Hydroponic Nutrient Film Technique on Lettuce (*Lactuca sativa* L.) Production

Shine Ko Ko

Plant Biotechnology Center

Horticulture and Plant Biotechnology Division

Department of Agriculture

29.1.2020

Contents

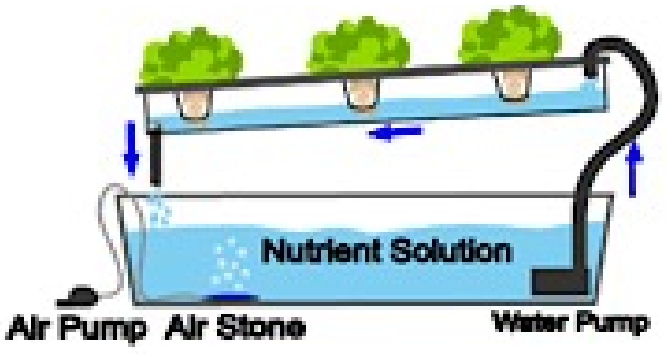
Introduction

Hydroponics

- water saving, percentage of efficient fertilizer usage, increase in the percentage of productivity and percentage of water productivity
- solution culture method (liquid hydroponics) and media culture method

Solution Culture Method (Liquid Hydroponics)

- continuous flow solution culture (nutrient film technique and deep flow technique) and
- static solution culture (root dipping method, floating method and capillary action technique).



Nutrient Film Technique

- a popular and versatile hydroponic system, the nutrient solution is pumped to growing tubes and flow over the roots of plants, then drain back into the reservoir

Lettuce (*Lactuca sativa* L.)

- a green leafy vegetable, is a commonly consumes as salad. It is very nutritious and a rich source of vitamin C, minerals and fiber

Objectives

- to examine the different nutrient composition to plant height, leave number, fresh and dry weight of lettuce, and
- to investigate the feasibility of lettuce growing under greenhouse condition.

Materials and Method

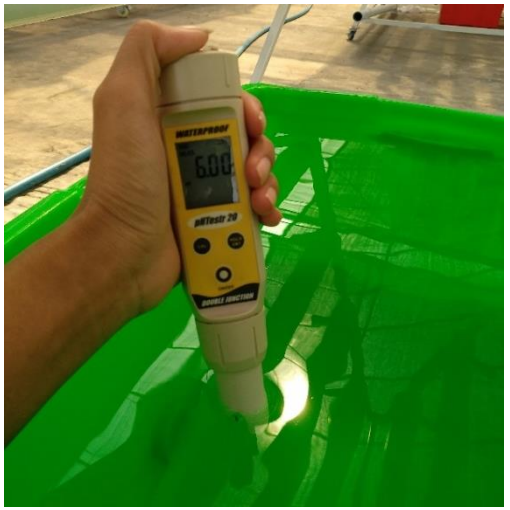
- conducted at Plant Biotechnology Center, Mingaladon Tsp., Yangon, from Nov 2019 to Jan 2020.
- lettuce cultivar “Rapido 344” on Nov 2019
- young plants (15 days after sowing, DAS) were transplanted into hydroponics system.

Nutrient Solution

- Yoshida and additional 40 cc (PBC40), 60 cc (PBC60) and 80 cc (PBC80) of the commercial foliar fertilizer (Bayfolan 11-8-6 liquid foliar fertilizer)
- commercial Bayfolan foliar fertilizer composed of N (11%), P_2O_5(8%), K_2O (6%), Fe(0.0176%), Mn (0.0130%), Cu (0.0072 %), Zn (0.0056%), B (0.0049%) and Mo (0.0007%).

Maintenance of Nutrient Solution

- nutrient solution pH-6.
- pH was measured and adjusted once in a week kept at pH 6 by adding NaOH or HCl as per needed and
- nutrient solution was changed in every two weeks interval.



Experimental Design

- RCB with three replications
- shelves were designed as “A” shaped (6 ft x 6 ft x 4 ft) with 5 PVC pipes in each side and the spacing between pipe was 1 ft.
- the diameter of PVC pipe was 3 in.
- the hole which has diameter of 2.5 in were used for germination.
- the spacing between holes was 4.7 in.
- the plastic cups (width x height- 2.8 in x 3.2 in) were used. After putting the cups, the height above the PVC was 1 in.
- single plant per plot was sown in each hole.

Data Collection

- fifteen days old lettuce plants were transplanted into hydroponic culture and these were harvested after 14, 21, and 28 days after transplanting (DAT).
- the response variables measured were plant height (cm), number of leaves, fresh and dry weight (gm).
- five plant samples were randomly harvested for data collecting.

Statistical Analysis

- The data were analyzed using IBM-SPSS v 23, and mean separation was performed using LSD test at ($p<0.05$).

Result and Discussion

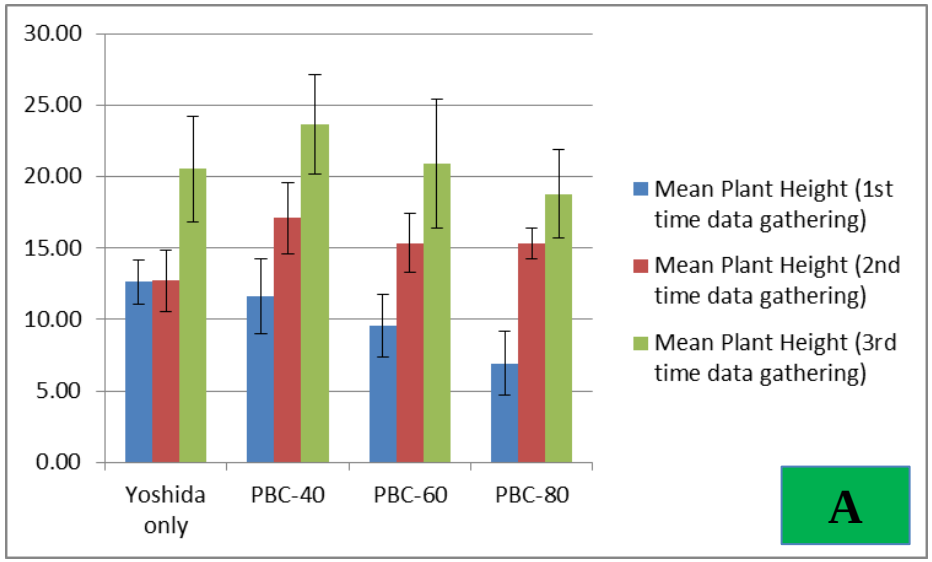
Table 1. Mean ± standard deviation of plant height (cm), no. of leaves, fresh weight (gm) and dry weight (gm) in different nutrition of hydroponic experiments. Yoshida solutions and Bayfolan (11-8-6) liquid foliar fertilizer.

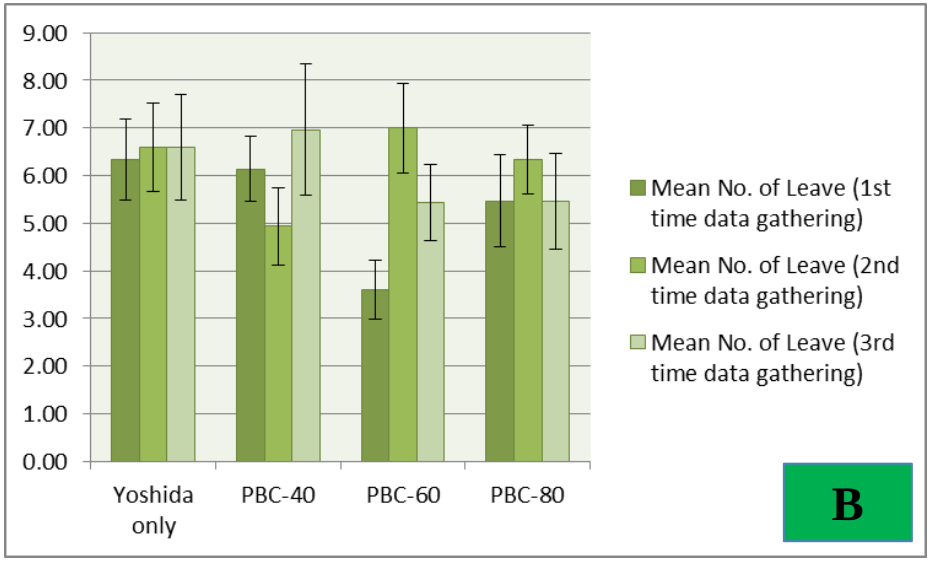
Growth Stage	Nutrient composition	Plant Height (cm)	No. of Leaves	Fresh Weight (gm)	Dry Weight (gm)
Average over three data collection	Yoshida only	15.30 ± 2.13 AB	6.51 ± 0.49 A	1.188 ± 0.443 B	0.051 ± 0.014 B
	PBC40	17.46 ± 0.25 A	6.01 ± 0.51 AB	2.002 ± 0.353 A	0.111 ± 0.028 A
	PBC60	15.27 ± 0.61 AB	5.34 ± 0.08 B	1.309 ± 0.399 B	0.075 ± 0.022 B
	PBC80	13.67 ± 1.52 B	5.76 ± 0.52 AB	0.659 ± 0.168 B	0.033 ± 0.011 C
	F test	3.99^{ns}	3.72^{ns}	7.19*	8.44**
I (14 DAT)	Yoshida only	12.65 ± 1.05 A	6.33 ± 0.23 A	0.600 ± 0.063 A	0.022 ± 0.001 A
	PBC40	11.62 ± 1.23 AB	6.13 ± 0.42 AB	0.598 ± 0.267 A	0.028 ± 0.014 A
	PBC60	9.54 ± 1.32 AB	3.6 ± 0.69 C	0.321 ± 0.171 AB	0.015 ± 0.008 AB
	PBC80	6.93 ± 0.76 C	5.47 ± 0.23 AB	0.138 ± 0.077 B	0.008 ± 0.003 B
	F test	15.51**	24.49**	5.59*	3.18ns

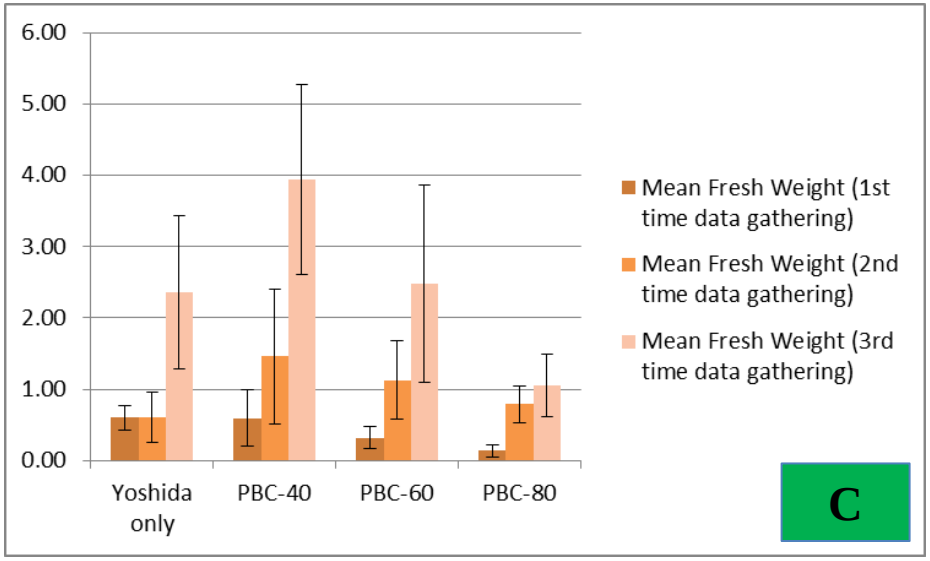
Table 1. Continued…

Growth Stage	Nutrient composition	Plant Height (cm)	No. of Leaves	Fresh Weight (gm)	Dry Weight (gm)
II (21 DAT)	Yoshida only	12.73 ± 0.87 B	6.60 ± 0.35 A	0.605 ± 0.078 B	0.032 ± 0.004 B
	PBC40	17.09 ± 0.89 A	4.93 ± 0.64 A	1.461 ± 0.549 A	0.082 ± 0.039 A
	PBC60	15.34 ± 0.96 B	7.00 ± 0.35 A	1.131 ± 0.432 AB	0.065 ± 0.026 AB
	PBC80	15.29 ± 3.73 B	6.33 ± 0.83 A	0.789 ± 0.402 AB	0.045 ± 0.024 AB
	F test	2.37ns	7.19**	2.62ns	2.08ns
III (28 DAT)	Yoshida only	20.52 ± 5.29 A	6.60 ± 1.39 A	2.358 ± 1.389 B	0.098 ± 0.038 BC
	PBC40	23.66 ± 0.81 A	6.97 ± 0.81 A	3.946 ± 0.245 A	0.224 ± 0.031 A
	PBC60	20.92 ± 1.05 A	5.43 ± 0.12 A	2.474 ± 0.659 B	0.143 ± 0.036 B
	PBC80	18.77 ± 0.23 A	5.47 ± 0.57 A	1.053 ± 0.032 B	0.048 ± 0.06 C
	F test	1.64ns	2.53ns	6.92*	17.93**

Means followed by the same letters in rows are not significantly different ($p>0.05$) by LSD test; F*= ($p<0.05$), **=($p<0.01$), ns= not significant ($p<0.05$).







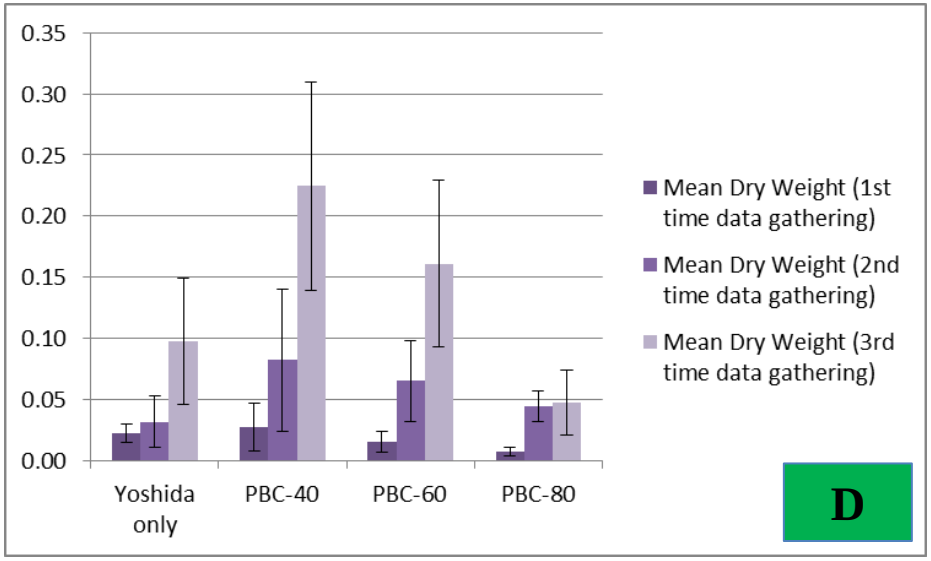


Figure 1. Mean and standard deviation of (a) Plant height, (b) no. of leaves, (c) fresh weight and (d) dry weight of lettuce grown under different nutrient solutions (14 DAT= 1st time data gathering, 21 DAT =2nd time data gathering, 28 DAT=3rd time data gathering).

Conclusions

- the increase in concentration by adding 40 cc of Bayfolan 11-8-6 liquid foliar fertilizer has higher value in plant height and leave number compared to Yoshida solution only although these are not significantly differences.
- however, increasing concentration by adding upto 80 cc Bayfloan liquid foliar fertilizer did not contribute to yield (fresh weight and dry weight).
- yield reduction due to increased concentration of nutrient solution has been observed in study of Miceli et al. (2003).

Future Prospects

- hydroponic culture research will be conducted for biofortication purpose of oligo elements (e.g. iodine (I), selenium (Se), silicon (Si) and calcium (Ca).
- in addition, hydroponic technique such as static solution culture (floating method) will conduct at fully controlled environments in order to create a micro climate as Inlay Lake to make sustainable crop model for floating agriculture in this area.
- Aquaponic

Some Activities of Hydroponic Research


THANK YOU.
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