

631.7

An1

2007

PERFORMANCE OF DRIP-IRRIGATED LETTUCE
UNDER VARIOUS SOIL SUBSTITUTES

THESIS

JERWIN C. ANACAN

College of Engineering and Information Technology
CAVITE STATE UNIVERSITY
Indang, Cavite

April 2007

✓
**PERFORMANCE OF DRIP-IRRIGATED
LETTUCE UNDER VARIOUS
SOIL SUBSTITUTES**

**Undergraduate Thesis
Submitted to the Faculty of the
Cavite State University
Indang, Cavite**

**In partial fulfillment
Of the requirements for the degree of
Bachelor of Science in Agricultural Engineering**

JERWIN C. ANACAN
April 2007

ABSTRACT

ANACAN, JERWIN C., Performance of Drip-Irrigated Lettuce Under Various Soil Substitutes. Undergraduate Thesis. Bachelor of Science in Agricultural Engineering, Cavite State University, Indang, Cavite. February, 2007. Adviser: Dr. Leyma L. Cero.

The study was conducted at CvSU, Indang, Cavite from January 26, 2006 to February 24, 2006. The study aimed to: a) evaluate the performance of lettuce grown under the drip irrigation system; b) determine the growing medium suited for growing lettuce under drip irrigation system; and c) determine the cost of the study.

The study was conducted with four treatments having three replications each. The treatments were: T1 (pure coir dust), T2 (50 % coir dust and 50 % carbonized rice hull), T3 (50 % coir dust and 50 % saw dust) and T4 (50 % coir dust, 25 % saw dust and 25 % carbonized rice hull). The treatments were arranged in Completely Randomized Design (CRD).

The study revealed that the plant height, number of leaves, leaf diameter, leaf length, root length and yield were significantly affected by the different growing media. Lettuce grown in treatments having a mixture of coir dust and carbonized rice hull produced the greatest yield.

The fixed cost and the variable cost of the study amounted to P 7,273.50 and P 2,161.55, respectively, giving a total cost of P 9,435.05.

TABLE OF CONTENTS

| | Page |
|---|-------------|
| BIOGRAPHICAL DATA | iii |
| ACKNOWLEDGMENT | iv |
| ABSTRACT | vi |
| LIST OF TABLES | x |
| LIST OF FIGURES | xi |
| LIST OF APPENDIX TABLES | xii |
| LIST OF APPENDIX FIGURES | xiv |
| INTRODUCTION | 1 |
| Significance of the Study | 2 |
| Objectives of the Study | 2 |
| Time and Place of the Study | 3 |
| Scope and Limitation of the Study | 3 |
| REVIEW OF RELATED LITERATURE | 4 |
| MATERIALS AND METHODS | 14 |
| Materials | 14 |
| Methods | 14 |
| Design of the irrigation system | 14 |
| Construction of the system | 14 |
| Growing medium preparation | 17 |

| | |
|---|-----------|
| Preparation of seedlings | 17 |
| Transplanting | 17 |
| Cultural management | 17 |
| Nutrient solution | 17 |
| Evaluation of the designed drip irrigation system | 18 |
| Experimental layout | 19 |
| Statistical analysis | 19 |
| Evaluation of the crop (lettuce) | 19 |
| Data gathering | 19 |
| RESULTS AND DISCUSSION | 22 |
| General Observations | 22 |
| Plant Height | 22 |
| Number of Leaves | 24 |
| Leaf Diameter | 25 |
| Leaf Length | 27 |
| Final Root Length | 28 |
| Total Yield of Lettuce (Original Form) | 29 |
| Total Yield of Lettuce (Marketable Form) | 31 |
| Solution Analysis | 32 |
| Cost Analysis | 32 |
| Distribution Efficiency and Distribution Uniformity | 34 |
| SUMMARY, CONCLUSION AND RECOMMENDATIONS | 35 |
| Summary and Conclusion | 35 |

| | |
|---------------------------|----|
| Recommendations | 36 |
| BIBLIOGRAPHY | 37 |
| APPENDICES | 39 |

LIST OF TABLES

| Table | | Page |
|-------|---|------|
| 1 | Chemical components of carbonized rice hull (CRH). | 9 |
| 2 | Nutrient solution for cultured lettuce | 18 |
| 3 | Final height of lettuce | 23 |
| 4 | Final number of leaves of lettuce | 25 |
| 5 | Final leaf diameter of lettuce | 26 |
| 6 | Final leaf length of lettuce | 28 |
| 7 | Final root length | 29 |
| 8 | Average individual yield of lettuce in grams (original form) | 30 |
| 9 | Average individual yield of lettuce in grams (marketable form) | 31 |
| 10 | Cost of producing lettuce under different soil substitutes | 32 |

LIST OF FIGURES

| Figure | | Page |
|--------|---|------|
| 1 | Preparation of support stands and growing containers | 15 |
| 2 | Installation of drip irrigation system | 16 |
| 3 | Experimental layout of the system | 20 |
| 4 | Weekly plant height of lettuce | 23 |
| 5 | Weekly number of leaves | 24 |
| 6 | Weekly leaf diameter | 26 |
| 7 | Weekly leaf length | 27 |

LIST OF APPENDIX TABLES

| Appendix Table | | Page |
|-------------------|---|------|
| 1 | Average weekly height of lettuce at Week 1 | 40 |
| 2 | Average weekly height of lettuce at Week 2 | 40 |
| 3 | Average weekly height of lettuce at Week 3 | 40 |
| 4 | Average weekly height of lettuce at Week 4 | 41 |
| 5 | Average weekly number of leaves of lettuce at Week 1 . . . | 41 |
| 6 | Average weekly number of leaves of lettuce at Week 2 . . . | 41 |
| 7 | Average weekly number of leaves of lettuce at Week 3 . . . | 42 |
| 8 | Average weekly number of leaves of lettuce at Week 4 . . . | 42 |
| 9 | Average weekly leaf diameter of lettuce at Week 1 | 42 |
| 10 | Average weekly leaf diameter of lettuce at Week 2 | 43 |
| 11 | Average weekly leaf diameter of lettuce at Week 3 | 43 |
| 12 | Average weekly leaf diameter of lettuce at Week 4 | 43 |
| 13 | Average weekly leaf length of lettuce at Week 1 | 44 |
| 14 | Average weekly leaf length of lettuce at Week 2. | 44 |
| 15 | Average weekly leaf length of lettuce at Week 3 | 44 |
| 16 | Average weekly leaf length of lettuce at Week 4 | 45 |
| 17 | Mean root length of lettuce at harvest | 45 |
| 18 | Average individual yield of lettuce (original form) | 45 |
| 19 | Average individual yield of lettuce (marketable form) | 46 |

| | | |
|----|---|----|
| 20 | ANOVA for final plant height | 46 |
| 21 | ANOVA for final number of leaves | 46 |
| 22 | ANOVA for final leaf diameter | 47 |
| 23 | ANOVA for final leaf length | 47 |
| 24 | ANOVA for final root length | 47 |
| 25 | ANOVA for final yield (original form) | 48 |
| 26 | ANOVA for final yield (marketable form) | 48 |
| 27 | Measurement of NPK content of the nutrient solution used | 48 |
| 28 | Daily pH of the solution upon transplanting, relative humidity and air temperature | 49 |
| 29 | Distribution efficiency and uniformity before transplanting | 50 |
| 30 | Distribution efficiency and uniformity after harvesting | 53 |
| 31 | Computation of distribution efficiency of the irrigation system | 57 |

LIST OF APPENDIX FIGURES

| Appendix Figure | | Page |
|--------------------|--|------|
| 1 | Photographic view of lettuce to be transplanted | 58 |
| 2 | Transplanting the lettuce | 58 |
| 3 | Photographic view of lettuce at 4th week | 59 |
| 4 | Yield of lettuce (Treatment 1) | 59 |
| 5 | Yield of lettuce (Treatment 2) | 60 |
| 6 | Yield of lettuce (Treatment 3) | 60 |
| 7 | Yield of lettuce (Treatment 4) | 61 |
| 8 | Yield of lettuce at different treatments | 61 |
| 9 | Pressurized tank and sprinkler | 62 |
| 10 | Graduated cylinders, thermometers and hygrometer | 62 |

PERFORMANCE OF DRIP-IRRIGATED LETTUCE UNDER VARIOUS SOIL SUBSTITUTES

JERWIN CORTEZ ANACAN

^{1/} An undergraduate thesis presented to the Faculty of the Department of Agricultural and Food Engineering, College of Engineering and Information Technology, Cavite State University, Indang, Cavite in partial fulfillment of the requirements for the degree of Bachelor of Science in Agricultural Engineering with Contribution No. AE – 2006 – 07 - 001. Prepared under the supervision of Dr. Leyma L. Cero.

INTRODUCTION

Drip irrigation is the slow and precise application of water or nutrient solution directly to the plant's root zone. It maintains near-perfect moisture level in the root zone of plants, avoiding the too wet/too dry swings typical of water head watering. In traditional watering methods, there is extreme fluctuation in the water content, temperature and aeration of the soil, resulting in plant stress. In drip watering method, the moisture content of the soil is kept relatively constant and oxygen is ensured to remain available to the root system.

Drip irrigation has its important role in agriculture. In many parts of the world, it is the only option available for harsh climates with limited water supplies.