Innovative Waste Management Strategies: Utilizing Locally Produced By-Products as Organic Amendments for Crop Production in Hawaii

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INTRODUCTION

- Food- and nutritional-security and self-sufficiency are major concerns for people living in Hawaii and the Pacific Region.
- Organic farmers have taken the lead in innovative use of local waste products as fertilizer inputs.
- Effective use of local resources to replace imported inputs is crucial for Hawaii's sustainability and community well being.
- Recent research activities, funded by Western SARE, were conducted to develop recommendations and accelerate successful adoption by organic and other growers.

OBJECTIVES

- Predicting nitrogen (N) release pattern from high N content materials.
- Screening locally produced composts for plant growth response in relation to quality parameters.
- Identifying mechanism of potassium (K) release from invasive algae waste.
- Improving nutrient availability and reduce losses with biochar applications.

MATERIALS AND METHODS

- Batch-to-batch variability, N content and losses, crop growth and yield responses to the locally produced rendered meat and bone meal were evaluated in lab and field trials.
- Developed a recipe and evaluated the quality of high N liquid organic fertilizer using rendered meat and vermicompost.
- Eleven locally produced composts were evaluated for N release pattern and pak choi growth, yield, and leaf chlorophyll content.
- Invasive algae waste were evaluated for K release mechanism in greenhouse and field trials.
- Applications of biochar were assessed for nutrient availability and losses, soil properties, and crop quality, in a series of greenhouse and field trials, under different soils .

Fig. 1: Evaluated Amendments:

A) Compost.

B) Rendered meat and bone meal (tankage).

C) Invasive seaweed algae.

D) Biochar.

RESULTS AND DISCUSSION

1) Locally Produced Compost:

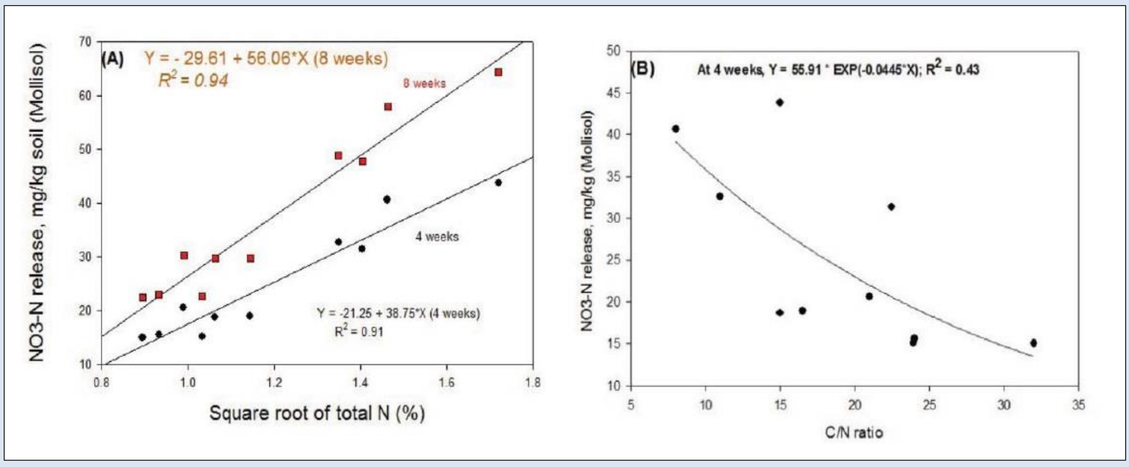

Fig. 2: Nitrogen release from 11 locally produced composts in relation to A) Total N content and B) C/N ratio.

2) Rendered Meat and Bone Meal (tankage):

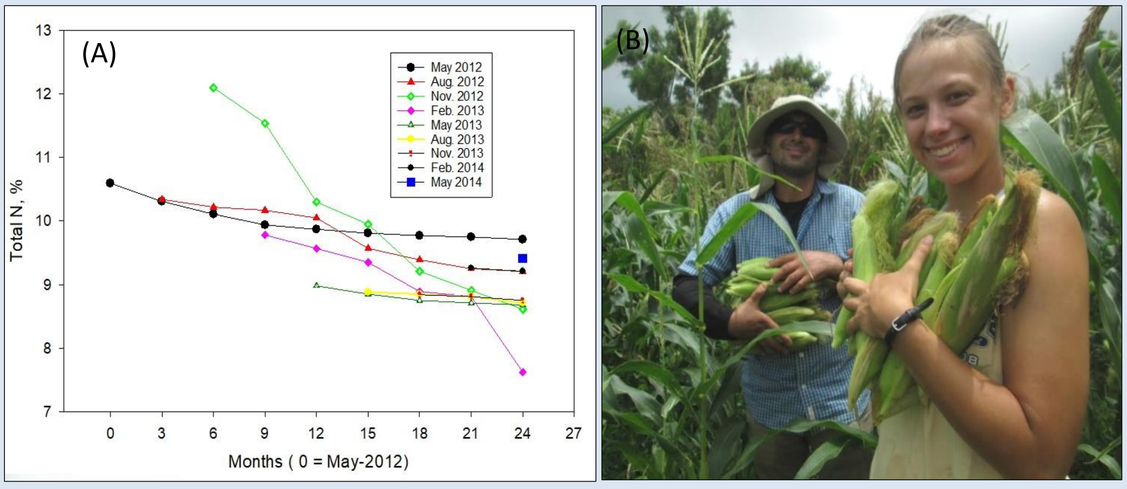

Fig. 3: Quality of the locally produced rendered meat and bone meal in A) Batch-to-batch variability in N content and losses over 2 year period and B) Sweet corn yield in a field trial.

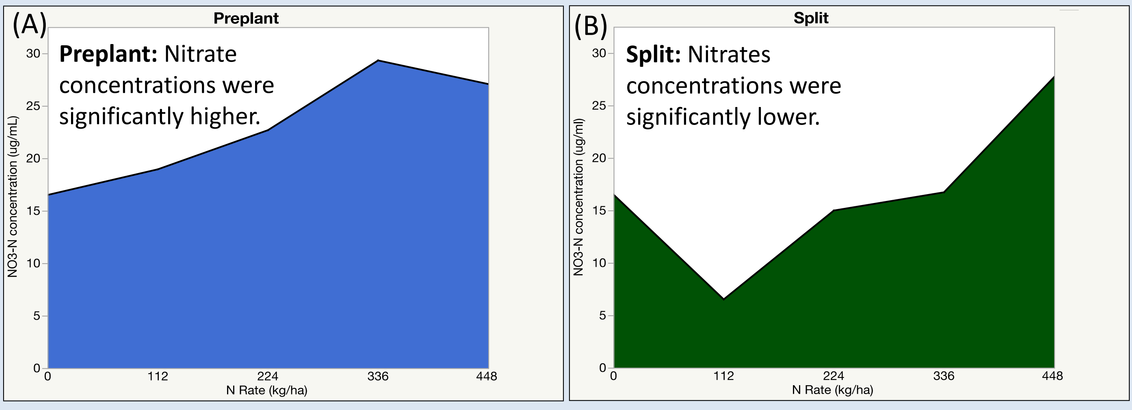

Fig. 4: Nitrate concentration below sweet corn root zone under A) full preplant and B) split application, of the rendered meat and bone meal (tankage).

3) Invasive Seaweed Algae:

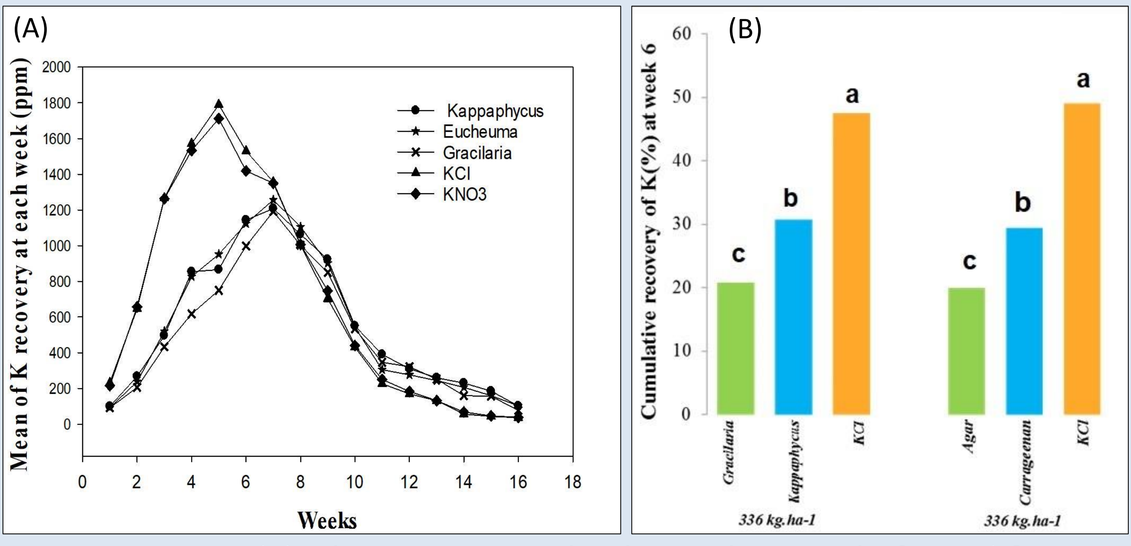

Fig. 5: Potassium (K) release pattern, in leachate column trials, from A) five K source and B) K source compared to K + agar and carrageenan gel.

RESULTS AND DISCUSSION

4) Biochar:

Fig. 6: A) Locally produced biochar from Macadamia Nutshell and B) Biochar particles under microscope at 20um.

Field trial setup:

- Biochar: 0, 2, and 4% rate of soil weight.
- Fertilizer: 2 organic and a synthetic source.
- Nitrogen application rate: 0, 150, and 300 kg.ha^{-1}.
- Crop: Soybean, sweet corn, and okra.

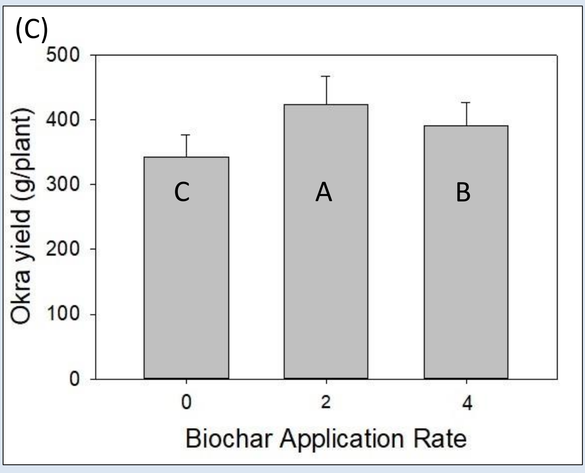

Fig. 7: A) Field trial setup, B) Flowering okra at Poamoho Station and C) Okra yield (g/plant) under different biochar (% of soil weight) application rates.

CONCLUSIONS

- Selecting compost based on initial N content and C:N ratio is important to supply crop with sufficient nutrient.
- Split application of rapid mineralizing rendered meat and bone meal may result in lower risk of nitrogen leaching.
- Utilizing carrageenan containing algae may increase release of plant available potassium relative to agar containing algae.
- One application of biochar is expected to increase crop productivity for long period and lead to a better nutrient management plan.

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