Bioassay: Tomato and Okra Growth Evaluation on 5 Soilless Potting Mixtures in Barbados

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Introduction

Waste disposal is an inevitable issue, especially for geographically insulated small islands such as Barbados. The Sustainable Barbados Recycling Centre Inc. (SBRC) is the only company that manages home and industrial wastes on this island. This centre aims at reducing the amount of waste going to landfills by creating recycled materials and commercial products. One of their main products is Soil Conditioner Compost that consists of green waste (50%) chicken and horse manure (16.7%), coconut fiber (16.7%), and seaweed (16.7%) (pers. com. Susanne Ryan, 2016). Another product, Coconut and Wood Mulch (½ in) contains both coconut fibre and wood pallets or green waste. Despite the fact that SBRC are producing a range of soil-related products, there is currently no specific horticultural product. Our project was to develop a soilless potting mixture using SBRC products as well as a seedling bioassay to test these substrates and future products.

Goals

1. Analyse and test soilless potting mixtures based on SBRC components (with a range of suitable controls) using seed germination/early seedling growth bioassays.

2. Provide procedures and guidelines to SBRC for seedling bioassays, so that they can continue to test their potting mixture components and ascertain and maintain the quality of the horticultural materials they sell.

Materials and Methods

This study involved three crop species (okra, tomato and beet) planted in a new greenhouse at SBRC. These were planted into 5 potting mixtures in 20 plastic seed trays of 72 seeds each. Three replicates in time were done for the entire experiment, and at each planting date new potting mixtures with the same ratio were prepared (June 20, July 11, July 19).

Figure 1. The mixing

Figure 2. The greenhouse

Figure 3. The trays

Figure 4. The oven-drying

As the seedlings grew, multiple parameters were measured: germination, percentage of abnormal seedlings and height of stem. In addition, after preparing the mixtures we sampled them and oven-dried at 50 °C for 5-7 days. After they were dry, their pH, EC and moisture content were analyzed to understand the features of these mixtures.

Results and Discussion

Of the three crops, okra was the fastest to germinate and the easiest to grow, and these results will be presented. Firstly, the commercial peat-lite mix and self-made peat-lite mix gave similar results in terms of growth (Fig. 7), which suggested using peat, perlite and soil conditioner compost would lead to as good a result as the imported commercial control while significantly cutting down the cost. When the self-made peat-lite mixture was fertilized (trial 3) plant growth improved; the plants were shorter and greener.

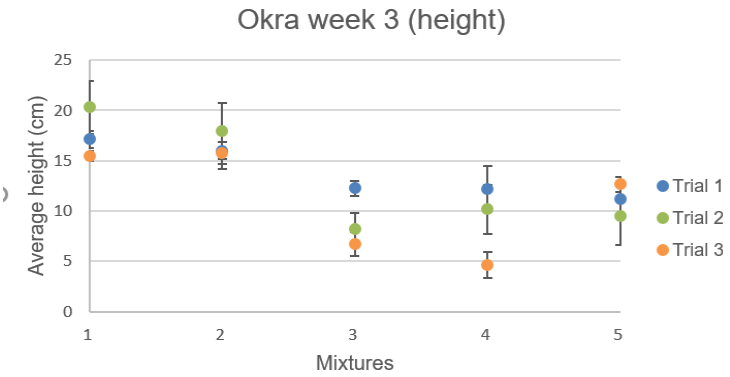

Figure 5. Height of okra seedlings after 3-weeks growth. Trial 1 was planted on June 20, trial 2 was planted on July 11, and trial 3 was planted on July 19 with fertilizer additions into the mixtures. Mixture 1 was Commercial peat-lite mix, Mixture 2 was self-made peat-lite mix, mixture 3 was coir-lite mix, mixture 4 was soil conditioner compost and sand, and mixture 5 was soil conditioner compost.

The same was true in the coir-lite mixture. Compared with the control and peat-lite mixture, the coir-lite mixture showed good germination rate, this might due to the fact that coir holds more water so even if the plants underwent water stress they were able to germinate well. However, coir-lite seedlings did not grow as tall, which indicated a lack of nutrients available for later seedling development due to either low nutrient level or high pH. The pH of SBRC coir product was about 8.5, which makes the nutrients unavailable.

The difference between coir-lite mixture, soil conditioner compost and sand, and soil conditioner compost alone, in terms of seedling height was not significant (Fig. 6), but coir-lite was much better for germination. This suggested that by mixing sand with compost, one could get the same results while lowering the cost. Although the heights of seedlings were far behind those in control and peat-lite mixture, they were good enough to be planted into the field.

Figure 6. Coir-lite mix (left), Soil conditioner compost and sand (middle), and Soil conditioner compost (right)

Figure 7. Commercial peat-lite mix (right) and Peat-lite mix (left)

Many recommendations can be made to improve the design of future projects. We recommend tomato and okra for bioassays. Also, germination rate and height are good parameters to measure. A uniform watering of plants is essential to avoid water stress and for each plant to receive the same treatment. Finally, for SBRC coir product, adding ammonium nitrate and phosphoric acid will lower the pH (Rainbow and Wilson, 1998); however, costs should be taken into consideration.

Conclusion

In conclusion, self-made peat-lite mixture was as good as the commercial peat-based mixture and was more economical. Coir-lite mixture was good for germination but would need further development for optimizaiton. The soil conditioner compost and sand mixture, and the pure soil conditioner compost yielded similar results, while mixing sand with that compost would cut down costs.

Acknowledgement

A very special thank you to the staff at the Sustainable Barbados Recycling Centre for their support and for providing us with all the materials necessary for our research project. Thank you to our mentors Susanne Ryan and Tony Parris for their guidance and for involving every staff member of SBRC in our project. This made our project more meaningful and rich as we constantly had feedback from different points of view. Thank you for providing us with a greenhouse. Thank you to Dr. Danielle Donnelly for believing in our project from the beginning and always making us improve our methodology. We would like to acknowledge the contributions of Jeff Chandler, Tony Armstrong, Lucas Nolan, Francois Grimes, Nicholas Cox, Roderick Yarde, Debbie Rhynd and Matt Gittens for their advice and willingness to help us.

Literature Cited

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