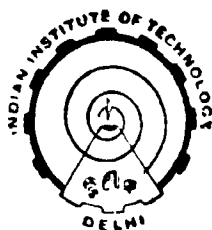


RECYCLING OF ORGANIC WASTES THROUGH EARTHWORMS FOR CROP GROWTH

BY

NEETA SHARMA

Thesis Submitted to the
Indian Institute of Technology, Delhi
for the Award of the Degree of
DOCTOR OF PHILOSOPHY



Centre for Rural Development and Appropriate Technology
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
NEW DELHI-110016

September 1986

DEDICATED TO

MY LOVING SON

VARUN

CERTIFICATE

This is to certify that the thesis entitled, "RECYCLING OF ORGANIC WASTES THROUGH EARTHWORMS FOR CROP GROWTH", submitted by Mrs. Neeta Sharma has been prepared under our supervision in conformity with the rules and regulations of Indian Institute of Technology, Delhi. The research report and results presented in this thesis have not been submitted for any degree in any other University/Institution.

Dr. O.P. Vimal,
Director
Department of Non-
Conventional Energy Sources,
Block No. XIV,
C.G.O. Complex, Lodi Road,
New Delhi-110003.

Mira Madan
Dr. (Mrs) Mira Madan
F.L.S., F.P.S.I.
Senior Scientific Officer-I
Centre for Rural Development and
Appropriate Technology,
Indian Institute of Technology,
New Delhi-110016.

ACKNOWLEDGEMENTS

It is my great pleasure and privilege to express profound indebtedness to Dr.(Mrs) Mira Madan, my guide and mentor, for her valuable guidance, constructive criticism, stimulating discussions and constant inspiration offered at each and every stage of this work, as a consequence of which the present study reached fruition. I place on record my sincere thanks to her. I am equally thankful to the co-supervisor Dr.O.P.Vimal, Director, Department of Non-conventional Energy Sources, New Delhi, for his valuable suggestions, advice and discussions during the entire period of study. To me instead of being formal and official, he has always been informal, cordial and homely.

It is my privilege to have Prof.(Mrs.) P.Vasudevan, as Head of the Department, who in her capacity extended all possible help. I am highly indebted for her assistance and her keen interest in my work. I deeply acknowledge the constant encouragement and help of Prof.S.V.Patwardhan, the former Head, Centre for RD&AT, which was a big moral support extended to me during this work.

I am grateful to Zoological Survey of India, Calcutta, for the identification of earthworm species.

Sincere thanks are also due to Dr.J.S.Kushwaha and Shri Rajbir Singh, Indian Agriculture Research Institute, New Delhi, for their help and cooperation. Due interest shown and cooperation extended by my colleagues and faculty members of the Centre for RD&AT is thankfully acknowledged.

I have no befitting words to express my deep sentiment towards my beloved parents for their endless tolerance and moral support during the course of present investigations.

I wish to record my thanks to Mr.Narang for his patient typing of this thesis.

Lastly, I am thankful to my close friend Mrs. Vibha for her continuous encouragement.

(NEETA SHARMA)

C O N T E N T S

Page

CHAPTER-1

INTRODUCTION AND OBJECTIVES 1-8

CHAPTER-II

REVIEW OF LITERATURE 9-47

- 2.1 Availability and characteristics of organic wastes. 9-22
- 2.2 Agricultural value of organic wastes 23-27
- 2.3 Health aspects and environmental pollution 27-28
- 2.4 Role of earthworms 29-47
- 2.4.1 Castings 31-33
- 2.4.2 Effect of earthworms on soil structure 33-34
- 2.4.3 Effect of earthworms on crop yield 35-37
- 2.4.4 Mineralization of nutrients 38-39
- 2.4.5 Earthworms and pollution control 39-41
- 2.4.6 Organic recycling and earthworms 41-47

CHAPTER-III

MATERIALS AND METHODS 48-75

- 3.1 Collection, culturing and identification of earthworms 48-50
- 3.2 Pot experiment 50-58
- 3.3. Incubation experiment 59
- 3.4 Analysis of soil 59-71
- 3.5 Plant analysis 71-75
- 3.6 Statistical analysis 75

CHAPTER-IV

EXPERIMENTAL RESULTS AND DISCUSSION 76-161

- 4.1 Results 76-147
- 4.1.1 Effect of organic wastes alone and in combination with earthworms on dry matter yield of wheat grain 77-79

CONTENTS

contd...

Page

4.1.2	Effect of organic wastes alone and in combination with earthworms on dry matter yield of wheat straw	79-81
4.1.3	Effect of organic wastes alone and in combination with earthworms on dry matter yield of wheat crop	81-82
4.1.4	Effect of organic wastes alone and in combination with earthworms on nitrogen uptake by wheat grain	83-85
4.1.5	Effect of organic wastes alone and in combination with earthworms on nitrogen uptake by wheat straw	85-87
4.1.6	Effect of organic wastes alone and in combination with earthworms on nitrogen uptake by wheat crop	87-89
4.1.7	Effect of organic wastes alone and in combination with earthworms on phosphorus uptake by wheat grain.	90-92
4.1.8	Effect of organic wastes alone and in combination with earthworms on phosphorus uptake by wheat straw	92-94
4.1.9	Effect of organic wastes alone and in combination with earthworms on phosphorus uptake by wheat crop	94-96
4.1.10	Effect of organic wastes alone and in combination with earthworms on potassium uptake by wheat grain.	96-98
4.1.11	Effect of organic wastes alone and in combination with earthworms on potassium uptake by wheat straw	98-100
4.1.12	Effect of organic wastes alone and in combination with earthworms on potassium uptake by wheat crop	100-102

CONTENTS

		<u>Page</u>
4.1.13	Effect of organic wastes alone and in combination with earthworms on the available nitrogen status of the soil with wheat as the test crop	102-104
4.1.14	Effect of organic wastes alone and in combination with earthworms on the available phosphorus status of the soil with wheat as the test crop	104-106
4.1.15	Effect of organic wastes alone and in combination with earthworms on the available potassium status of the soil with wheat as the test crop	106-108
4.1.2.1.	Effect of organic wastes alone and in combination with earthworms on dry matter yield of maize grain	109
4.1.2.2.	Effect of organic wastes alone and in combination with earthworms on dry matter yield of maize straw	109-112
4.1.2.3	Effect of organic wastes alone and in combination with earthworms on dry matter yield of maize crop	113-114
4.1.2.4	Effect of organic wastes alone and in combination with earthworms on nitrogen uptake by maize grain	115-117
4.1.2.5	Effect of organic wastes alone and in combination with earthworms on nitrogen uptake by maize straw	117-118
4.1.2.6	Effect of organic wastes alone and in combination with earthworms on nitrogen uptake by maize crop	119-121
4.1.2.7	Effect of organic wastes alone and in combination with earthworms on phosphorus uptake by maize grain	121-123

CONTENTS

contd...

		<u>Page</u>
4.1.2.8	Effect of organic wastes alone and in combination with earthworms on phosphorus uptake by maize straw	123-125
4.1.2.9	Effect of organic wastes alone and in combination with earthworms on phosphorus uptake by maize crop	125-127
4.1.2.10	Effect of organic wastes alone and in combination with earthworms on potassium uptake by maize grain	127-129
4.1.2.11	Effect of organic wastes alone and in combination with earthworms on potassium uptake by maize straw	129-131
4.1.2.12	Effect of organic wastes alone and in combination with earthworms on potassium uptake by maize crop	131-133
4.1.2.13	Effect of organic wastes alone and in combination with earthworms on the available nitrogen status of the soil with maize as the test crop	133-136
4.1.2.14	Effect of organic wastes alone and in combination with earthworms on the available phosphorus status of the soil with maize as the test crop	136-138
4.1.2.15	Effect of organic wastes alone and in combination with earthworms on the available potassium status of the soil with maize as the test crop	138-141
4.1.3.1	Effect of enrichment of soil using organic wastes alone and in combination with earthworms on the changes in organic carbon	141-144
4.1.3.2	Effect of enrichment of soil using organic wastes alone and in combination with earthworms on the changes in C:N ratio	144-147
4.2.	Discussion	148-161
<u>CHAPTER-V</u>		
	SUMMARY AND CONCLUSIONS	162-170
	REFERENCES	171-189