



## CERTIFICATE

This is to certify that the thesis entitled “**HARNESSING THE BENEFITS OF GROUNDNUT AND TODDY PALM SHELL BIOCOMPOST ON SELECTED CROPS**” submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641043, in partial fulfilment of the requirements for the award of the degree of **DOCTOR OF PHILOSOPHY IN BOTANY**, is a record of original research work done by **V. KARTHIYA**, during the period of her study (July 2017 – March 2024) in the Department of Botany, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, under my supervision and guidance and the thesis has not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship or similar titles to any candidate of any other University or Institute.


  
Signature of the Supervisor


  
Head of the Department

  
Signature of the Dean

## DECLARATION

I hereby declare that the thesis entitled “**HARNESSING THE BENEFITS OF GROUNDNUT AND TODDY PALM SHELL BIOCOMPOST ON SELECTED CROPS**” is the result of the investigation carried out by me in the Department of Botany, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, under the supervision and the guidance of **Dr. A. VIJAYALAKSHMI**, M.Sc., M.Phil., Ph.D., Professor & Head, Department of Botany, Dean Academics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and it has not been submitted for the award of any Degree / Diploma / Associateship / Fellowship or similar title of any other University or Institute.

  
Signature of the Supervisor

  
Signature of the Candidate

## ACKNOWLEDGEMENT

First and foremost, praises and thanks to the **God Almighty** for giving me strength, wisdom, health and courage and showering his blessings throughout my research work to complete the thesis successfully.

I take this opportunity to sincerely thank **Padmabhusan Dr. T.S. Avinashilingam Ayya**, Founder and First Chancellor of Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and **Padmasree Dr. Rajammal P. Devadas, M.A., M.Sc., Ph.D.**, First Vice Chancellor and Former Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for providing and shaping this temple of learning.

I express my sincere thanks to our esteemed **Thiru. T.S.K. Meenakshi Sundaram, M.A., M.Phil., Ph.D.**, Chancellor and Managing Trustee, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for providing the opportunity to conduct my investigation in this esteemed institution.

I record my gratitude and heartfelt thanks to **Dr. (Mrs.) V. Bharathi Harishankar M.A., M.Phil., Ph.D., FRSA**, Vice Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for providing necessary facilities for the completion of the study.

My sincere thanks to **Dr. (Mrs.) S. Kowsalya, M.Sc., M.Phil., Ph.D.**, Registrar, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for her motivation and help rendered during the investigation.

I express my deep sense of gratitude to **Dr. S. P. Thyagarajan, Ph.D., M.D., D.Sc., FAMS., FNASc., FIMSA., FABMS., FFTM.**, Former Chancellor and **Dr. (Mrs.) Premavathy Vijayan, M.Sc., M.Ed., Dip. Spl. Edu. Ph.D.**, Former Vice Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for the facilities provided to carry out the thesis work.

I remain extremely grateful to **Dr. (Mrs.) K. Manimozhi, M.Sc., B.Ed., M.Phil., Ph.D.**, Controller of Examinations, Avinashilingam Institute for Home Science and Higher

Education for Women, Coimbatore for extending all possible help towards the submission of this work.

I extend my profound gratitude to **Dr. (Mrs.) P. Lalitha, M.Sc., M.Phil., Ph.D.**, Professor, Dean, Research and Consultancy (i/c) and **Dr. (Mrs.) G. P Jeyanthi, M.Sc., M.Phil., Ph.D.**, Former Director, Research and Consultancy and Controller of Examinations, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for their timely help constant support and valuable suggestions during the tenure of the research work.

I express my sincere heartfelt gratitude to my beloved research supervisor, **Dr. (Mrs.) A. Vijayalakshmi, M.Sc., M.Phil., Ph.D.**, Dean Academics, Professor and Head, Department of Botany, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore who paved the way towards the successful completion of my work by her eminent guidance, kind treatment, sustained interest, constant encouragement and constructive suggestions during the course of my study.

I am very much grateful to **Dr. A. S Krishnamoorthy, M.Sc., Ph.D.**, Former Registrar, Doctoral committee subject expert, Tamil Nadu Agricultural University, Coimbatore for his enthusiastic support critical suggestions and guidance given during the research investigation.

I express my thanks and gratitude to **all the teaching staff** members of the Department of Botany, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore who helped and encouraged me throughout the period of my study.

I gratefully acknowledge **Dr. M. U Sharief, M.Sc., Ph.D.**, Scientist 'F' & Head of office, Botanical Survey of India, Tamil Nadu Agricultural University, Coimbatore for his timely help in plant identification.

I am grateful to **Dr. P. Lakshminarayanan**, Assistant Professor, Kalasalingam Academy of Research and Education, Krishnankoil for permitting me to carry out certain experiments. I am highly thankful to **Mr. K. Selvakumar**, Euro Informatics, for his efficient job and timely help in printing the thesis.

I avail this opportunity to express my warm regards and sincere thanks to **Adi Dravidar and Tribal Welfare Scholarship**, Tamil Nadu for providing necessary financial support for my research work.

I express my profound sense of gratitude to all those who directly or indirectly helped me and made me possible to complete my study.

**(V. KARTHIYA)**

## LIST OF TABLES

Table No.	Title	Page No.
1	Physico-chemical composition of raw and composted groundnut shell and toddy palm shell	50
2	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	70
3	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	71
4	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub.) Var. MDU.1	73
5	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub.) Var. MDU.1	74
6	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	76
7	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	77
8	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	79
9	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	80
10	Effect of composted groundnut shell and toddy palm shell on yield parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4) on 90 DAS	97
11	Effect of composted groundnut shell and toddy palm shell on yield parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub.) Var. MDU.1) on 90 DAS	98

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
12	Effect of composted groundnut shell and toddy palm shell on yield parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4) on 90 DAS	99
13	Effect of composted groundnut shell and toddy palm shell on yield parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2) on 90 DAS	100
14	Effect of composted groundnut shell and toddy palm shell on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	111
15	Effect of composted groundnut shell and toddy palm shell on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of Cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub. Var. MDU.1)	112
16	Effect of composted groundnut shell and toddy palm shell on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of Coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	113
17	Effect of composted groundnut shell and toddy palm shell on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	114
18	Nutritional status of experimental soil	130
19	Nutritional status of pre harvest soil	130
20	Effect of composted groundnut shell and toddy palm shell on post harvest soil nutrients status of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	131
21	Effect of composted groundnut shell and toddy palm shell on post harvest soil nutrients status of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub. Var. MDU.1)	132
22	Effect of composted groundnut shell and toddy palm shell on post harvest soil nutrients status of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	133
23	Effect of composted groundnut shell and toddy palm shell on post harvest soil nutrients status of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	134

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
24	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	142
25	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	143
26	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub. Var. MDU.1)	145
27	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub. Var. MDU.1)	146
28	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	148
29	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	149
30	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	151
31	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	152
32	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on yield parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	157
33	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on yield parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub. Var. MDU.1)	158
34	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on yield parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	159

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
35	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on yield parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	160
36	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	165
37	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of cluster bean ( <i>Cyamopsis Tetragonoloba</i> (L.) Taub. Var. MDU.1)	166
38	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	167
39	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	168
40	Nutritional status of experimental soil	179
41	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on pre-harvested soil of test crops	179
42	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on post harvested soil analysis of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	180
43	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on post harvested soil analysis of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub.) Var. MDU.1	180
44	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on post harvested soil analysis of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	181
45	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on post harvested soil analysis of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	181

## LIST OF FIGURES

Figure No.	Title	Page No.
I	Microbial population during composting and vermicomposting of groundnut shell and toddy palm shell	48
II	FT-IR spectra of raw and composted groundnut shell and toddy palm shell	60
III	XRD analysis of raw groundnut shell, toddy palm shell and composted samples	61
IV	SEM micrographs of raw and composted groundnut shell	64
V	SEM micrographs of raw and composted toddy palm shell	65
VI	Effect of composted groundnut shell and toddy palm shell on carbohydrate content in leaves of bhendi, cluster bean, coriander and fenugreek	108
VII	Effect of composted groundnut shell and toddy palm shell on protein content in leaves of bhendi, cluster bean, coriander and fenugreek	109
VIII	Effect of composted groundnut shell and toddy palm shell on leghaemoglobin content in root nodules of cluster bean and fenugreek	118
IX	Effect of composted groundnut shell and toddy palm shell on carbohydrate content in fruits, pods and seeds of bhendi, cluster bean, coriander and fenugreek	122
X	Effect of composted groundnut shell and toddy palm shell on protein content in fruits, pods and seeds of bhendi, cluster bean, coriander and fenugreek	123
XI	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on carbohydrate content in leaves of bhendi, cluster bean, coriander and fenugreek	162
XII	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on protein content in leaves of bhendi, cluster bean, coriander and fenugreek	163
XIII	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on leghaemoglobin content in root nodules of cluster bean and fenugreek	172

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
XIV	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on carbohydrate content in fruits, pods and seeds of bhendi, cluster bean, coriander and fenugreek on 90 DAS	175
XV	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on protein content in fruits, pods and seeds of bhendi, cluster bean, coriander and fenugreek on 90 DAS	176

## LIST OF PLATES

Plate No.	Title	Page No.
1	Disposale of agricultural wastes	2
2	Bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench Var. (Co 4)	7
3	Cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub Var. MDU 1)	8
4	Coriander ( <i>Coriandrum sativum</i> L. Var. Co. 4)	9
5	Fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co 2)	10
6	Preparation of groundnut shell and toddy palm shell biocompost	36
7	Area of study	38
8	Details of experimental field preparation	39
9	Microbial population during composting and vermicomposting of groundnut shell and toddy palm shell	47
10	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4) on 25, 50 and 75 DAS	69
11	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub.) Var. MDU.1) on 25, 50 and 75 DAS	72
12	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of coriander ( <i>Coriandrum sativum</i> (L.) Var. Co.4) on 25, 50 and 75 DAS	75
13	Effect of composted groundnut shell and toddy palm shell on vegetative parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2) on 25, 50 and 75 DAS	78
14	Effect of composted groundnut shell and toddy palm shell on yield parameters of bhendi, cluster bean, coriander and fenugreek on 90 DAS	96
15	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of bhendi ( <i>Abelmoschus esculentus</i> (L.) Moench. Var. Co.4)	141

<b>Plate No.</b>	<b>Title</b>	<b>Page No.</b>
16	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of cluster bean ( <i>Cyamopsis tetragonoloba</i> (L.) Taub. Var. MDU.1)	144
17	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of coriander ( <i>Coriandrum sativum</i> L. Var. Co.4)	147
18	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on vegetative parameters of fenugreek ( <i>Trigonella foenum-graecum</i> L. Var. Co.2)	150
19	Effect of composted toddy palm shell compared with coirpith and effective microorganisms on yield parameters of bhendi, cluster bean, coriander and fenugreek	156

## LIST OF APPENDICES

Appendix No.	Title	Page No.
1	Estimation of Lignin	225
2	Estimation of Cellulose	226
3	Estimation of Organic carbon	227
4	Estimation of Total nitrogen	229
5	Estimation of Total phosphorus	230
6	Estimation of Total potassium	232
7	Estimation of Calcium and Magnesium	233
8	Estimation of Protein	235
9	Estimation of Carbohydrate	236
10	Estimation of Chlorophyll	237
11	Estimation of Leghaemoglobin content	239
12	Estimation of Available nitrogen in soil	240
13	Estimation of Available phosphorus in soil	241
14	Estimation of Available potassium in soil	242