COOPERATIVE EXTENSION UNIVERSITY OF HAWAI'LAT MÁNOA COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

Sustainable Agriculture in Hawaii Local Organic Waste Fertilizers Presentation for Hawaii WSARE PDP 2019-2022

Dr. Amjad Ahmad University of Hawai'i at Mānoa College of Tropical Agriculture and Human Resources November 2019



servation Association



CENTER FOR RURAL AGRICULTURAL TRAINING & ENTREPRENUERSHIP JUNESHT CTI NUMBER AT SEAM



College of Tropical Agriculture and Human Resources University of Hawai'i at Mānoa



College of Tropical Agriculture and Human Resources University of Hawai'i at Mānoa



Hanai'Ai Extension Bulletins Website



@SustainAgCTAHR

UNIVERSITY OF HAWAI'I AT MÅNOA College of Tropical Agriculture and Human Resources

Social Media & Program Website:



The 3Ps of Sustainable Agriculture:

Evaluate practices to ensure they fall within the 3 Ps of sustainable agriculture.

- Practices are environmentally friendly.
- Practices lead to produce healthier food.

•Practices ensure higher profit to growers (Increase net profit by reducing production cost or increasing yield).



Building Soil Organic Matter:

Definition:

Soil organic matter is the fraction of the soil that consists of plant or animal tissue in various stages of breakdown (decomposition).

ICULTURE AND HUMAN RESOURCES

It improves soil physical, chemical, and biological properties. It also contributes to soil productivity in many different ways.





Soil Organic Matter:





UNIVERSITY OF HAWAIT AT MANOA COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

Locally Available & Produced Organic Fertilizers in Hawaii:

Western SARE award focused on reducing the reliance of Hawaii's farmers on imported fertilizers, by answering knowledge gaps in the locally produced compost and meat and bone meal, and evaluating the quality of the invasive seaweeds as source of potassium.







In compost selection:

- Higher nitrogen content is better.
- Nitrogen (N) to Carbon (C) ratio (C:N ratio) between 5-15.





Nitrogen release from 11 locally produced composts in relation to C:N ratio & total N content.



Invasive Algae:

Invasive seaweeds causing many issues, including Ocean dead zones, degradation of the native coral reefs, and decline in fish natural habitats. The DLNR and volunteer groups been harvesting the invasive seaweeds from different beaches in Hawaii.

At the Sustainable and Organic Agriculture Program of the University of Hawaii, evaluating the invasive species for nutrient content. Results showed high potassium content that can be used in organic farming.





Invasive Algae:

Taro, sweet potato, papaya are among the highest potassium demanding crops in Hawaii.

Species	Washed/ Unwashed	%			
		N	С	Р	K
G. salicornia	Unwashed	1.43	20.44	0.11	12.48
G. salicornia	Washed	1.32	18.23	0.09	9.15
E. spp.	Unwashed	1.01	21.14	0.07	18.02
E. spp.	Washed	0.78	17.78	0.06	16.94
K. spp.	Unwashed	1.39	22.10	0.07	14.81
K. spp.	Washed	1.21	21.78	0.06	14.11

Evaluated washing on changes in nutrient & salt content.



Bio-security protocol was established to reduce the risk of spreading out the invasive seaweeds into new locations in Hawaii.

Invasive seaweed application for Sweet Potato:



Sweet potato responded significantly to the application of potassium from seaweeds.



Sweet potato yield increased significantly with the application of potassium (K) from seaweeds under Oxisol and Mollisol soils. The Application rates were: 0, 0.75, 1.5, and 3 ton of fresh seaweeds.



UNIVERSITY OF HAWAI'I AT MĂNOA College of Tropical Agriculture and Human Resources

Invasive seaweed application for Pak choi:



Pak choi yield increased significantly with potassium application from seaweed. However at high application rates, the yield declined, maybe due to salinity or toxicity.

۲

UNIVERSITY OF HAWAI'I AT MANOA College of Tropical Agriculture and Human Resources

Meat & Bone Meal (tankage):

An average of 3 year sampling, Tankage contain about10% N, 3% P, and 1% K & its C:N Ratio: 5:1





The purchase of super-sack might be economically viable. However, its not recommended to store unused tankage, since N content will decline overtime.

I ENSION | College of Tropical Agriculture and Human Resources

Meat & Bone Meal (tankage): Nitrogen Mineralization & Release Pattern





The mineralization study showed that about 75% of the applied tankage mineralized over 90 days. Tankage was applied at 0.5, 1, and 2 ton/ha rates.

Nitrogen release (%) from tankage applied at different application rates over 90 days.

Table for NPK Application from Tankage:

Nitrogen (N) (lb/acre)	Tanakage (lb/acre)	Phosphorus (P) (lb/acre)	Potassium (K) (lb/acre)	Applying
50	665	20	6.50	
100	1,335	40	13.50	
150	2,000	60	20.00	macro- &
200	2,665	80	26.50	micro-
250	3,335	100	33.50	nutrient
300	4,000	120	40.00	

- Calculations here were made based on 10% N content and 75% N mineralization rate in tankage.
- Simple cross-multiply was used to calculate N application.
- 10% N in tankage is among the highest in most organic fertilizers.

COOPERATIVE EXTENSION | &

UNIVERSITY OF HAWAI'I AT MĂNOA College of Tropical Agriculture and Human Resources

Tankage split application:





- Nutrient release from organic fertilizers tend to be slow. Mainly due to the complex structure of nutrient in the organic fertilizers.
- Soil biology plays a major rule in nutrient mineralization from organic fertilizers.
- Split application did not affect sweet corn yield significantly. However, nitrate concentrations below the rootzone were $\sim 20\%$ less compared to preplant application of tankage.



UNIVERSITY OF HAWAI'I AT MĂNOA College of Tropical Agriculture and Human Resources

Liquid Fertilizer:



- •Provide nutrient for immediate uptake.
- •Suitable for long-term crops.
- •Suitable for mulching.
- Suitable for drip-irrigation.



Liquid Organic Fertilizer from Tankage:

- There's a local need for locally produced liquid organic fertilizer.
- Western SARE award was obtained to produce liquid organic fertilizer using tankage.
- Recipe was developed and training video was made on how to make your own liquid organic fertilizer.

Tankage produced locally, relatively cheap & high N content



Factors (time, temperature and chemical/biological agents) were tested



Recipe for high NO₃-N liquid organic fertilizer was achieved

Liquid Organic Fertilizer Recipe:

- 1.5 lbs of tankage into 10 gallon water.
- Add about 1 ounce vermicompost.
- Air for 12-24 hours.
- Strain & apply with drip irrigation. **NOTE:** This recipe can be used to produce small and large quantities of the liquid fertilizer.





Cotton Shopping Bag



An air-pump is important to provide oxygen for the biology in the solution.



Video demonstration on how to make your own liquid organic fertilizer: Vimeo Link: <u>https://vimeo.com/245473495</u>



Please note:

• The liquid organic fertilizer is meant to be as a supplemental application of nutrient and not main source.

• Do not spray the liquid organic fertilizer into plant foliar, since it has high nitrogen content.



Liquid Fertilizer Application (Injection)



Please Note:

- Different injectors are available (vary in setup, cost & plan/goal)
- Start with irrigation water till the drip irrigation lines are full.
- Then inject the liquid fertilizer into the drip irrigation lines.
- OR liquid fertilizer will not be distributed uniformly.

Results-Lettuce, Pak Choi, and Daikon



COOPERATIVE EXTENSION



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



Daikon was harvested after 9 weeks of planting

Watermelon On-Farm Trial on Molokai:



	Fruit	BRIX/Sample Location				Blossom	
	Peduncle	-				Calyx	
	End				End		
Melon #	Weight	1	2	3	4	5	Average
	(lbs)						
1	24	10.2	12.0	12.2	12.3	12.1	11.8
2	19	10.8	12.0	12.2	11.8	10.8	11.5
3	18	11.2	13.0	13.0	13.0	12.0	12.4
Average	20.3	10.7	12.3	12.5	12.4	11.6	

Watermelon produced using the liquid organic fertilizer was much sweater and higher in yield.

Improving seedlings quality with liquid fertilizer:





Con = Water only, LS = Liquid Synthetic & LO = Liquid Organic

Biochar:

Produced by burning organic materials in the absence of or low oxygen.
Biochar is not ash. The high temperature and closed condition during biochar production are main factors in the quality of the final product (biochar or charcool).

•Biochar application will increase the soil surface area and nutrient balance in the soil.





Biochar been reported to improve soil quality, nutrient balance, nutrient availability, soil water holding capacity & soil health, especially in low fertility, acidic & heavy clay soils.

Applications of Biochar in Field & Greenhouse Trials:

Application rates of biochar (0, 10, and 20 ton/ha) were evaluated on various crops and under different soils.

Please Note: We are evaluating the short- and long-term effect of biochar on crops and soils in order to conduct a cost-benefit analysis.





Okra plant growing under different application rates of biochar.



Thanks for listening





For More information:

Sustainable and Organic Agriculture Program

University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources

https://cms.ctahr.hawaii.edu/soap

Oahu Agriculture & Conservation Association

https://www.oahuaca.org

WSARE

Western Sustainable Agriculture Research and Education

https://www.westernsare.org/









College of Tropical Agriculture and Human Resources University of Hawai'i at Mānoa



