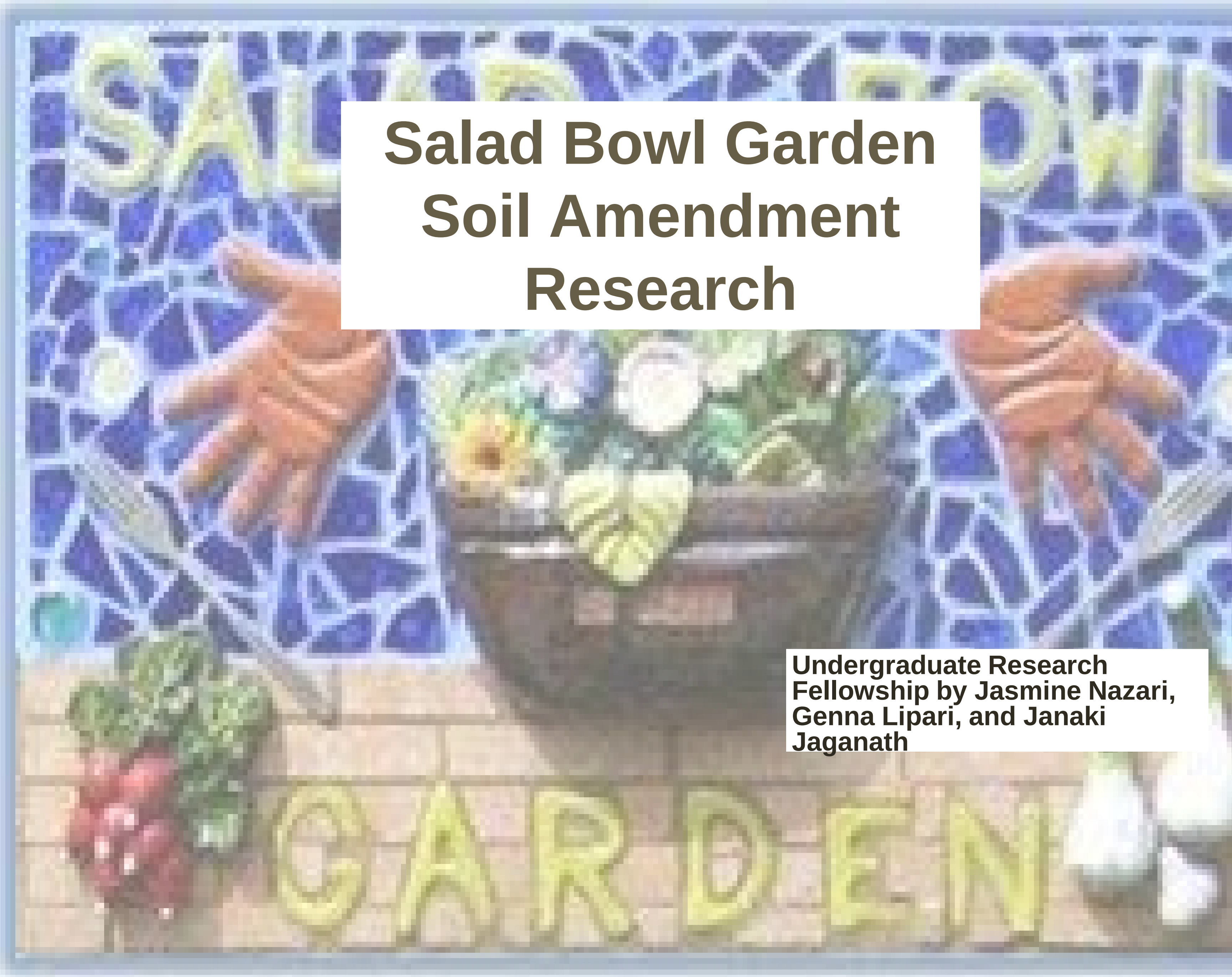


Salad Bowl Garden Soil Amendment Research

Undergraduate Research Fellowship by Jasmine Nazari, Genna Lipari, and Janaki Jaganath

Project Background

The Salad Bowl Garden is an intensively planted vegetable garden located in front of the Plant and Environmental Sciences building on the UC Davis campus. It is an interactive learning environment where passersby can learn about organic vegetable production.

The PES Salad Bowl Garden Project began in February 2008, by a group of student volunteers and faculty advisors, with the support of UC Davis Grounds and a Campus Sustainability grant for $1800.

The 600 square feet have been used to exposure community members to methods of appropriate food raising around human habitation, an opportunity to actively participate in sustainable living, and the increased beautification of the entrance with educational benefits.

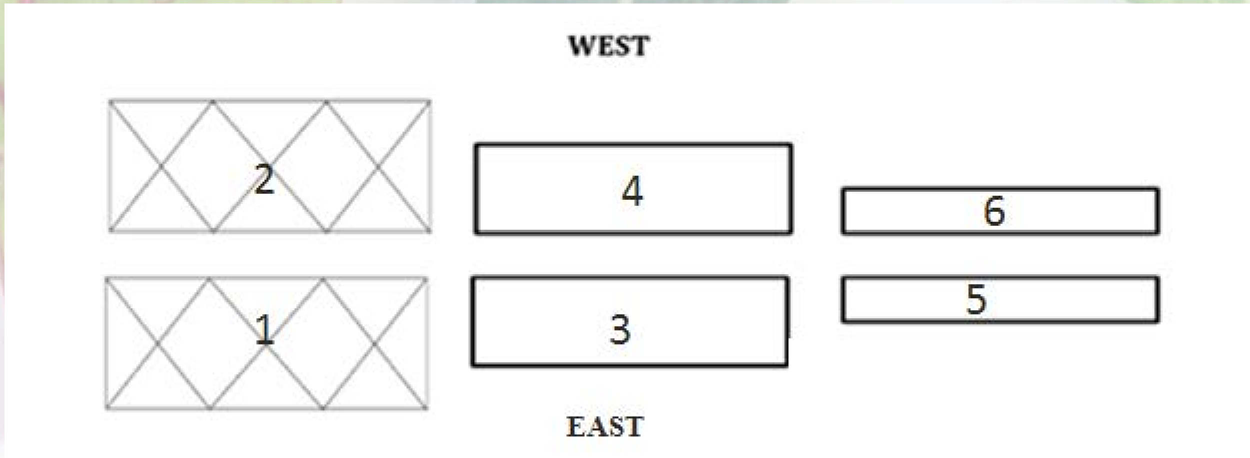
Project Proposal

- Over the next year we hope to use this space to conduct research that will benefit the greater community and our understanding of the space through two research initiatives. One of which will help inform home gardeners in the local community about the effect of soil amendments on nutrient availability to plants. The other will compare different soil amendments available to home gardeners in order to evaluate CO_2
  - emissions with respect to temperature and moisture.
- This project will evaluate steer manure, compost, and no amendment applications on soil nutrient availability and CO_2 emissions.
- The main objectives are to:
  - 1) Measure anion and cation nutrient availability between treatments
  - 2) Quantify soil respiration through CO_2 capture

Details

- The Salad Bowl Garden is made up of three symmetrical rows of two beds of equal surface area. The beds were adjusted for sun and each set of opposite beds contained the same plants to account for differences in nutrient needs of plants across amendments.

- Bed 1 and 5 = steer manure
- Beds 2 and 4 = student farm compost
- Bed 3 and 6 = control of no amendment



Our Hypotheses

- Increases in CO_2, indicating more biotic respiration, and may would also mean more nutrient cycling from organic matter.
- This would be reflected in higher nutrient content as measured by Plant Root Simulator probes.
- There will be an iron deficiency, based on our visual assessment of interveinal chlorosis.
- We expected that our amended soils will sequester more CO_2 than our control.
- We expected our steer manure amended soil to be higher in nitrogen than our compost and non-amended soil.

Methods – CO_2 capture with Li-cor 8100

- Soil CO_2 production has been shown to be heavily influenced by environmental factors (soil temperature, soil moisture, organic content, etc.) and biological factors (above ground canopy size, growth activity, etc.). Soil CO_2 efflux, which is what we measured, is a physical process driven primarily by the CO_2 concentration diffusion gradient between the upper soil layers and the atmosphere near the soil surface, meaning that as soil respiration increases, CO_2 concentration in the soil increases and thereby increases the gradient between itself and the atmosphere – and increasing emissions.

Li-cor 8100 measures CO_2 flux, which is calculated at the CO_2concentration of the surrounding ambient air. This minimizes effects resulting from the necessary increase in chamber CO_2 concentration during a measurement.

Methods – CO_2 capture with Li-cor 1800

<u>Testing Implemented</u>

•Samples were taken at three random locations in each bed. Moisture and temperature were also taken consecutively at the each sampling location.

•This resulted in 3 samples per bed, replicated over two beds; 6 replicates per amendment.

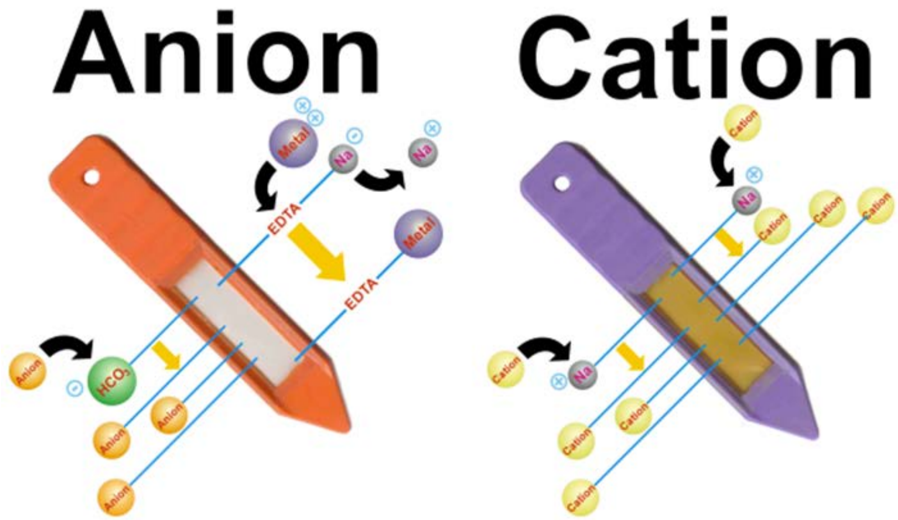
•Samples were taken every Friday from 2-5:00 for 7 weeks in Spring of 2011.

Methods: Plant Root Simulator Probes

"An alternative soil analysis tool"

When buried in soil, the PRS-probe can assess nutrient supply rates (μg/cm^2) by continuously adsorbing charged ionic species over the burial period.

The anion and cation exchange resin membrane (which is chemically pretreated) exhibits surface characteristics and nutrient sorption phenomena that closely resemble a plant root surface.



An ion exchange resin membrane is used to develop a snapshot of dynamic ion flux (cations and anions) in soil. These probes can indicate not only what nutrients are readily available for absorption by plant roots, but also the variation in nutrient or salt transport rates within a soil, which could signify more organic matter.

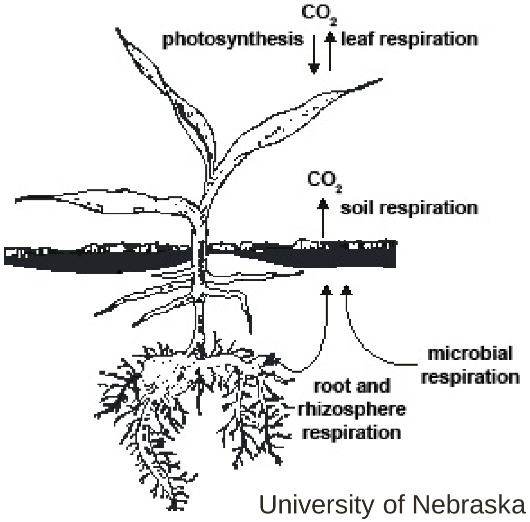
Methods: Plant Root Simulator Probes and Testing Implemented

- 4 cation and 4 anion probes were inserted into the soil of each bed. There were four cation probes and four anion probes per site, and there was one site per bed

- The probes were located at random sites within each bed and left for two weeks before being sent to a lab for analysis. We ran 3 rounds of probes over the 7 week period in Spring 2011.

- The 8 probes per site depicted the rate of nutrient mobility in each amended soil from a plants perspective.

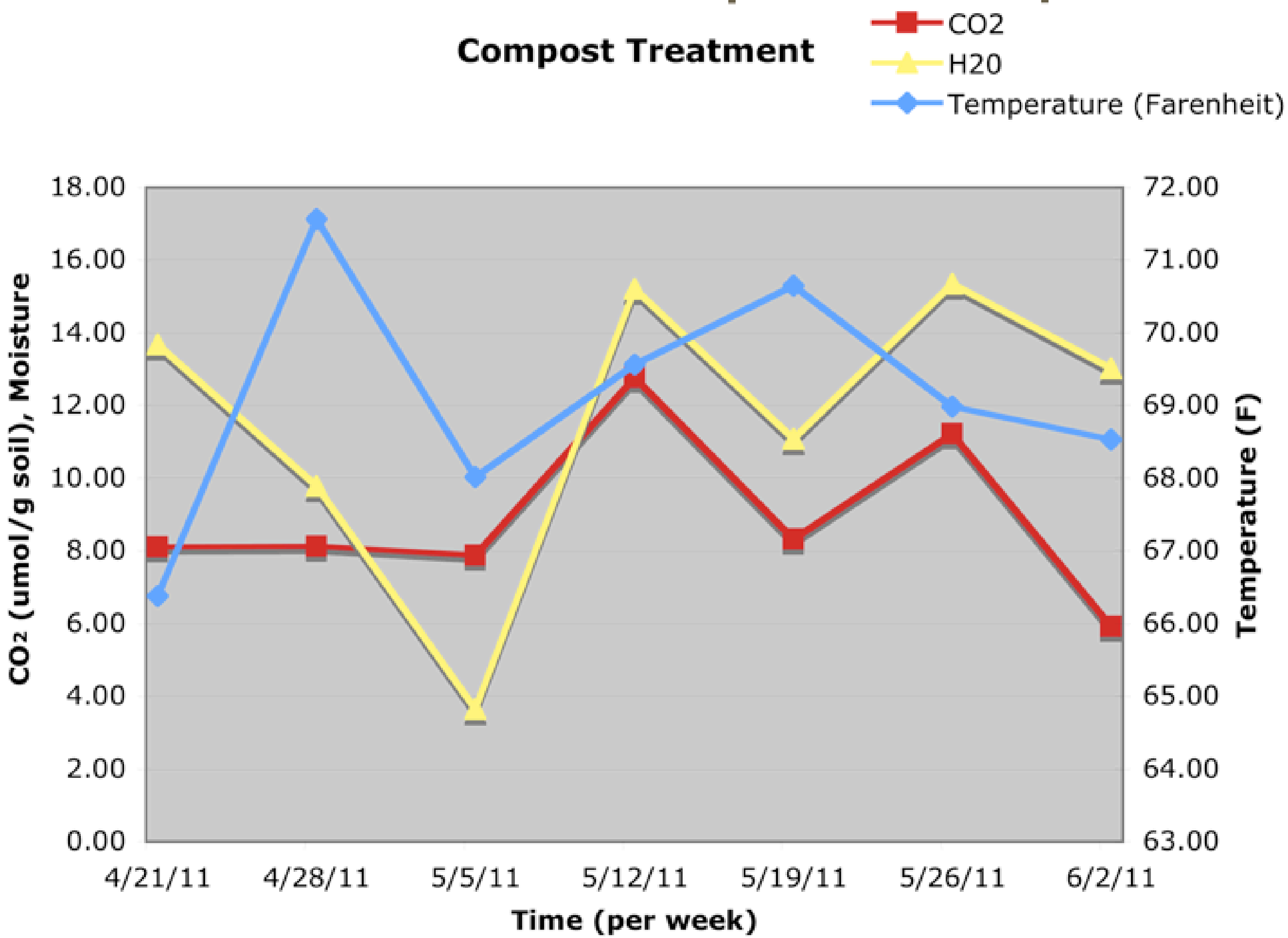
CO_2 Results

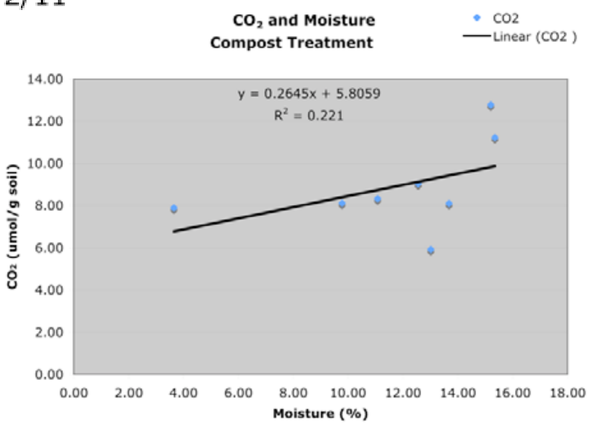


University of Nebraska
Carbon Sequestration Program

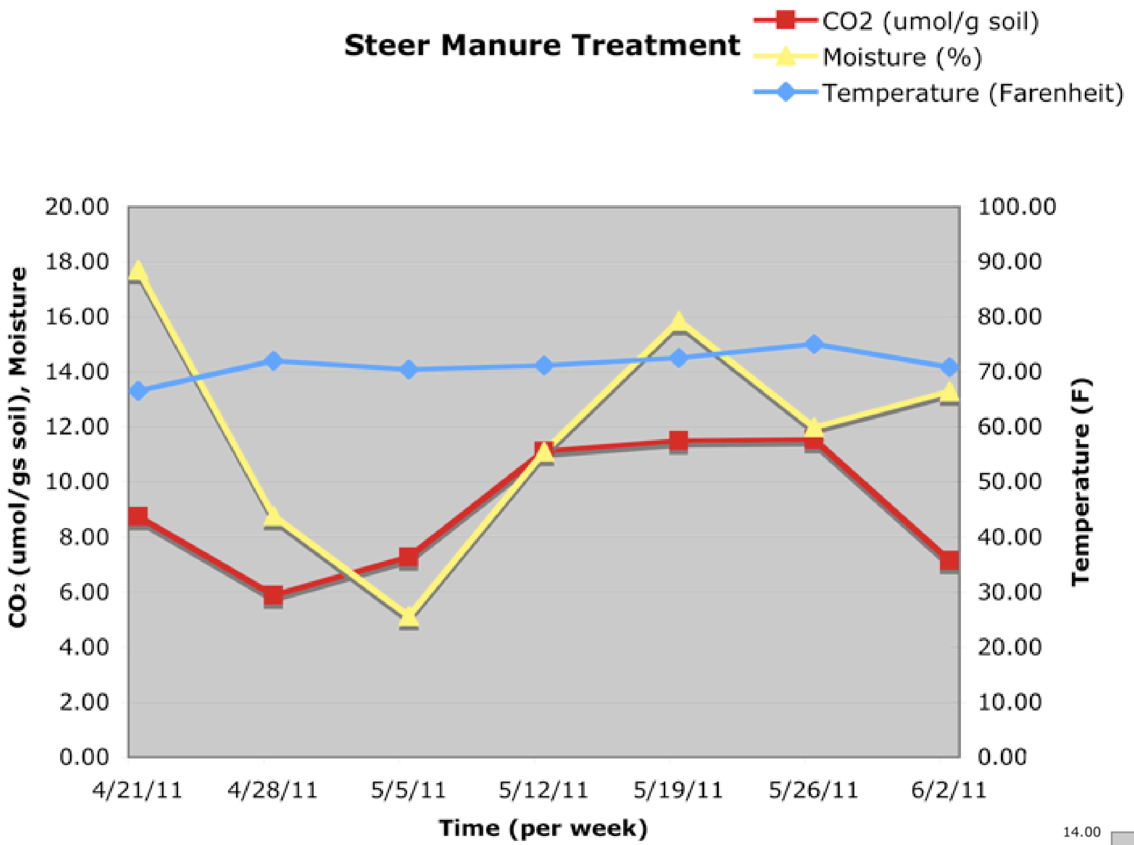
	Amendments		
Mean ± standard dev.	**Compost**	**Steer**	**Control**
Temperature	69.1 ± 2.71 (a)	68.4 ± 3.60 (a)	68.6 ± 3.33 (a)
CO_2	8.9 ± 3.12 (a)	8.9 ± 2.93 (a)	8.3 ± 3.04 (a)
Moisture	12.9 ± 4.63 (a)	12.9 ± 4.82 (a)	13.8 ± 4.91 (a)

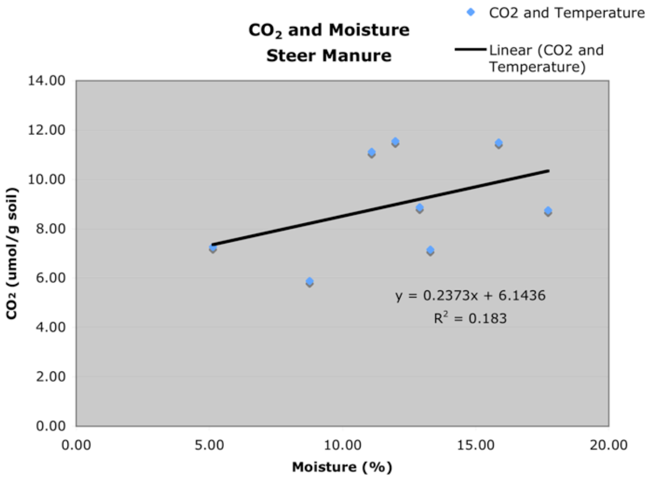
Results: CO_2 Graph: Compost Treatment



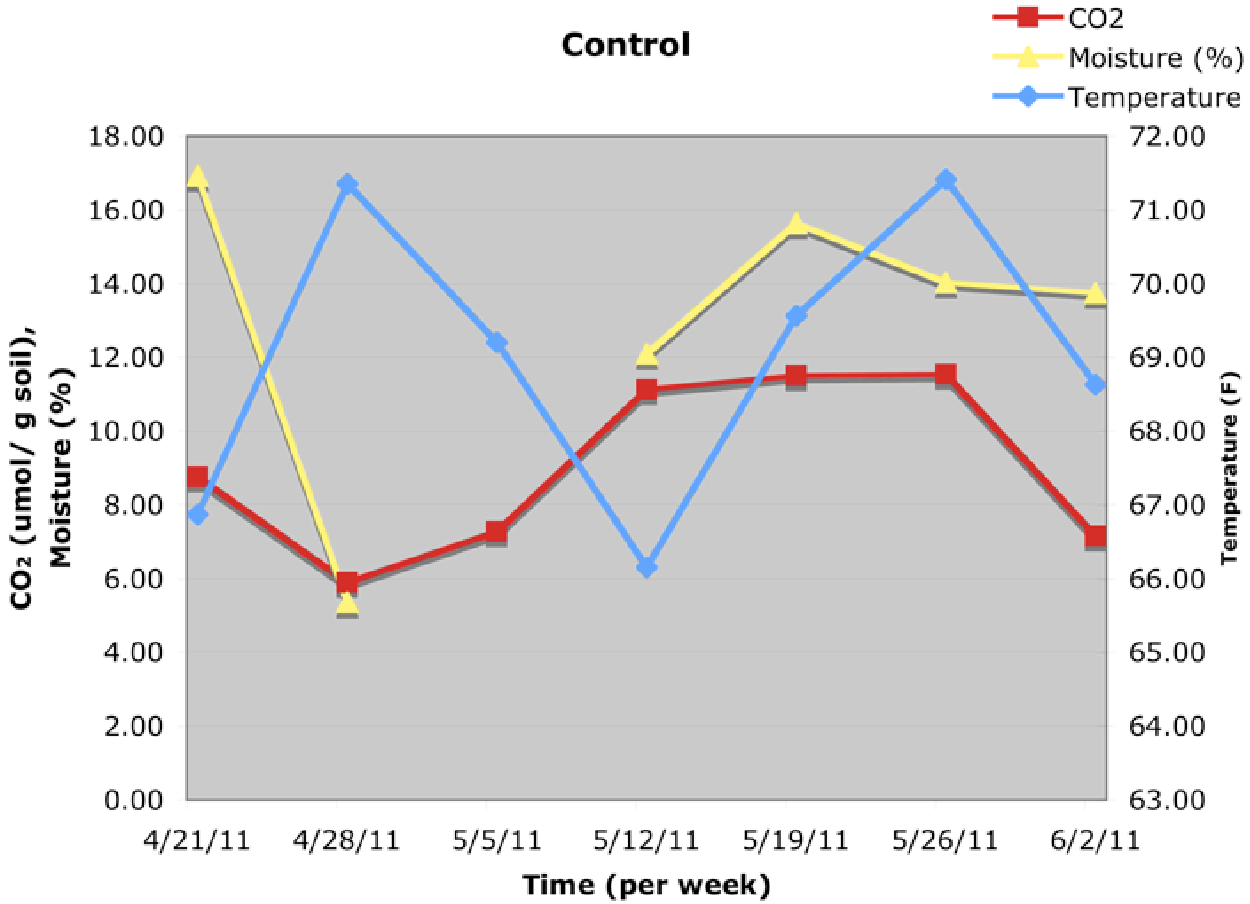


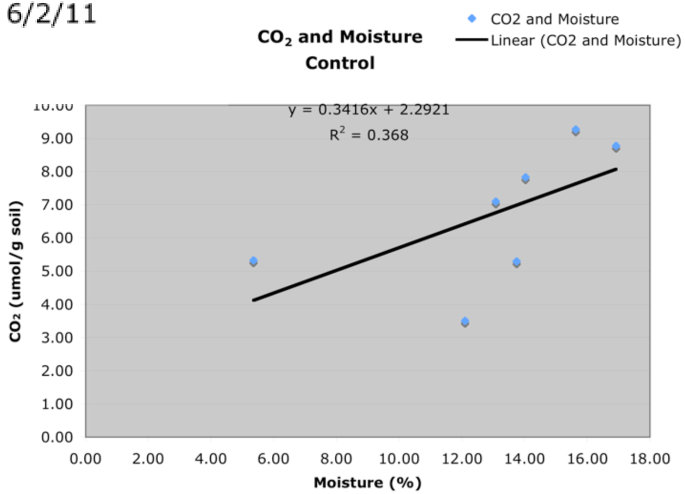
Results: CO2: Steer Manure Treatment





Results: CO2 No Treatment



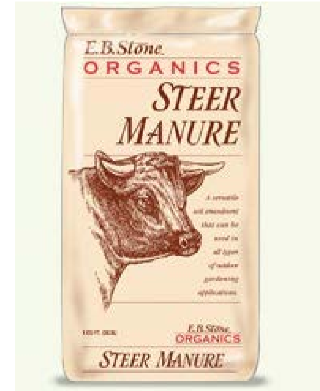


Plant Root Simulator Probe Results:

We found no difference in nutrient availability over time

After a statistical analysis with ANOVA software we found that the only three nutrients that showed variance were P, Mn, and Pb.

The table to right presents the mean ± standard deviation of all metals measured.



In general compost nutrient availability > steer = control

	Amendment		
Nutrient	Compost	Steer	Control
P	**47.2 ± 14.25 (a)**	**41.13 ± 17.08 (a)**	**21.63 ± 10.23 (b)**
Mn	**2.25 ± .85 (a)**	**1.46 ± 0.68 (b)**	**0.77 ± 0.43 (b)**
Pb	**.93 ± .35 (a)**	**.56 ± .27 (b)**	**.3 ± .21 (b)**
Total N	271.02 ± 57.74 (a)	287.57 ± 74.49 (a)	367.7 ± 139.86 (a)
NO3-N	270.82 ± 58.01 (a)	287.48 ± 74.52 (a)	367.7 ± 139.86 (a)
NH4-N	.2 ± .4 (a)	.083 ± .16 (a)	0 ± 0 (a)
Ca	1452.88 ± 158.06 (a)	1330 ± 170.14 (a)	1417.47 ± 159.52 (a)
Mg	1141.15 ± 63.21 (a)	1059.47 ± 125.54 (a)	1148.9 ± 109.99 (a)
K	56.25 ± 43.31 (a)	101.73 ± 91.95 (a)	63.13 ± 56.84 (a)
Fe	8.38 ± 4.86 (a)	8.13 ± 3.63 (a)	4 ± .9 (a)
Cu	.77 ± .15 (a)	.67 ± .23 (a)	.5 ± .11 (a)
Zn	5.58 ± 2.20 (a)	5.88 ± 4.21 (a)	5.40 ± 1.53 (a)
B	1.70 ± 0.30 (a)	1.58 ± 0.23 (a)	1.53 ± 0.43 (a)
S	691.80 ± 21.83 (a)	565.52 ± 156.06 (a)	476.90 ± 52.55 (a)
Al	26.53 ± 2.85 (a)	24.02 ± 2.23 (a)	23.57 ± 3.24 (a)
Cd	0.03 ± 0.08 (a)	0.02 ± 0.01 (a)	0.00 ± 0.00 (a)

Implications

The results will advise us further in which amendments we will personally use in the garden as well as the greater community for their gardens.

The role of amendments on CO_2 emissions, at least on this scale is negligible.

Conclusions and Lessons

- Given the application of equal amounts of organic amendments, we do not observe statistical difference in CO_2 emissions.

- Among the nutrients, only phosphorous, manganese and lead showed statistical differences for organically amended treatments.