Investigating Sustainable Production Practices on the Growth and Development of Ethnic Crops Grown on the Delmarva Peninsula

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Abstract

Demographics on the Delmarva Peninsula are becoming more diverse; hence, the need for small farmers to capitalize on this trend and diversify crop offerings. The goal of this project is to provide research-based production practices for high-yielding ethnic crops that can be grown on Delmarva. Four studies were conducted, at two separate locations on the UMES research farm, to examine yield of *Brassica rapa* cv. Bosai Chinensis (bok choy) and *Amaranthus viridis* Linn (callaloo)), using sustainable production practices. Two varieties of bok choy were planted, using complete randomized design, six treatments ((1) Control (20:20:20), (2) Vermicompost Tea and Fish Emulsion (VCT+FE), (3) Poultry Litter Leachate (PLL), (4) Control + Azospirillum (Azo), (5) VCT+FE+Azo, and (6) PLL+Azo), with four replications. Two fertilizer regimes, biofertilizers and sustainable fertilizers, were used for callaloo production using complete randomized design, three treatments with four replications. Biofertilizer treatments included (1) control, (2) Azo, and (3) Endo/Ecto Mycorrhizae, and sustainable fertilizer treatments included (1) control, (2) VCT+FE, and (3) PLL. Bok choy was harvested at the mature stage, while callaloo was harvested eleven consecutive weeks. There was no significant difference between the control and treatments for each study, which indicates that either treatment can be used to produce a quality yield. At both locations, the yield of the Azo treatment, for the callaloo biofertilizer study, and the yield of the PLL treatment, for the callaloo sustainable fertilizer study, was higher than the other treatments. The higher yields varied among treatments and locations for the bok choy studies.

Introduction

The Delmarva Peninsula, located on the east coast of the United States, is home to a highly diverse population, which is increasing rapidly (Figure 1). Between 2000 and 2010, the total population has increased from 13,158,600 to 14,672,500 (U.S. census, 2010). This increase in ethnic diversity has increased the amount of ethnic foods consumed in the United States. The increased demand for locally grown food provides opportunities for small farmers on Delmarva to grow ethnic and specialty crops to serve the increasing local ethnic markets, sustain their farming operations, and increase profitability. However, cropping on the Delmarva is constrained by sandy soils that are mainly acidic and low in plant nutrients. The region is also prone to high temperatures and periodic drought conditions during the grown season, which results in low yield production and low farm income. Ethnic crops, not traditional grown in the United States, are usually imported to the U.S., and are considered exotic high-value crops (Tubene and Myers, 2008). Therefore, the introduction of high-yielding highly nutritious ethnic crops, using sustainable production practices, can benefit farmers/stakeholders economically and improve the environment. Sustainable production practices, such as organic fertilizers and biofertilizers, can improve soil biodiversity and soil fertility, produce safe and nutritious crops, and reduce the use of chemical fertilizers and environmental pollution.

Organic Fertilizers:

- Compost and Vermicompost: Increase crop yield, suppress diseases, reduce waste, improve soil fertility and structure, increase microbial population, improve plant health, and nutritional quality
- Fish Emulsion: Improve plant growth and yield, suppress diseases, and increase microbial population

Biofertilizers: Nitrogen fixation, solubilize phosphorus, and stimulate plant growth (Vesicular-Arbuscular Mycorrhiza, *Trichoderma*, Azospirillum)

The **main objective** of this project is to address stakeholders' needs by providing research-based sustainable production practices for high-yielding ethnic crops that can successfully be grown on the Delmarva Peninsula to improve the profitability of small farm operations.

Figure 1. Delmarva Peninsula

Figure 2. Bok choy

Materials and Methods

Four studies were conducted to examine yield production of two ethnic crops (*Brassica rapa* cv. Bosai Chinensis (bok choy) and *Amaranthus viridis* Linn (callaloo) using sustainable production practices.

Bok Choy Study: Two varieties of bok choy (Joi Choi F1 and Mei Qing Choi F1) were planted at different times during the growing season (early summer and late summer, respectively) at two separate locations in a complete randomized design with six fertilizer treatments and four replications each. Fertilizer treatments were applied biweekly throughout the growing season. Bok choy was harvested at the mature stage.

Organic Fertilizer Treatments:
T1: Control (20:20:20)
T2: Vermicompost Tea + Fish Emulsion (VCT+FE)
T3: Poultry Litter Leachate (PLL)
T4: Control + Azospirillum (Control+AZO)
T5: Vermicompost Tea + Fish Emulsion + Azospirillum (VCT+FE+AZO)
T6: Poultry Litter Leachate + Azospirillum (PLL+AZO)

Callaloo Study: Two fertilizer regimes, organic fertilizers and biofertilizers, were used for callaloo production using a complete randomized design with three treatments and four replications each. For the biofertilizer study, commercial fertilizer (20-20-20) was applied as needed. The organic fertilizer treatments were applied biweekly throughout the growing season. The young stems of the callaloo were harvested for eleven consecutive weeks.

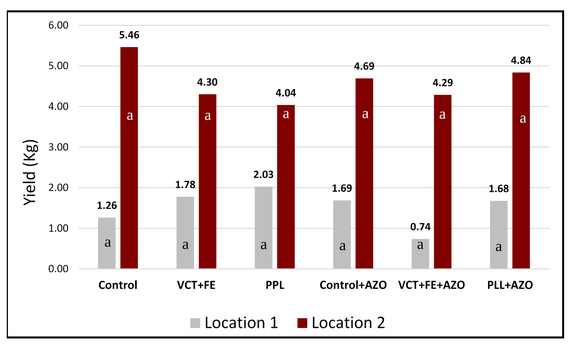
Organic Fertilizer Treatments:
T1: Control (20:20:20)
T2: VCT+FE
T3: PLL

Biofertilizer Treatments:
T1: Control (20:20:20)
T2: Azospirillum (AZO)
T3: Endo/Ecto Mycorrhizae (Endo/Ecto)

Figure 3. Callaloo

Results and Discussion

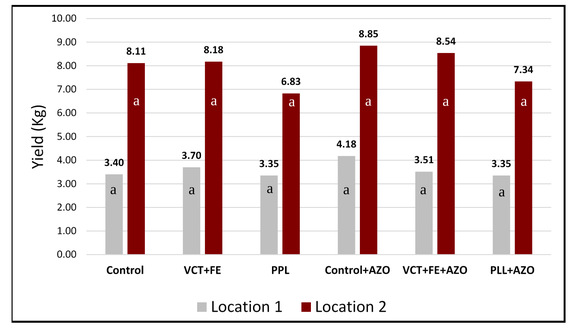
Figure 4. Bok choy (Joi Choi F1) yield for the early summer study



*Means with similar letters are not significantly different at (p≤0.05) according to Tukey's HSD All-Pairwise Comparisons Test.

- Bok choy yield varied among treatments and locations. Location 1 had a lower yield per treatment when compared to location 2.
- At location 1, the Poultry Litter Leachate (T3) produced the highest yield; whereas at location 2, the control (T1) produced the highest yield.
- There were no significant difference (P<0.05) between the control and treatments at both locations (Figure 4).

Figure 5. Bok choy (Mei Qing Choi F1) yield for the late summer study



*Means with similar letters are not significantly different at (p≤0.05) according to Tukey's HSD All-Pairwise Comparisons Test.

- The late summer bok choy study produced higher yields than the early summer study (Figures 4 & 5).
- At location 1 and location 2, the Control+Azospirillum (T4) produced the highest yield (Figure 5).

Figure 6. Callaloo yield for the organic fertilizer study

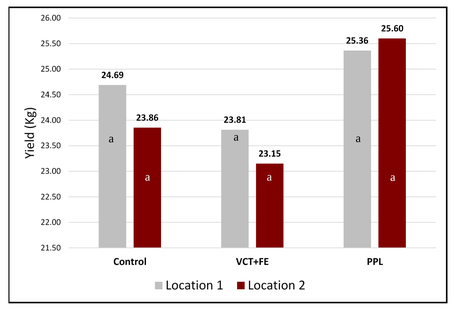
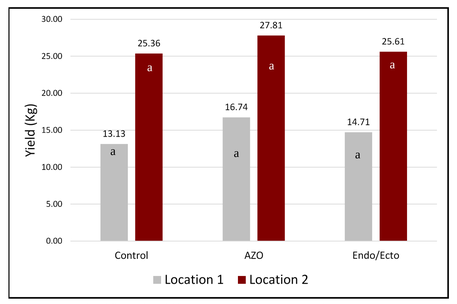


Figure 7. Callaloo yield for the biofertilizer study



*Means with similar letters are not significantly different at (p≤0.05) according to Tukey's HSD All-Pairwise Comparisons Test.

- Callaloo yield varied among treatments at both locations in both studies.
- Poultry Litter Leachate (PLL) produced the highest yield among the organic fertilizer treatments at both locations (Figure 6); and Azospirillum (T2) produced the highest yield among the biofertilizer treatments at both locations (Figure 7).

Conclusion

There was no significant difference between the control and treatments for each study, which indicates that either fertilizer treatment can be used to produce a quality yield. Results from these studies concluded that the application of organic fertilizers and biofertilizers can be used on the Delmarva Peninsula as natural/biological fertilizer alternatives to chemical fertilizers.

Literature Cited

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