Local Fertilizer Research Updates

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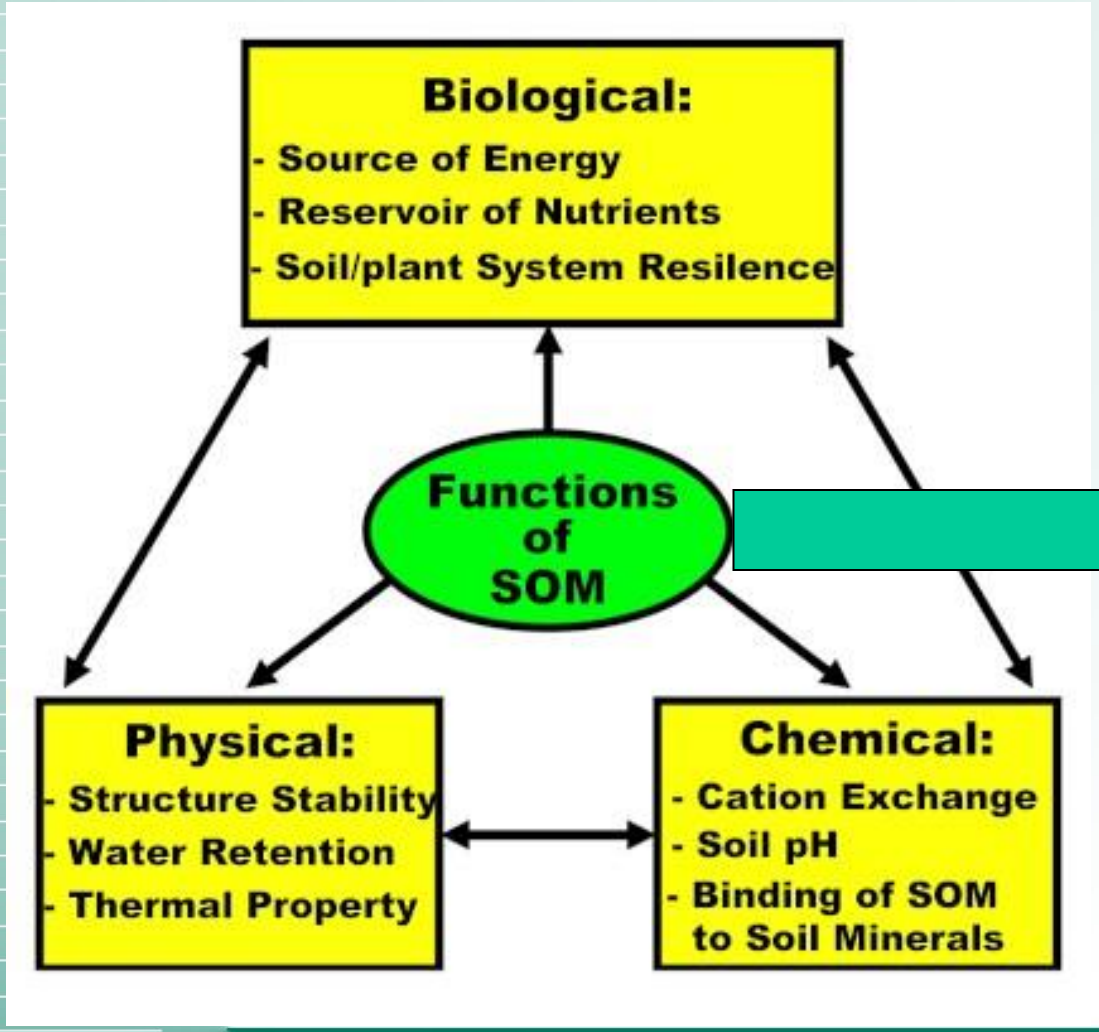
Type of Research/Activities since 2006

- Local & Alternative Inputs
- Seedlings Media Improvement
- Compost Tea & Liquid Fertilizer
- Crop Diversity & Variety Selection
- Herbs & Spices
- Extension/Education Activities

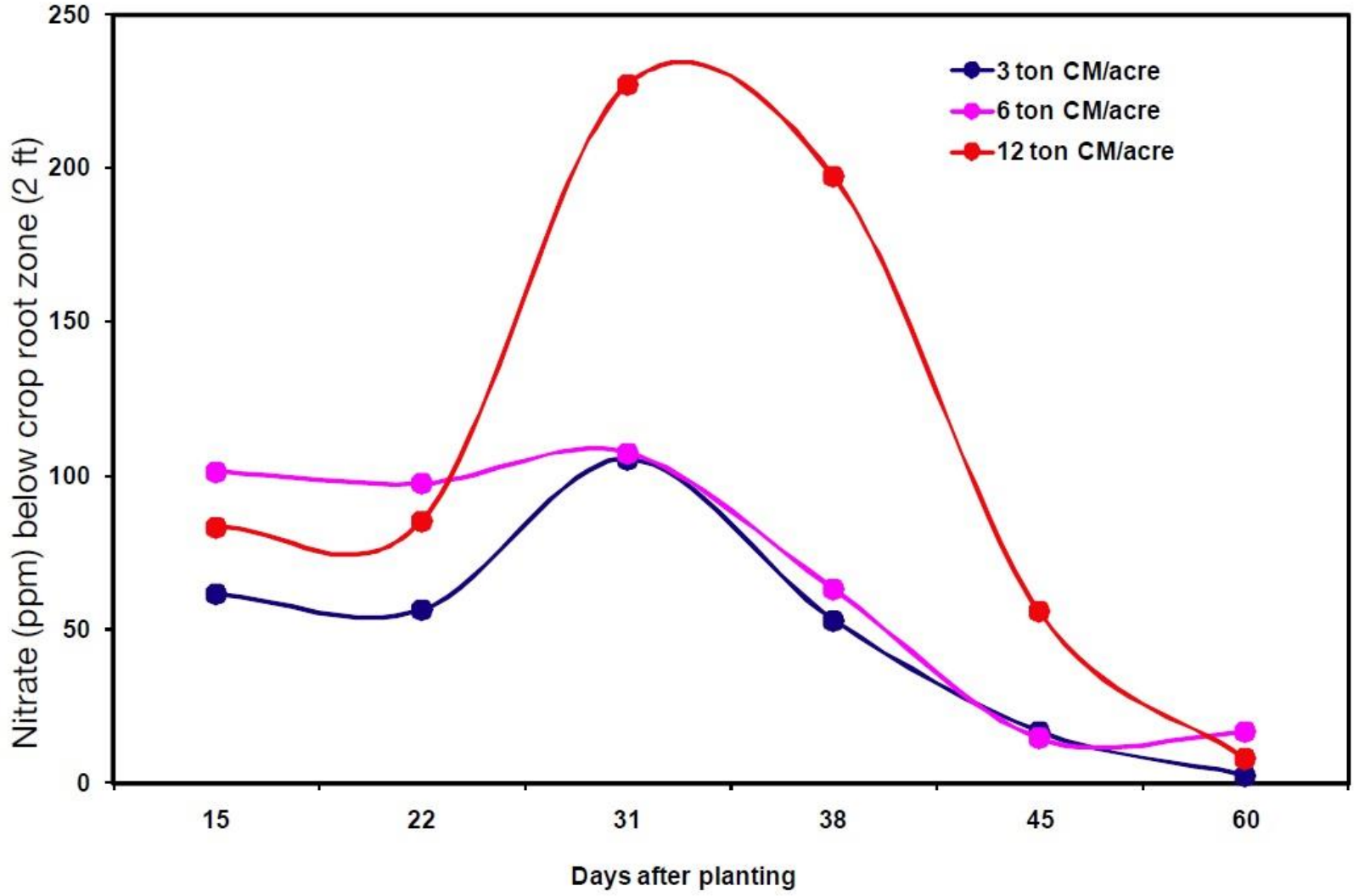
Hanai'Ai Newsletter

Building Soil Organic Matter

Why building SOM?

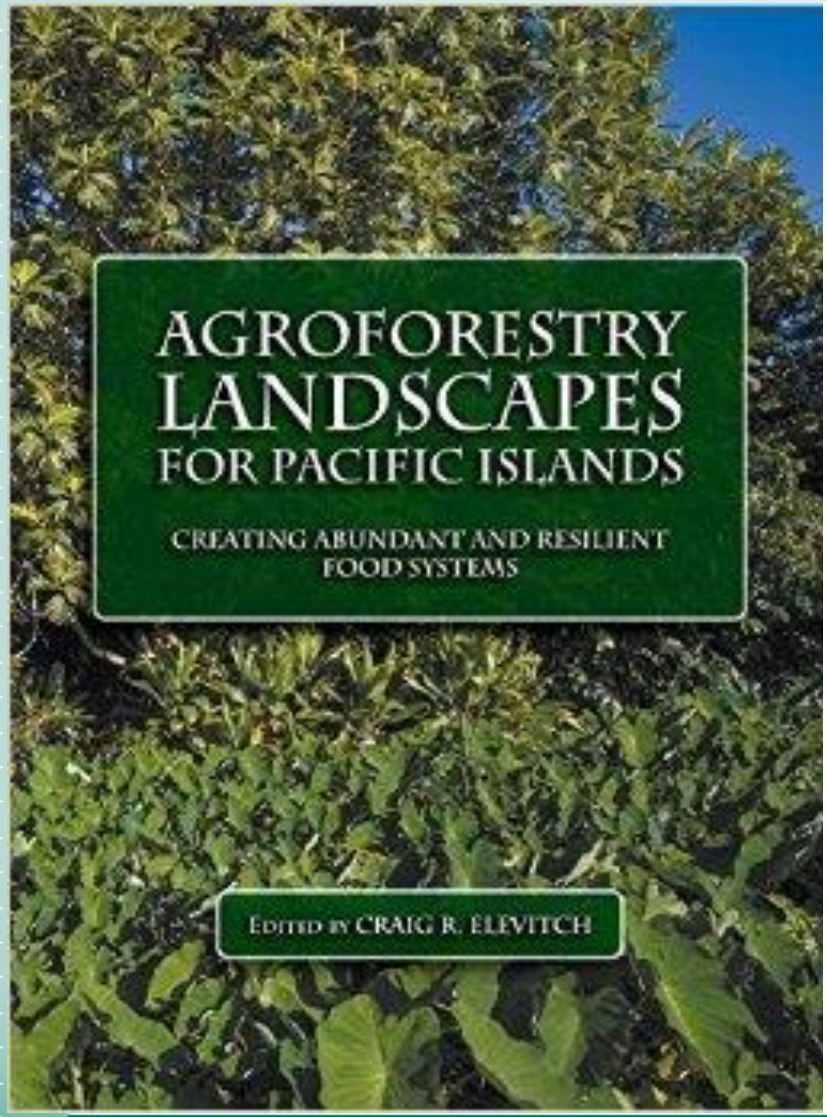


Is more always better?



Western SARE
Research & Education
Radovich et al:
Local Inputs

Free Publications



Chapter 4

Use of Organic Fertilizers to Enhance Soil Fertility, Plant Growth, and Yield in a Tropical Environment

Amjad A. Ahmad, Theodore J.K. Radovich, Hue V. Nguyen, Jensen Uyeda, Alton Arakaki, Jeana Cadby, Robert Paull, Jari Sugano and Glenn Teves

Additional information is available at the end of the chapter

http://dx.doi.org/ 10.5772/62529

Abstract

Soils rarely have sufficient nutrient for crops to reach their potential yield. Applying organic fertilizers without prior knowledge of their properties may cause yield decline under low application or pollute the environment with excessive application. Understanding the nutrient variability and release pattern of organic fertilizers is crucial to supply plants with sufficient nutrients to achieve optimum productivity, while also rebuilding soil fertility and ensuring protection of environmental and natural resources. This chapter presents the authors' experiences with different organic amendments under Hawaii's tropical conditions, rather than an intensive literature review. For meat and bone meal by-products (tankage), batch-to-batch variability, nutrient content/release pattern and quality, and plant growth response to the liquid fertilizer produced from tankage were evaluated. For animal livestock, dairy manure (DM) and chicken manure (CM) quality, changes in soil properties, and crop biomass production and root distributions were evaluated. For seaweed, an established bio-security protocol, nutrient, especially potassium (K) variability, and plant growth and yield response were evaluated in different tropical soils.

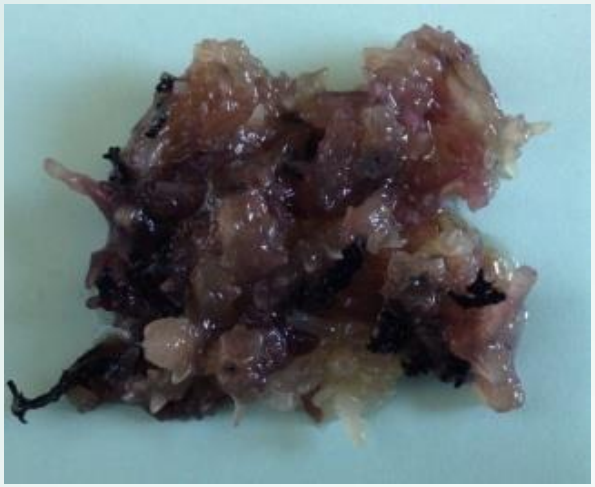
Keywords: organic fertilizers, tropical soils, nutrient variability, mineralization, plant growth, yield

Invasive Algae

The tissue samples were analyzed at the University of Hawaii-Manoa.

Species	Washed/ Unwashed	%							µg/g				
		N	C	P	K	Ca	Mg	Na	Fe	Mn	Zn	Cu	B
G. salicornia	Unwashed	1.43	20.44	0.11	**12.48**	6.93	1.24	3.53	3564	553	22	11	316
G. salicornia	Washed	1.32	18.23	0.09	**9.15**	3.21	0.91	2.65	3204	482	19	9	286
E. spp.	Unwashed	1.01	21.14	0.07	**18.02**	1.08	0.63	4.81	123	18	18	3	196
E. spp.	Washed	0.78	17.78	0.06	**16.94**	0.37	0.61	3.71	45	9	14	2	166
K. spp.	Unwashed	1.39	22.10	0.07	**14.81**	0.47	0.53	4.71	83	8	14	5	139
K. spp.	Washed	1.21	21.78	0.06	**14.11**	0.28	0.52	4.43	67	7	12	3	135
A. amadelpha	Unwashed	0.67	12.21	0.05	**0.36**	30.13	2.21	1.81	9157	215	2	10	42
A. amadelpha	Washed	0.48	11.13	0.04	**0.21**	26.44	2.08	1.56	7853	197	2	6	42

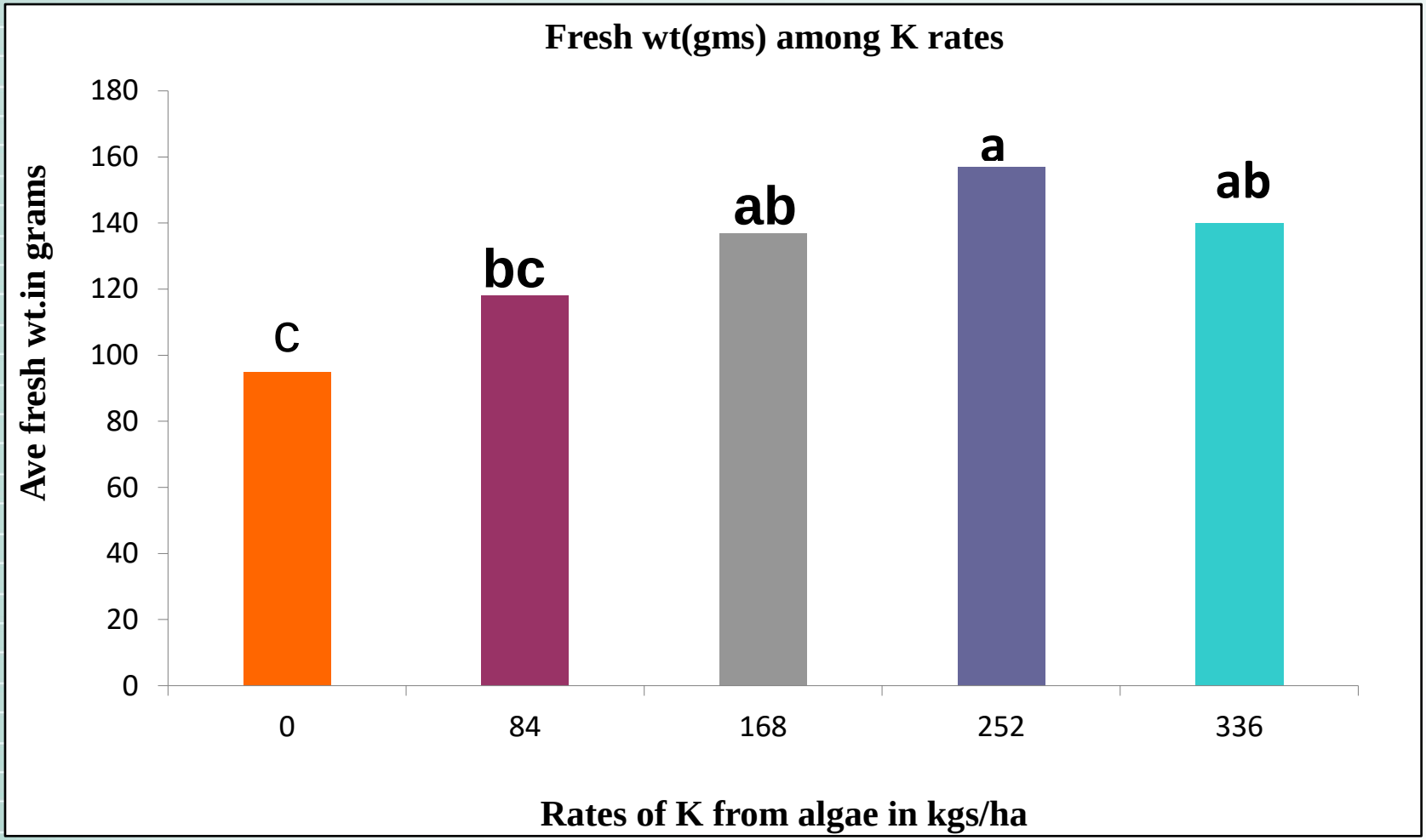
Establishing bio-security procedure



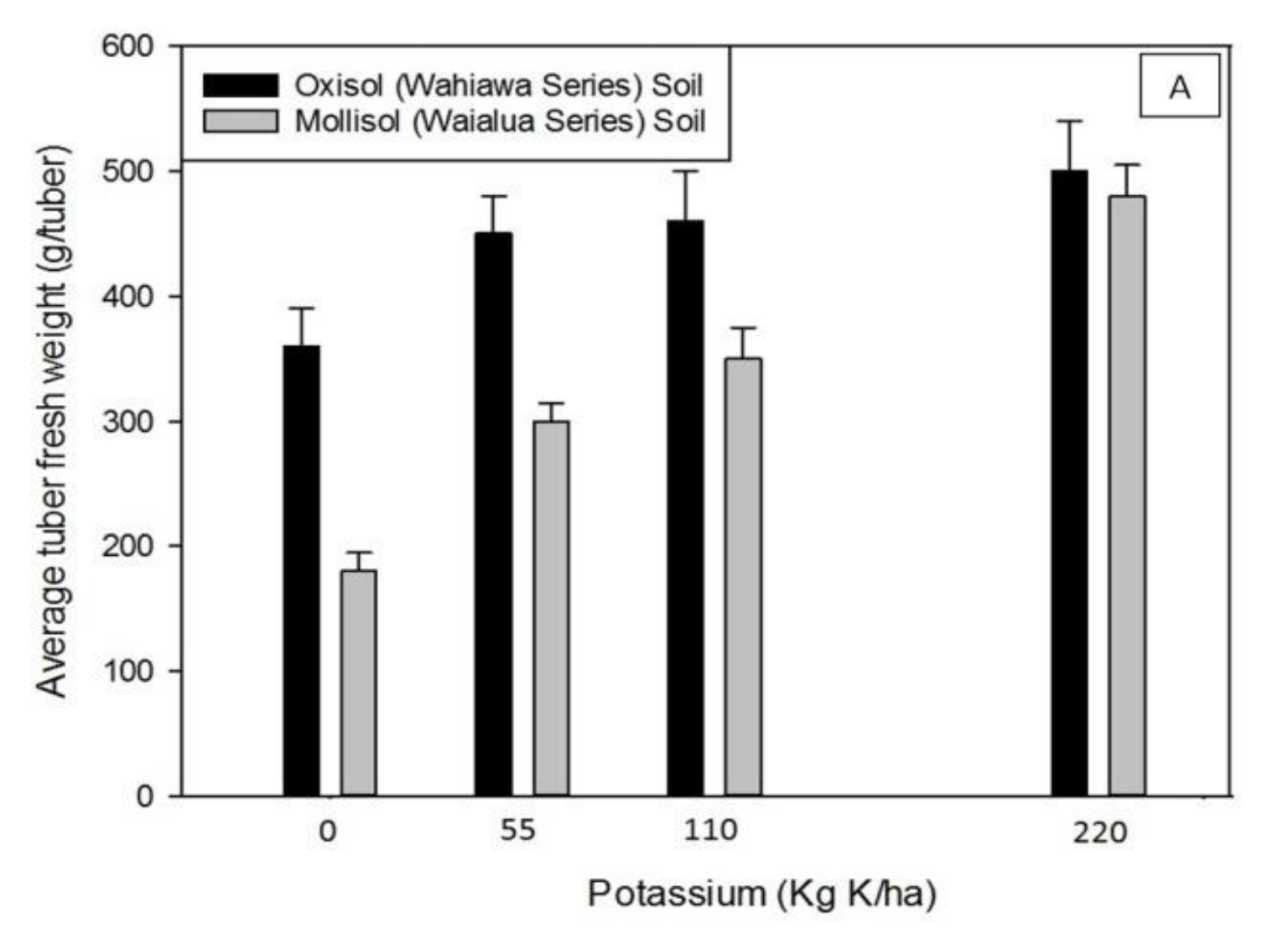
The four algae species showing signs of decomposition at the end of the second test experiment.

Field Application

Pak Choi and Sweet Potato crops were used to evaluate the effect of K application from seaweed on plant growth and yield.



The bar diagrams comparing the average Fresh wt.(gms) among the 5 different rates of Algae (K in kgs/ha) provided through 3 invasive species of Algae from the 1st greenhouse trial. Means followed by the same letter are not significantly different ($P < 0.05$) using Duncan's multiple range test.



The effect of different Potassium (K) application rates (Kg K/ha) on average sweet potato tuber fresh weight under Oxisol and Mollisol soils.

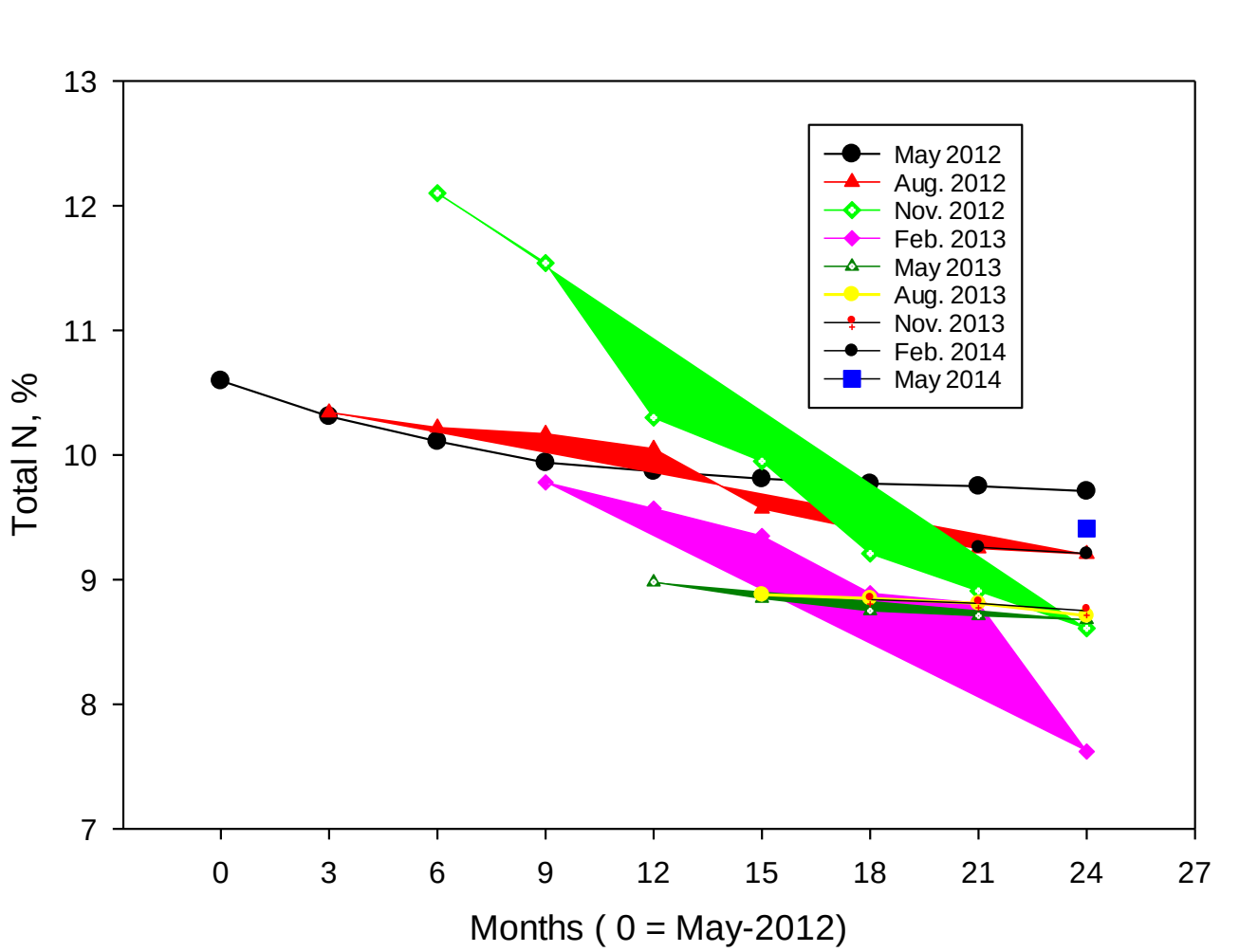
Tankage

Meat and Bone Meal by Products.

Produced Locally in Hawaii by Island Commodities. It contains:

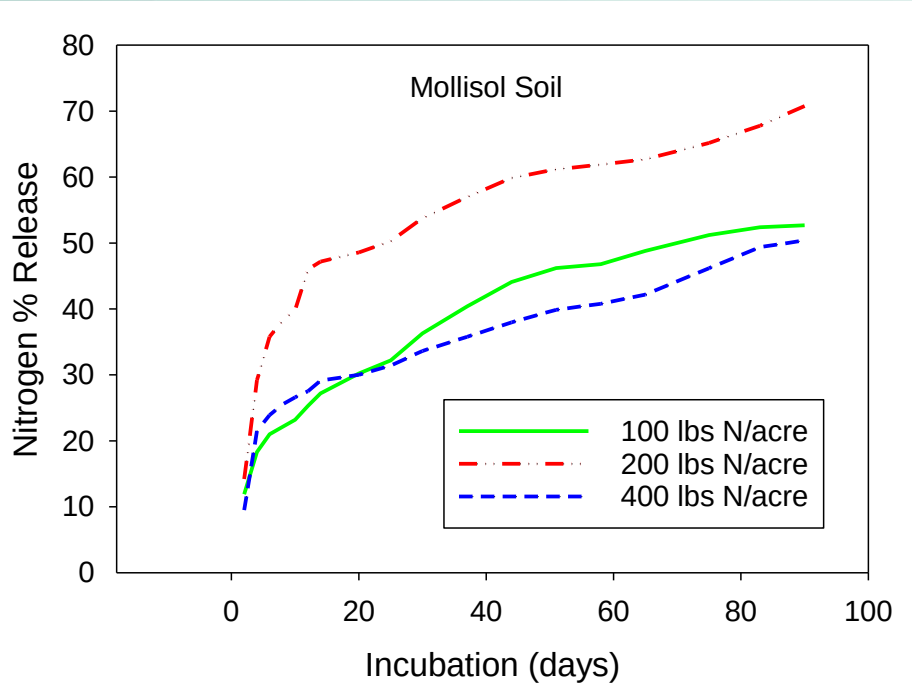
Nitrogen = ~ 10%,
Phosphorus = ~2.5%,
C:N Ratio = 5:1

Variability in Tankage based on initial stock

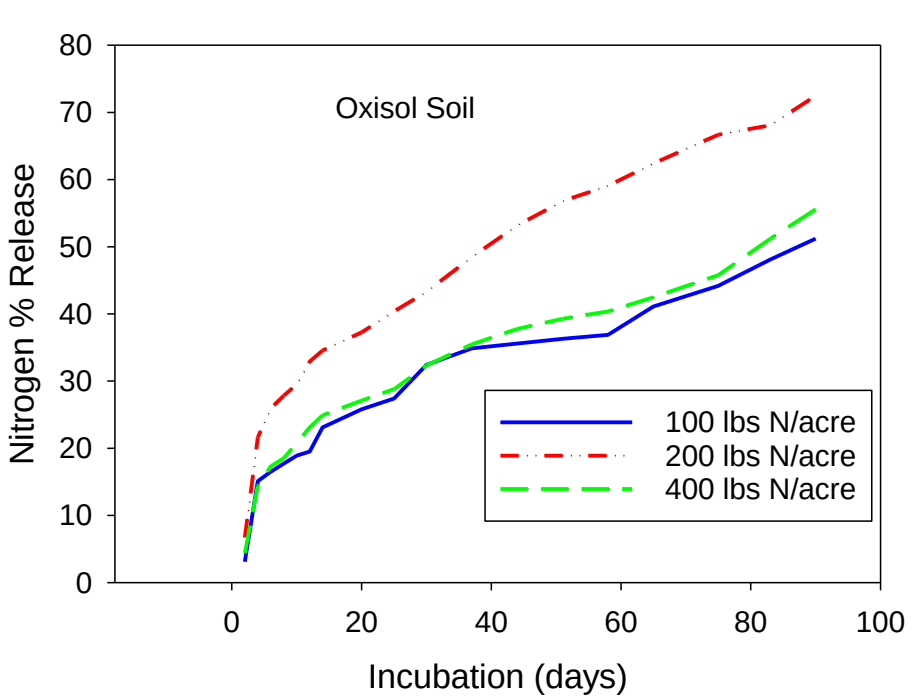


Initial nitrogen and loss (%) over time in tankage samples collected over two years period (May 2012 to May 2014).

Nitrogen Release Pattern/Percentage



Nitrogen release (%) from tankage applied at different application rates over 90 days under Waimanalo (Mollisol) and Poamoho (Oxisol) soils.



Tankage in Sweet Corn Field Trial:

- Application Rates: based on 75% mineralization.

- Split Application: didn't change yield but reduced leaching.

-Location/Soil Type: Results were applicable for both sites.

Harvesting sweet corn planted at Waimanalo Research Station

Western SARE R & E Project

Liquid Fertilizer (Fertigation)

Ahmad et al. *High Nutrient Solution Fertilizers Derived from Local Organic Inputs for Field and Greenhouse Application in the Tropics. Western SARE 2014-2017.*

Liquid fertilizer with high nitrogen from tankage

Meat and bone meal by products (Tankage). High nitrogen content (10%). Also good source of other nutrients.

The lab experiment setup. Showing 125 ml flask (covered and uncovered) contain 1 gram tankage and 50 ml deionized water. Each treatment was replicated 3 times.

Liquid Fertilizer from Tankage

Application Recipe:

-1.5 lbs of tankage into 10 gallon water

-Add about 1 ounce vermicompost

-Air for 12-24 hours

-Strain and apply with drip irrigation.

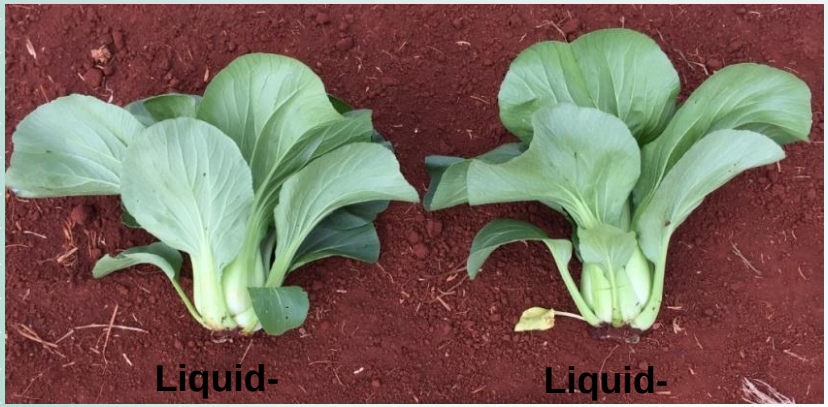
Field Trial

Field trial setup at Poamoho Research Station on an Oxisol soil.

Field Trial

Fertigation from 20 gallon bucket.

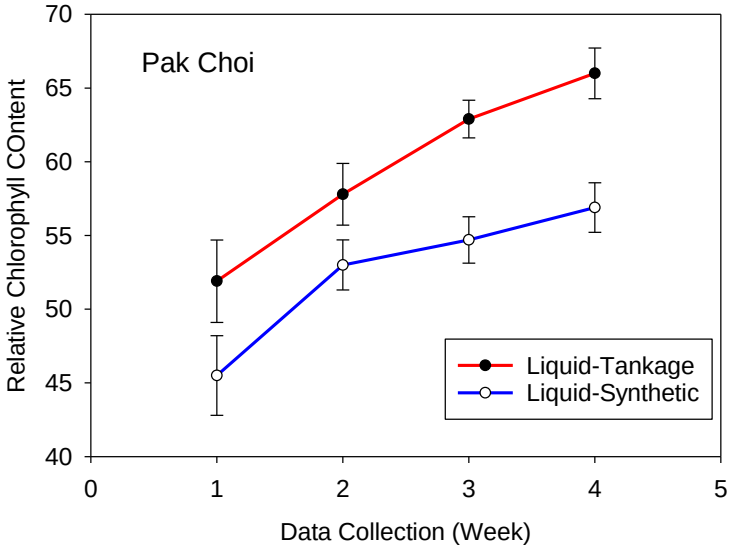
Results-Lettuce, Pak Choi, and Daikon

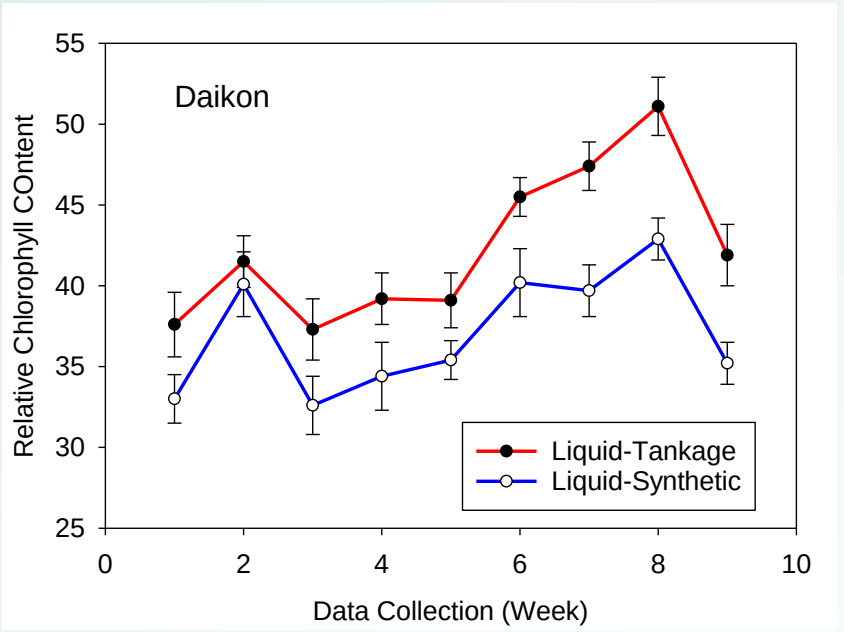


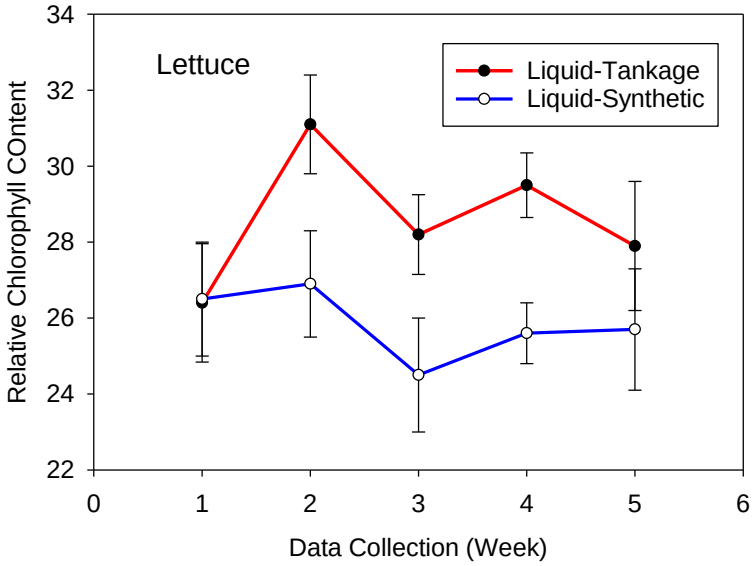
Lettuce and Pak choi were harvested after 4 and 5 weeks of seedlings transplant, respectively

Daikon was harvested after 9 weeks of planting

Results-Chlorophyll content

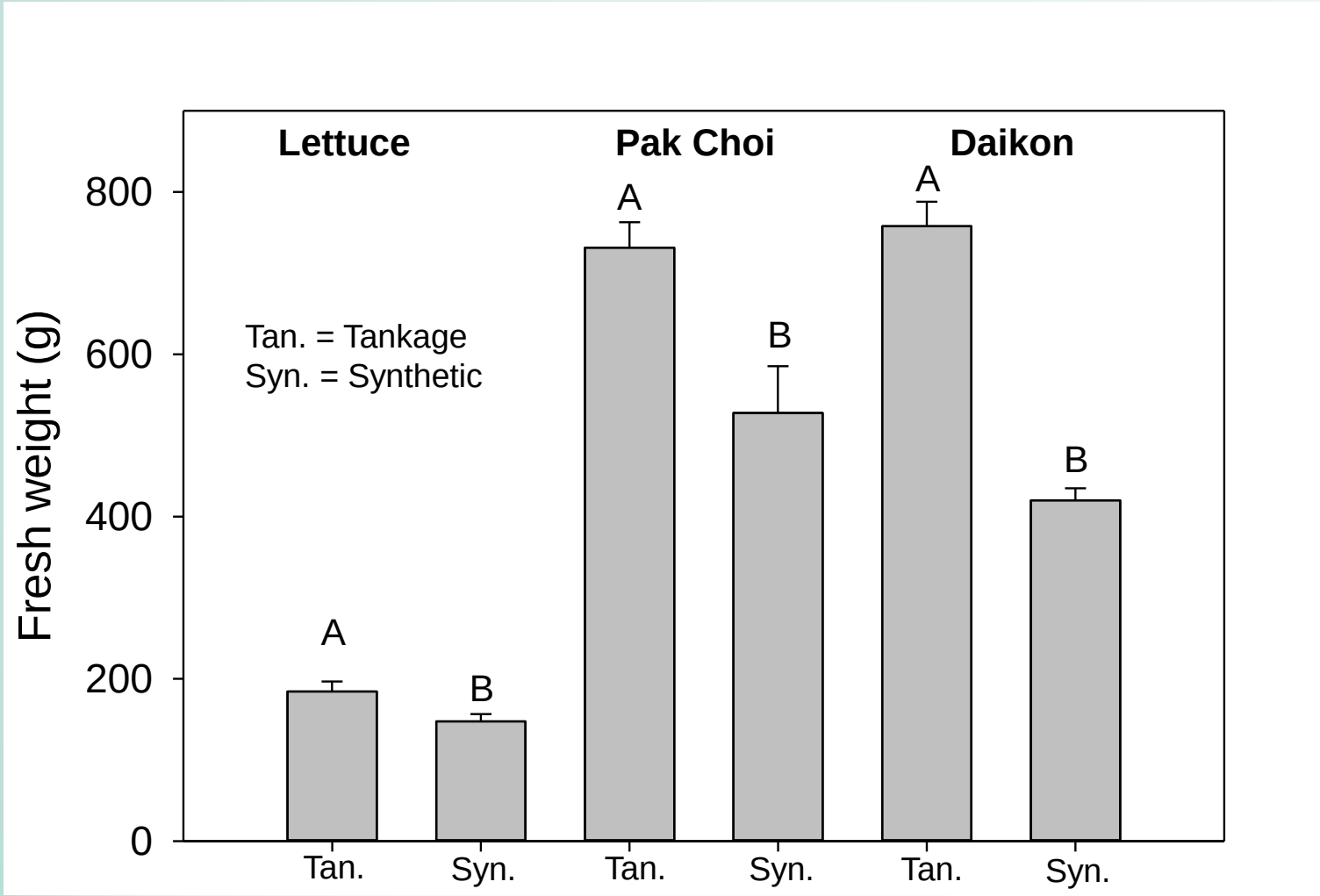






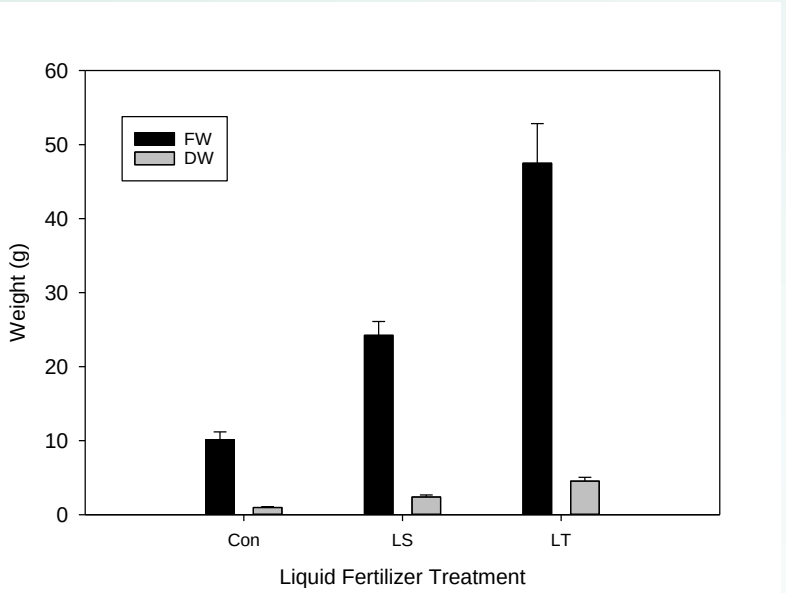
Relative chlorophyll content, data were taken weekly using Minolta SPAD meter, for pak choi, lettuce, and daikon under **organic and synthetic liquid fertilizers application.**

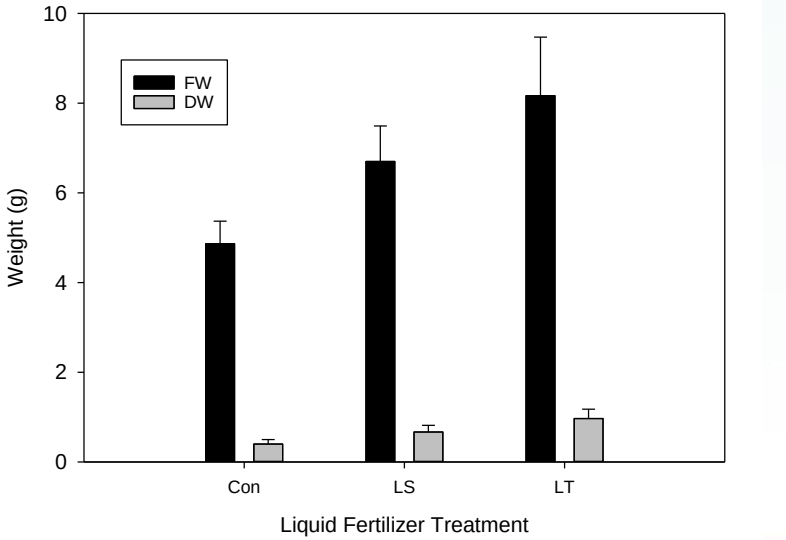
Results-Fresh weight (g)



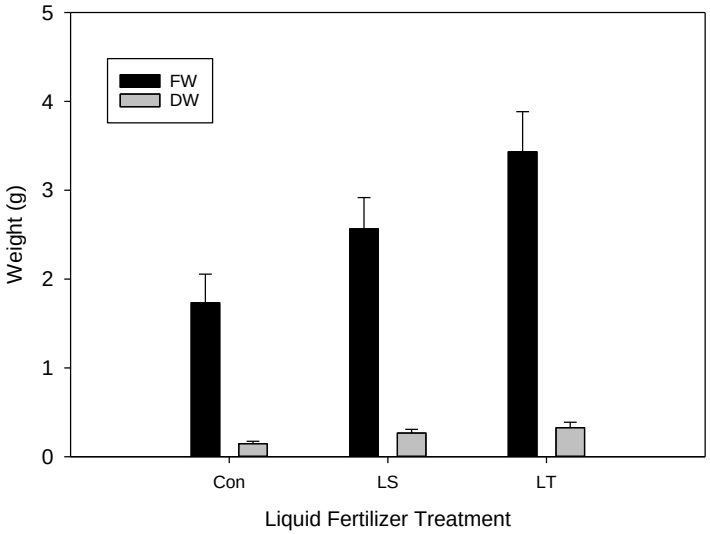
Fresh weight (gram) for lettuce, pak choi, and daikon under organic and synthetic liquid fertilizers application.

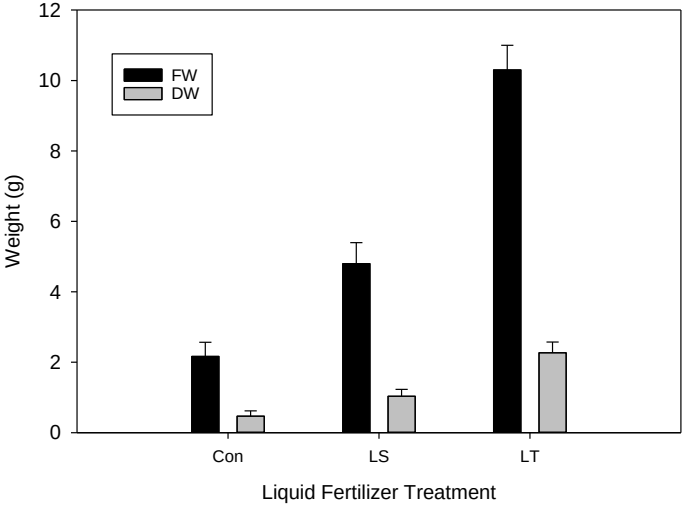
Seedlings quality





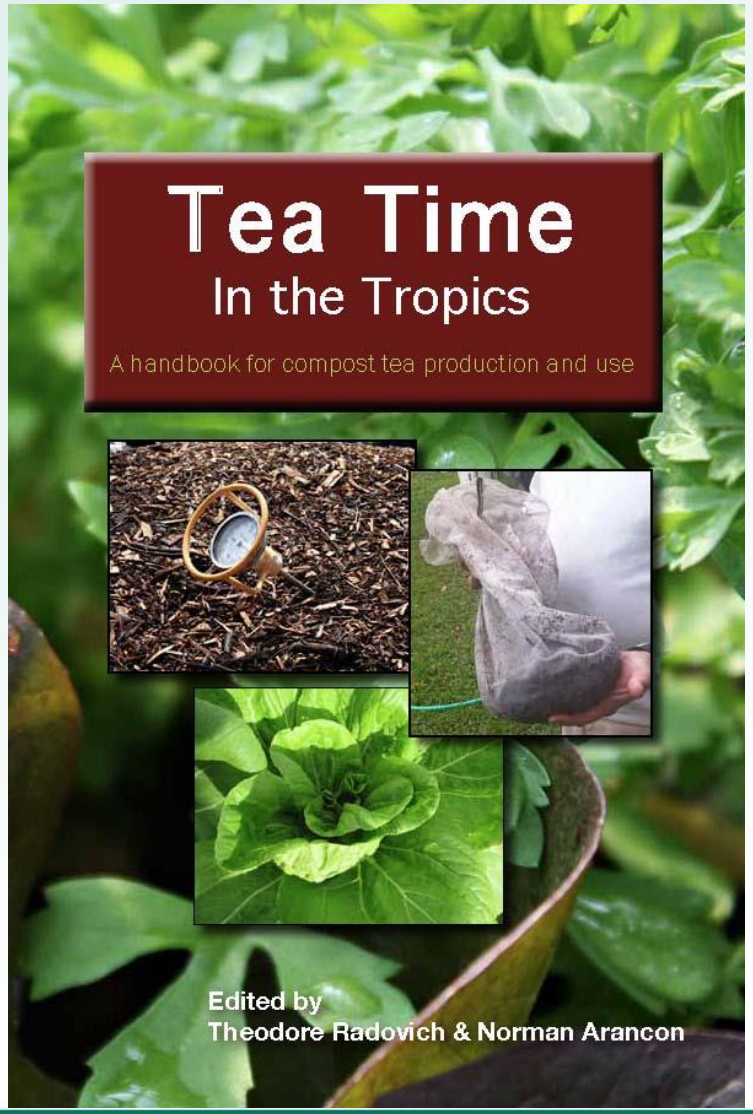
Seedlings quality





Vermicompost compost tea

http://www.backyardecosystem.com/vermicomposting/



Compost Tea Recipes

Recipe #1 Passively aerated vermicompost tea

1-8 cups of vermicompost (more is better)
1 paint strainer bag
5 gallons of rain water or tap water that has been allowed to sit overnight to degas chlorine
1 Five-gallon capacity bucket

Place vermicompost in paint strainer bag. Put bag in bucket. Add water to fill bucket. Cover and place in a shady area for 7 days. Stir once after 3-4 days. After 7 days, strain and apply to root zone weekly.

Recipe #2 Actively aerated vermicompost tea

1-8 cups of vermicompost (more is better)
Aquarium air pump with tubing and air stone
1 paint strainer bag
5 gallons of rain water or tap water that has been allowed to sit overnight to degas chlorine
1 Five-gallon capacity bucket

Place vermicompost in paint strainer bag. Put bag in bucket. Add water to fill bucket. Insert stone and aerate overnight. Apply to root zone weekly.

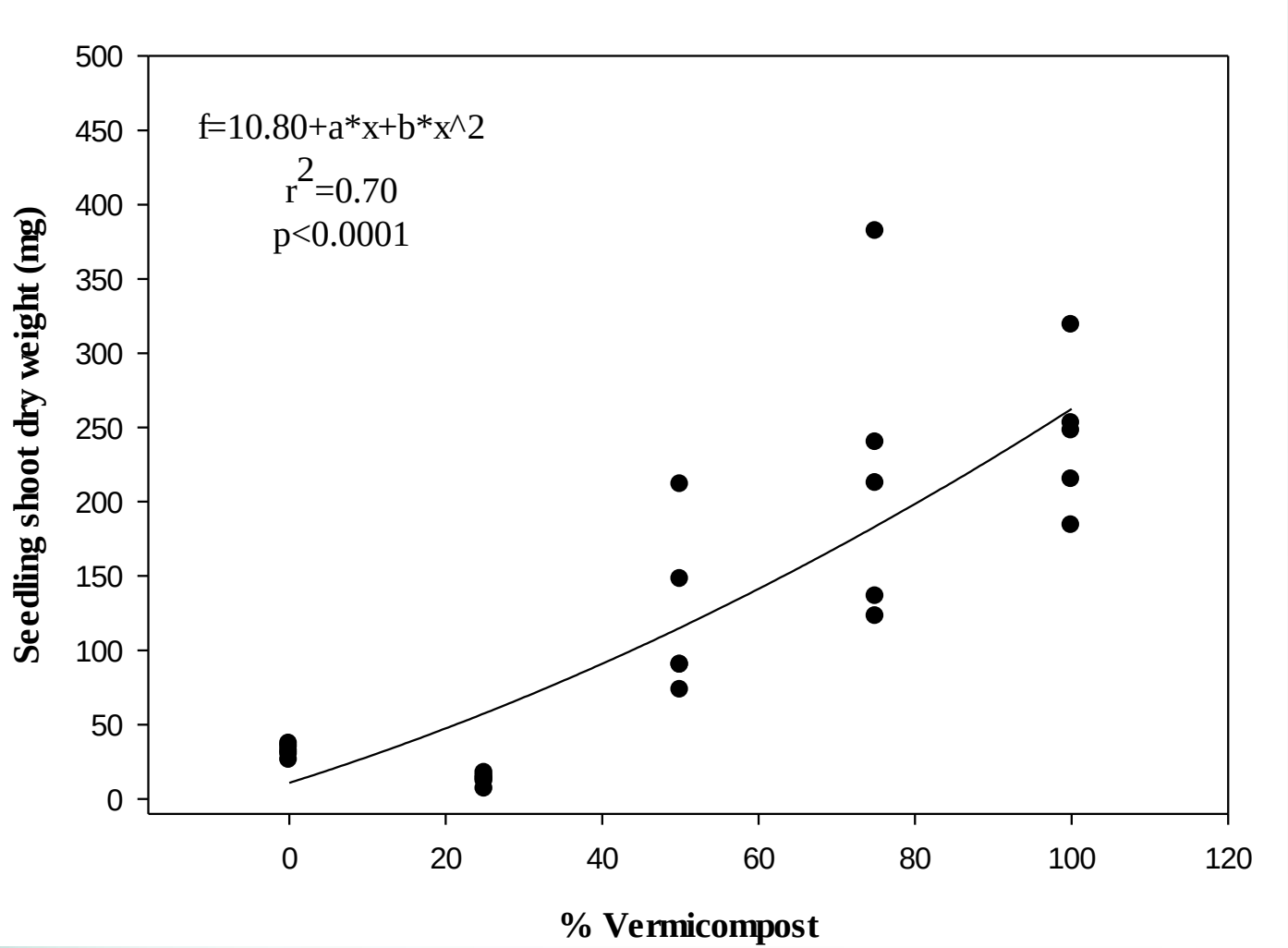
Compost “Tea”

- Uses air and water to extract:
  - Nutrients
  - Organic acids
  - Microbes
- Ratio of water to compost ranges 10:1-100:1
- Water is not circulated, only air
- 12-24 hrs

Seedlings media

Seedlings in 100% compost

Replacement of peat moss based media with local resources



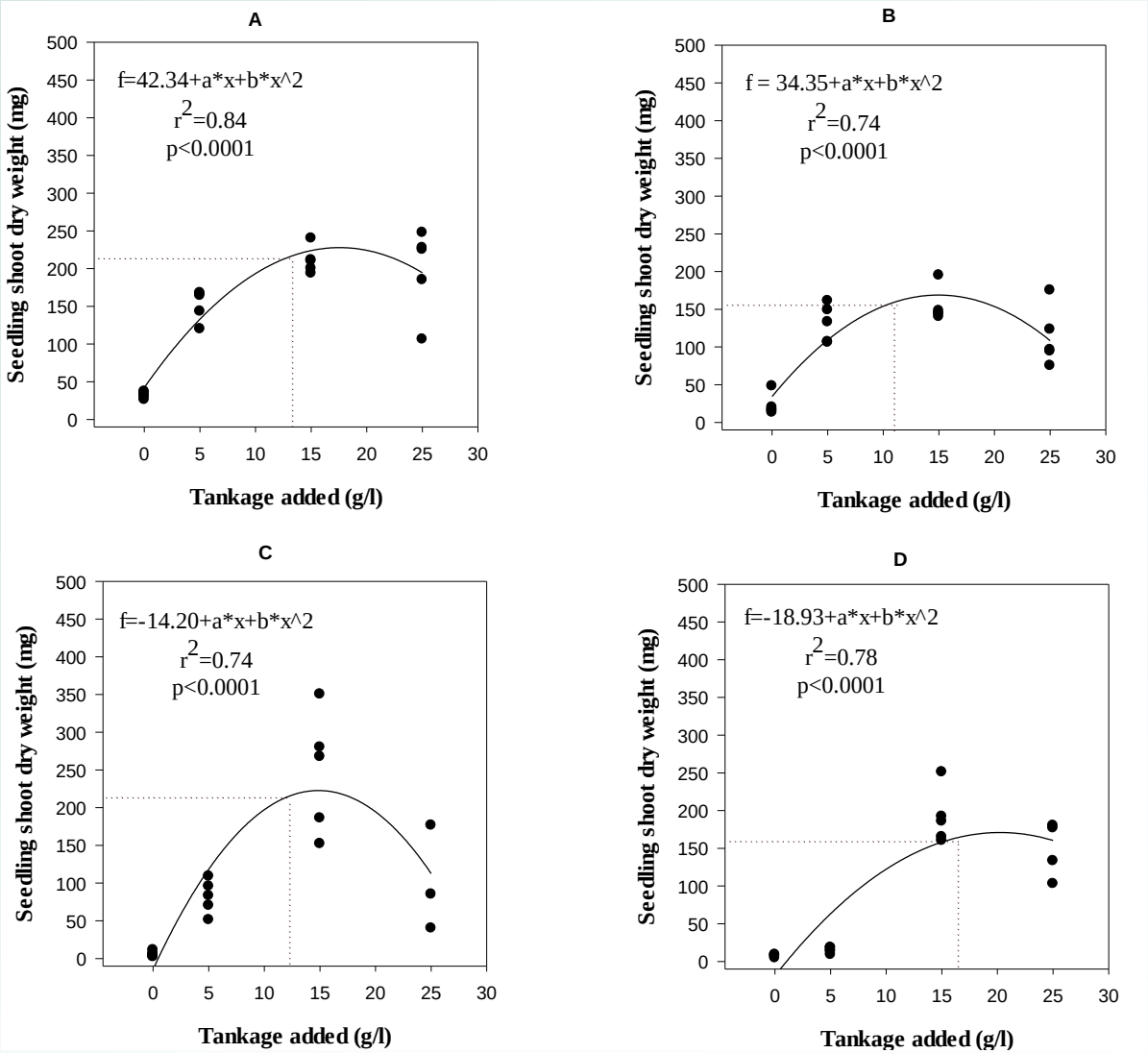
Regression analysis between vermicompost application rate and shoot dry weight of 6 week old eggplant seedlings grown in peat.

A: Peat

B: Peat amended with $CaCO_3$

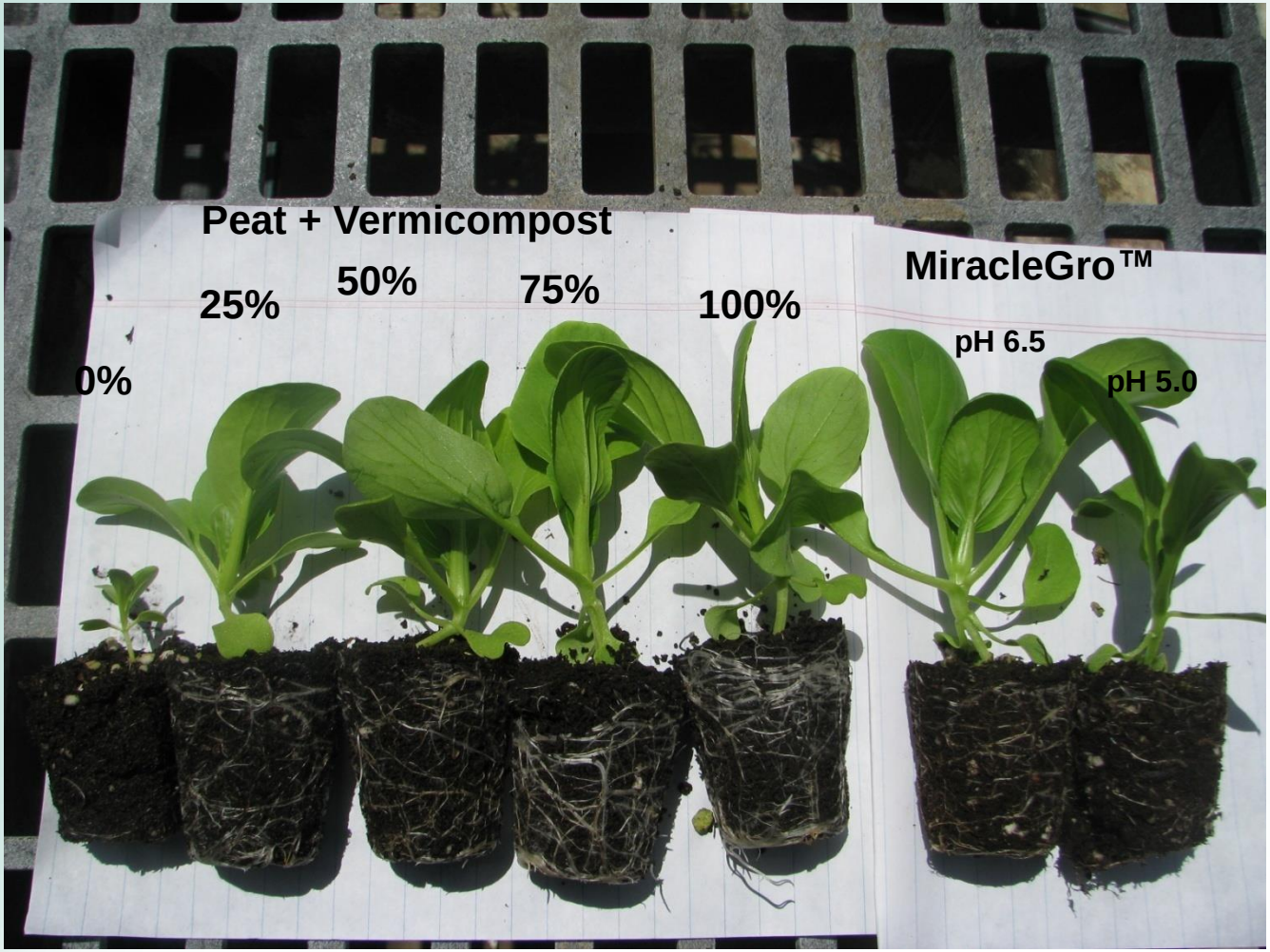
C: Coconut coir

D: Thermophilic compost



Regression analysis between tankage application rate and shoot dry weight of 6 week old eggplant seedlings grown in (A) peat, (B) peat amended with $CaCO_3$ 0.7 g/l of medium, (C) coconut coir, and (D) thermophilic compost.

Addition of vermicompost improved seedlings growth



New Projects:

Hawaii Department of Agriculture

Ahmad et al. *Evaluating the suitability of Chickpea (Cicer arietinum L.) as a new legume crop to the tropical condition of Hawaii. Hawaii Department of Agriculture, 2015-2017*

Biochar Project:
Funded by the Western SARE.

Compost “Tea”

Acknowledgements

Funding source:
-WSARE
-HDOA
-Hatch

Thanks for listening

…… Questions?