

EFFECT OF TWO BACTERIAL STRAINS ON VEGETATIVE GROWTH AND YIELD RESPONSE IN THE SRI LANKAN TRADITIONAL RICE VARIETY OF “KURULUTHUDA”



By

W.G.A Kavya Devindi



FTC316

Main Library, Eastern University, Sri Lanka

Department of Biosystems Technology

Faculty of Technology

Eastern University, Sri Lanka

Chenkalady

2026

ABSTRACT

Rice is a major food for humans in worldwide especially, in Sri Lanka. For more than three millennia, Sri Lankan farmers have developed, preserved, and utilized traditional rice types. The main objective of this research was to evaluate the two bacterial strains on vegetative growth and yield response in the Sri Lankan traditional rice variety of “Kuruluthuda”. The pots experiment was conducted under Completely Randomized Design (CRD) with Three treatments. Kuruluthuda is traditional red rice variety in Sri Lanka (Accession Nu of Kuruluthuda:3549). Bacteria strains were used as bacterial-based biofertilizers. They were known as “Plant Growth Promoting Bacteria”. In this study, used two bacterial treatments and another one is control. Bacteria strains were members of the *Bacillus* genus. In this study, Treatment One was known as Bacterial strain I-I (Accession Nu: PV174539). The treatment two was known as Bacterial strain I-II (Accession Number:174565) in NCBI. These Bacteria were already isolated from Rhizosphere soil and 16S rRNA gene was partially sequenced using sanger dideoxy sequencing method by Faculty of Agriculture, University of Ruhuna. Biofertilizers were added once every two weeks for rice plants. Vegetative growth parameters were analyzed by ANOVA version of Minitab 17 at 0.05 significant level. Bacteria strain I-I (T1) had significantly different from other two treatments in plant height. T1 had highest mean plant height ($118.00 \pm 3.62\text{cm}$). T2 recorded minimum mean plant height ($94.50 \pm 9.12\text{cm}$). T3 indicate the moderate mean plant height ($110.00 \pm 3.03\text{cm}$). About tiller number had no significant difference by treatments. Statistically significant difference among treatments results in number of leaves. Bacterial strain I-I (T1) resulted in the longest leaves while bacterial strain I-II (T2) produced the shortest but higher width, and the control plants (T3) showed moderate values. Also, Colour of leaves were observed by visually using Leaf Colour Chart. Bacterial strain I-II (T2) had very greenest colour other than treatments. The study demonstrates that *Bacillus* inoculation can improve vegetative growth and yield in traditional rice varieties of Kuruluthuda, offering a sustainable alternative to chemical fertilizers.

Key words: *Bacillus* sp., Biofertilizer, Kuruluthuda, Plant Growth Promoting Bacteria, Vegetative growth

TABLE OF CONTENT

DECLARATION	iii
DEDICATION	iv
ACKNOWLEDGMENT.....	v
ABSTRACT.....	vi
TABLE OF CONTENT	vii
LIST OF FIGURES	xi
LIST OF TABLES.....	xii
ABBREVIATIONS AND SYMBOLS.....	xiii
CHAPTER 01	1
INTRODUCTION	1
1.1 Problem statement.....	2
1.2 Objectives.....	3
1.2.1 Overall objective.....	3
1.2.2 Specific objectives.....	3
CHAPTER 02	4
LITERATURE REVIEW	4
2.1 Rice (<i>Oryza sativa</i> L.).....	4
2.2 Origin of rice	4
2.3 Taxonomy.....	5
2.3.1 Classification of <i>Oryza sativa</i>	5
2.4 Morphology of rice.....	6
2.5 Growth stages of rice.....	6
2.5.1 Vegetative growth phase	6

2.5.2 Reproductive phase.....	7
2.5.3 Maturation phase	7
2.6 Traditional rice variety in Sri Lanka	8
2.6.1 Nutritional composition and Medicinal Value of Traditional rice variety of “Kuruluthuda”	9
2.7 Fertilizer	9
2.7.1 Biofertilizer.....	10
2.8 Plant Growth Promoting Bacteria (PGPB)	10
2.8.1 Mechanisms of Plant Growth Promoting Bacteria	11
2.8.1.1 Direct mechanisms.....	11
2.8.1.1.1 Nitrogen fixation	11
2.8.1.1.2 Phosphate Solubilization	11
2.8.1.1.3 Potassium Solubilization	12
2.8.1.1.4 Phytohormone production	13
2.8.1.1.5 Siderophore Production	13
2.8.1.2 Indirect mechanisms	14
2.8.1.2.1 Antibiotic production	14
2.8.1.2.2 Competition.....	14
2.9 <i>Bacillus</i> sp as PGPB.....	15
2.9.1 Genus of <i>Bacillus</i> sp.	15
2.9.2 <i>Bacillus</i> Species: A Microbial Approach to Sustainable Agriculture	16
2.10 Strategies to Maximize the Functional Potential of PGPB	17
2.11 Impact of Bio-Inoculants on Reducing Chemical Fertilizer Dependency in Crops	17
CHAPTER 03	19
MATERIALS AND METHODOLOGY	19

3.1 Introduction	19
3.2 Location.....	19
3.3 Climate and Soil	19
3.4 Planting material	20
3.5 Experiment	20
3.6Experimental Design	21
3.7Agronomic Practices	22
3.7.1 Seed germination	22
3.7.2 Nursery Management	23
3.7.3Exposed to sunlight	23
3.7.4 Pots and labels preparation.....	23
3.7.5 Planting of “kuruluthuda” Plants.....	23
3.8 Laboratory Practices.....	24
3.8.1 Preparation of LB media.....	24
3.8.2 Bacteria inoculation.....	24
3.8.3 Measuring Optical Density (OD Value).....	25
3.9Application of Bacterial based biofertilizer	25
3.10 Management practices.....	26
3.10.1 Irrigation management.....	26
3.10.2 Weed control.....	26
3.11Data collection.....	27
3.11.1 Vegetative Growth Parameters.....	27
3.11.1.1 Plant Height	27
3.11.1.2 Number of leaves	27
3.11.1.3 Length of the leaf.....	27

3.11.1.4 Width of the leaf	28
3.11.1.5 Visual Evaluation of Leaf Colour by LCC (Leaf Colour Chart)	28
3.12 Data Analysis	29
CHAPTER 04	30
RESULTS AND DISCUSSION	30
4.1 Determination of vegetative growth parameters of Sri Lankan traditional rice variety of “Kuruluthuda”	30
4.1.1 Plant Height	30
4.1.2 Number of Tillers	32
4.1.3 Number of leaves	34
4.1.4 Leaf Length	36
4.1.5 Leaf width	38
4.1.6 Visual Evaluation of Leaf Colour by LCC (Leaf Colour Chart)	40
CHAPTER 5	42
CONCLUSION	42
Future Recommendations	42
REFERENCES	43
Annexes	48