National Institute of Diabetes and Digestive and Kidney Diseases

Effectiveness of Compost Application on Growing Spoon Cabbage (*Brassica rapa*) in Salt Treated Soil

PENNELY LAKJOHN

REPUBLIC OF THE MARSHALL ISLANDS

HIGH SCHOOL STEP-UP
AUGUST 6-10, 2017
Natcher Conference Center Bethesda, MD

INTRODUCTION

Marshall Islands soil conditions are generally sandy and poor in quality. It does not retain enough water and nutrients for healthy plant growth and development (Deenik & Yost, 2006). Problems like salt spray, inundation and strong winds are some challenges the island is facing. Imported foods are flooding the island and noncommunicable diseases are on the rise. Local farming is so limited, producing very minimal amounts of vegetables and fruits for the markets. Some farmers have given up tilling the land due to the many challenges encountered in addition to poor soil conditions and salt stress.

TEST PLANT

Spoon cabbage (*Brasicca rapa*) is one of the popular green leafy vegetables on the island, a common ingredient in soups and stir-fried vegetables. Spoon cabbage is a good source of vitamins and minerals, fibers and anticancer phytochemical agents

OBJECTIVES

This experimental study was conducted at the RMI Cooperative Research and Extension garden facility located at Arrak, Majuro Atoll, from May 22 to July 31, 2017. This study aims to fulfill the following objectives:

1. to assess the growth performance of spoon cabbage with varying concentrations of salt stress on sandy and compost treated soils in terms of:
    a. Mortality
    b. Percent growth
    c. Marketable weight
2. To compare and analyze statistically the growth performance of spoon cabbage in both soil types and determine each salt tolerance threshold level.

RESEARCH HYPOTHESIS

It was hypothesized that compost application on soil would result in a higher salt tolerance threshold level.

METHODOLOGY

1. Soil Prep

Sandy: 3 areas, blackish, fertile-looking

Compost: 1 sandy: 1 coconut husk: 1 seaweed debris: 1 chicken manure

2. Seedling Prep

3. Salt Water Prep

$$\text{15mM NaCl} \times \frac{1Mol\ NaCl}{1000mM\ NaCl} \times \frac{58.4g\ NaCl}{1Mol\ NaCl} \times 20 = 17.5g\ NaCl$$

Treatment	NaCl Concentration in Micromole (Mm)	Mass of Salt per 20-L Bucket of Water (g)
T1	0	0
T2	15	17.5
T3	30	35
T4	60	70
T5	120	140
T6	240	280

Irrigation for 10 days twice a day

4. Data Gathering & Analysis

RESULT & DISCUSSION

Planting Media	T1 (0mM) Control	T2 (15mM)	T3 (30mM)	T4 (60mM)	T5 (120mM)	T6 (240mM)
Sandy Topsoil						
Compost Treated Soil						

Figure 1. Appearance of spoon cabbage on both planting media after 10 days of salt water irrigation

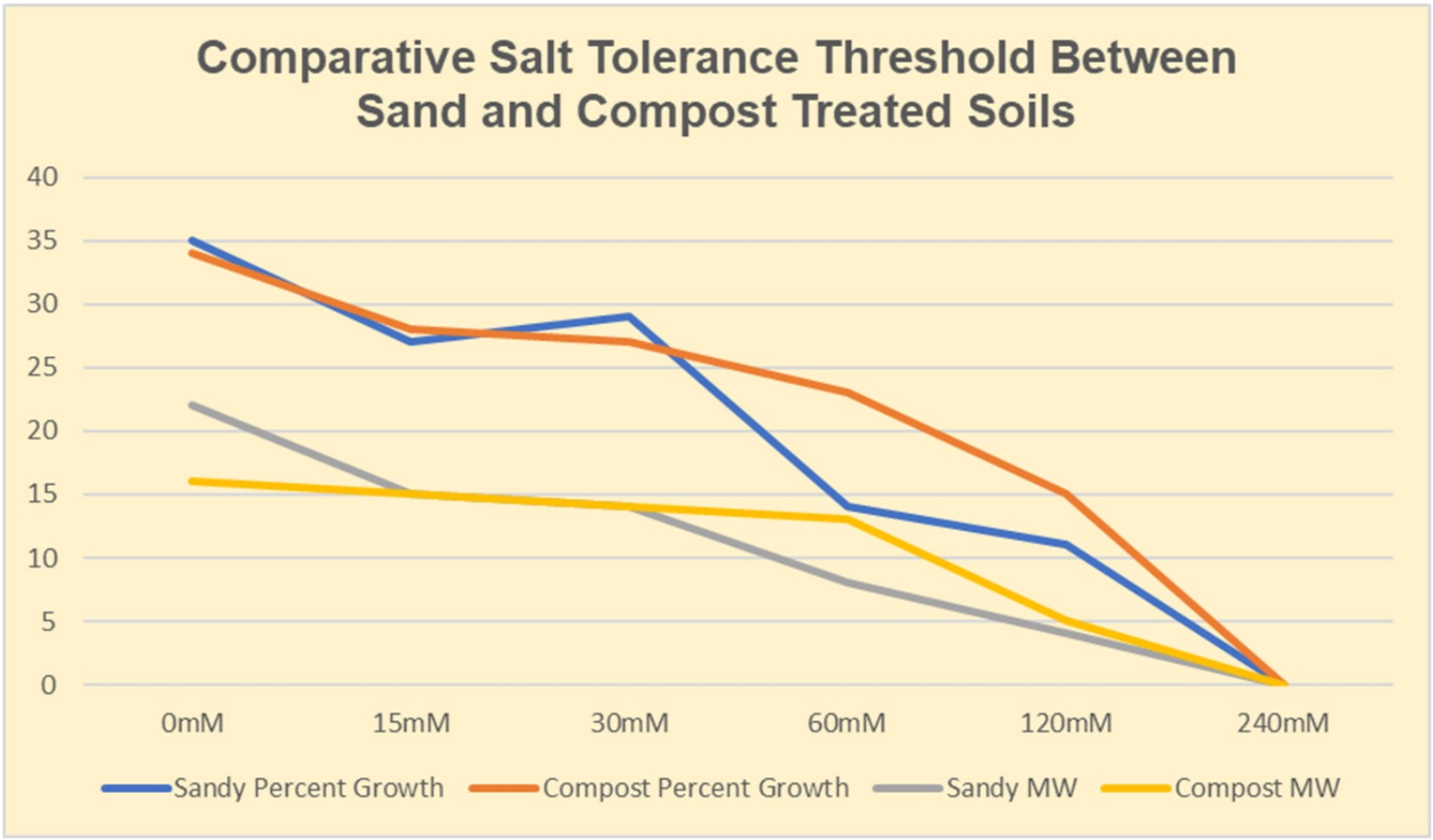
RESULTS AND DISCUSSION

Table 2

Comparative growth performance pattern of spoon cabbage on sandy topsoil and compost treated soil, the same letter on the line indicates no significant difference ($p<0.05$)

Treatment	Sandy Topsoil			Compost Treated Soil		
	Mortality (%)	Percent Growth	Marketable Weight (g)	Mortality (%)	Percent Growth	Marketable Weight (g)
0	0	35.28a	20.33a	0	34.38a	16.44a
15	0	27.34a	14.67a	0	28.26a	14.89a
30	0	28.67a	14.22a	0	26.88a	14.00a
60	44.44	14.21b	8.33b	33.33	23.33a	12.67a
120	86.42	10.97b	4.22b	55.56	15.15b	5.11b
240	100	0c	0c	100	0c	0c

RESULTS AND DISCUSSION



SUMMARY & CONCLUSION

The overall pattern shows that the growth performance of spoon cabbage in a compost-treated soil was found to be significantly more effective than the plants grown in the sandy soil. The results suggest that compost could be used as a soil amendment for the saline soil environment in the Marshall Islands. The results agreed with the previous studies that compost could improve, alleviate and remediate saline affected soil by improving its physical, chemical and biological properties (Ouni et al., 2013; Lashari et al., 2012; Rousk, et al., 2011; Lakhdar et al., 2009).

CONCLUSION

Application of compost on soil resulted in a higher salt tolerance threshold level and therefore the hypothesis was accepted.

BIBLIOGRAPHY

Deenik, J.L. & Yost, R.S. (2006). Chemical properties of atoll soils in the Marshall Islands and constraints to crop production. *Geoderma*. 136: 666-681. DOI10.1016.

Lakhdar, A., Rabhi, M, Ghanya, T., Montemurro, F., Jeddi, N. & Abdelly, C. (2009). Effectiveness of compost use in salt-affected soil. *Journal of Hazardous Materials*. 171:1-3: 29-37.

Lashari, M.S., Liu, Y., Li, L., Pan, W., Fu, J., Pan, G., Zheng, J., Zheng, J., Zhang. & Yu., X. (2012). Effects of amendment of biochar-manure compost in conjunction with pyroligneous solution on soil quality and wheat yield of a salt-stressed cropland from Central China Great Plain. *Field Crops Research*. 144: 113-118.

Ouni, Y., Lakhdar, A., Sceiza, R., Scotti, R., Abdelly, C., Barhoumi, Z. & Rao, M.A. (2013). Effects of two composts and two grasses on microbial biomass and biological activity in a salt-affected soil. *Ecological Engineering. 60: 363-369.*

Rousk, J., Elyaagubi, F., Jones, D.L. & Godbold, D.L. (2011). Bacterial salt tolerance is unrelated to soil salinity across an arid agroecosystem salinity gradient. *Soil Biology and Biochemistry.* 43-9: 1181-1887.

ACKNOWLEDGEMENT

Special thanks to:

Vincent Enriquez, MA (mentor): Agriculture Researcher, College of the Marshall Islands, Land Grant/USDA-NIFA Cooperative Research & Extension Program

George Hui, PhD: Pacific STEP-UP Program Director, John A. Burns School of Medicine UH, Manoa

Dr. Lawrence Y.C. Agoda, F.A.C.P.: Director OMHRC/NIDDK

Mr. Biuma Samson: Dean, Land Grant/USDA-NIFA Cooperative Research & Extension Program, College of the Marshall Islands

Walton Bohanny, MSN: Pacific STEP-UP Regional Coordinator, Republic of the Marshall Islands

Moses Sumaoang, RN-BSN, MA: Pacific STEP-UP Regional Coordinator, Republic of the Marshall Islands

Sali Andike, BSc.: Pacific STEP-UP Program Coordinator, Republic of the Marshall Islands

Kommol Tata