

**YIELD COMPARISON OF LETTUCE (*Lactuca sativa L.*) GROWN IN
HYDROPONICS USING FISH EFFLUENTS AND INORGANIC
FERTILIZER**

BY

R.M.U. RATHNAYAKA



Project Report
Library - EUSL



437

FACULTY OF AGRICULTURE

EASTERN UNIVERSITY

SRI LANKA

2016

PROCESSED
State Library, Colombo

ABSTRACT

Aquaponics, the integration of aquaculture and hydroponic crop production represents a more environmental friendly and energy efficient method of production than each method practiced in isolation. The food insecurity situation with respect to Sri Lanka is illustrated by the fact that, worst malnutrition status is observed. Aquaponics, as a closed loop system consisting of hydroponics and aquaculture elements, can contribute towards these problems. But Sri Lankan Agricultural sector has not yet initiated Aquaponics. Therefore this experiment was conducted to compare yield of lettuce grown in hydroponics using fish effluents and inorganic fertilizer. The experiment was arranged in a Complete Randomized Design (CRD) with five treatments (Water, Albert's solution, Catla waste water, Common carp waste water and Tilapia waste water) and four replications. Plant height, Canopy diameter, Number of leaves, Root length, Leaf fresh weight, Leaf dry weight, Root fresh weight, Root dry weight and Total yield were measured as plant growth measurements. Initial biomass/Fish, Final biomass/Fish, Initial stocking density and Final stocking density were measured as fish growth measurements. The result demonstrated that Albert's solution treated plants showed highest yield performance compared to the other nutrient solutions treated plants followed by higher yield obtained from waste water from Tilapia tank. Fish water solution did not fulfill the nutrient requirement due to fingerling stage of fish. Therefore, it could be concluded that higher yield was obtained in Albert's solution. While, selecting suitable age stage of fish and quality of feed can be expect to get higher yield like as in Albert's solution.

TABLE OF CONTENT

ABSTRACT	i
ACKNOWLEDGEMENT	ii
TABLE OF CONTENT	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF PLATE	ix
LIST OF ABBREVIATIONS	x
CHAPTER ONE	1
INTRODUCTION	1
OBJECTIVE;	4
CHAPTER TWO	5
REVIEW OF LITERATURE	5
2.1 Soil less culture	5
2.1.1 Hydroponic systems	5
2.1.1.1. Strength and weaknesses of Hydroponic plant growing systems	7
2.2 Hydroponic for lettuce production	9
2.2.1. Nutritional requirements	10
2.2.2. Advantages Associated With Hydroponics in the lettuce Production	11
2.3. Nutrient solutions	12
2.4. Aquaculture	13
2.4.1. Nutrient content of aquaculture waste	13
2.5. Aquaponics	13
2.5.1. Action of nitrifying bacteria and tank 'cycling'	15
2.5.2. Plant species	15
2.5.3. Fish species	16

2.5.3.1. Feeding.....	17
2.5.4. Water Quality.....	17
2.5.5. Advantages of Aquaponics	18
CHAPTER THREE.....	20
MATERIALS AND METHOD	20
3.1. Experimental Location.....	20
3.2. Treatments.....	20
3.3. Experimental design.....	20
3.4. The Aquaponic system.....	21
3.5. Crop establishment.....	21
3.6. Nutrient circulating system	22
3.7. Albert's solution.....	22
3.8. Rearing of fish.....	23
3.9. Data collection	24
3.9.1. Plant Growth Measurements.....	24
3.9.1.1. Plant height (cm).....	24
3.9.1.2. Canopy diameter (cm).....	24
3.9.1.3. Number of leaves	24
3.9.1.4. Root length (cm)	24
3.9.2. Harvesting parameters.....	24
3.9.2.1. Fresh weight of plants (g)	24
3.9.2.2. Fresh weight of leaves (g).....	25
3.9.2.3. Fresh weight of roots (g).....	25
3.9.2.4. Leaf dry weight per plant (g)	25
3.9.2.5. Root dry weight per plant (g).....	25
3.9.2.6. Total yield (ton/ha).....	25
3.9.3. Fish Growth Measurements	25
3.9.3.1. Body Weight	25
3.9.3.2. Initial stocking density [kg m ⁻³].....	26
3.9.3.3 Final stocking density [kg m ⁻³]	26
3.9.3.4. Mortality.....	26
3.9.4. Nutrient solution parameter.....	26

3.9.5. Nutrient composition in Rice bran	27
3.10. Data analysis	27
CHAPTER FOUR.....	28
RESULTS AND DISCUSSION	28
4.1. Nutrient solution	28
4.1.1. Nutrient solution composition.....	28
4.1.2. Nutrient increment in fish waste water	29
4.1.2. Temperature in nutrient solutions	32
4.1.3. pH of nutrient solutions.....	33
4.1.4. Electric Conductivity in nutrient solutions	34
4.2. Plant growth measurements	35
4.2.1. Plant height	35
4.2.3. Number of leaves	36
4.2.4. Root length.....	37
4.3. Harvesting parameters.....	39
4.3.1. Plant, leaf and root fresh weight per plant	39
4.3.2. Dry matter content.....	40
4.4.2. Initial stocking density and final stocking density.....	43
4.4.3. Mortality percentage	44
CHAPTER FIVE.....	46
CONCLUSION.....	46
SUGESSTIONS FOR IMPROVEMENTS.....	47
REFERENCES.....	48