ECO-FRIENDLY MANAGEMENT OF AGROWASTES AND ITS UTILITY IN CROP PRODUCTION

By

PAPPA MAHILA DEVI M.

97 PLS 07

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN - DEEMED UNIVERSITY, COIMBATORE - 641 043

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN LIFESCIENCES

MAY - 1999

ECO - FRIENDLY MANAGEMENT OF AGRO WASTES AND ITS UTILITY IN CROP PRODUCTION

By

M.PAPPA MAHILADEVI
(Reg.No.97 PLSO 7)

A Thesis submitted to the Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore - 641 043, In partial fulfilment of the requirements for the Degree of

MASTER OF SCIENCE IN LIFE SCIENCES

MAY 1999

CERTIFIED AS BONAFIDE RESEARCH WORK

Signature of the Head of
The Department

Signature of the
Guide

Acknowledgement

ACKNOWLEDGMENT

I wish to record my profound sense of gratitude to Dr(Tmt) Rajammal P.Devadas,M.A.,M.Sc., Ph.D., (ohio state),D.Sc (Madras),Hon. D.H.L. (Oregon State), Hon. D.H.L. (Ohio State), Hon.D.Sc (C.AZAD AGRI UNIVERSITY, KANPUR),Hon. D.Sc. (UNIVERSITY OF ULSTER NORTHERN IRELAND), Chancellor, Avinashilingam Institute for Home Science and Higher Education for women (Deemed University), Coimbatore for giving an opportunity to do this work.

I gratefully record my sincere gratitude to Dr.(Tmt) Lakshmi Santa Rajagopal, M.S.(Tennesse) Ph.D., (Madras) Vice chancellor , Avinashilingam Institute for Home Sciences and Higher education for women (Deemed University), Coimbatore, for the facilities provided to me by the institution and the keen interest shown by her in this study.

I wish to express my gratitude to Dr.(Tmt) Saroja Prabhakaran, M.A., Dip. in Ed (Madras), Ph.D, (Mother Teresa), Registrar Avinashilingam Institute for Home Science and Higher Education for women (Deemed University), Coimbatore, for providing facilities to carry out the work.

My Sincere thanks to Dr.(Tmt). S.Sivakamasundari M.Sc., (Annamalai) M.Phil, Phd (Madras) Dean, Faculty of sciences for providing facilities to carry out of work.

I wish to express my gratitude to Mrs.Rita Joseph, M.Sc., M.Phil., professor and Head of the Department of Botany Avinashilingam Institute for Home Science and Higher Education for women (Deemed University) Coimbatore, for her encouragement through out the study.

I wish to express my heart felt thanks to Dr.(Tmt) A.VIJAYALAKSHMI, M.Sc., M.Phil.,Ph.D (Bharathiar), Lecturer, Department of Botany, Avinashilingam Institute for Home Science and Higher Education for women (Deemed University) Coimbatore, for her dynamic and inspiring guidances, valuable advice and timely help given during the course of this study.

I record my deepest sense of gratitude to Miss.S.VIDHYA RANI,M.Sc., M.Phil., and Mrs.A.Sankarivadivu, M.Sc., M.Phil., Research scholars Department of Botany Avinashilingam Institute for Home Science and Higher Education for women (Deemed University) Coimbatore for their kind Co-operation and timely help through out the investigation.

I wish to express my gratitude to Dr.K.K.MATHAN, M.Sc., Ph.D., Professor and Head of the Department of soil science, Tamil Nadu Agriculture University for his timely help given during the course of this study.

My thanks are due to all other helping hands for their help and encouragement given.

Contents

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

1.	IL	-	INTERNODAL LENTH
2.	PL	-	PETIOLE LENGTH
3.	PFWT	-	PLANT FRESH WEIGHT
4.	PDWT	-	PLANT DRY WEIGHT
5.	NN	-	NUMBER OF NODULES
6.	VN	-	VOLUME OF NODULES
7.	POD LEN	-	POD LENGTH
8.	POD CIRCUM	-	POD CIRCUMFERENCE

Introduction

CHAPTER - I

INTRODUCTION

India is an agricultural country where, about 80% of the land is used for agricultural processes. Large quantities of crop residues such as straw, leaves, twigs, stobbles etc., are readily available in farms and agro based industries. Accumulation of these wastes from variety of sources causes environmental threats and health hazards. All these wastes cannot be applied or ploughed directly as such into the soil because of their wide C:N ratio (Ellicott et al., 1981)

To overcome such problems, these organic wastes are composted in appropriate manner with suitable microbial inoculants and used as organic manure in crop production. This kind of conversion of waste materials into useful organic manure is helpful for conserv ing fertiliser resources as well as controlling environmental pollution.

In India, sugarcane is grown on a surface of about 4 million hectares, with an average yield of 70t/ha. On an average, a hectare of sugarcane crop, leaves behind, 9-10 tonnes of trash. The amount of sugarcane trash available in India averages to about 6.7 t/ha and is an inexhaustible energy source considering its renewable character.(Goel.1999). Sugarcane trash have

high crude fibre and low nitrogen contents. They are thus of low nutritive value as animal fodder. At present cane trash is utilized as fuel, gur making, thatching and the remaining quantity is disposed of by burning. The compost making from sugarcane trash is not a practice due to its higher cost of its production and it decomposes at a very slow rate due to its wide C:N ratio, cellulose and lignin contents. This can be effectively composted by employing microbial inoculants.

High yield of modern agricuture are mainly dependant on chemical fertilizers. Due to the energy crisis as well as escalating prices of fertilizers, fertilizer consumption has shown a decreasing trend. Resorting to applications of biofertilizers and plant products like composts, minimize these problems as they posses many advantages which the chemical fertilizers lack.

Therefore, in the present investigation, sugarcane trash, which is available in a bulk in the sugarcane field is composted effectively using pure and mixed cultures of microorganisms. The effect of these composts were noted on greengram. (Vigna radiata [L])

OBJECTIVES:

(i) To minimise the pollution by utilising the vast potential of agrowastes by composting.

(ii) To evaluate the efficacy of the microorganisms in composting sugarcane trash.

(iii) To evaluate the impact of sugarcane trash compost on growth and yield of greengram.

(iv) To study the effect of Farm Yard-Manure and biofertiliers on growth and yield of greengram.

(v) To compare the effect of sugarcane trash compost with biofertiliers, FarmYard Manure and chemical fertiliers on growth and yield of green gram.

(vi) To analyse the post harvested soil samples.

Review of Literature

CHAPTER II

REVIEW OF LITEATURE

The available literature pertaining to the present investigation is reviewed and presented in this chatper.

Tambe and Wad as early as 1935, reported that from a yield of 20 tons of cane/acre, giving 42 tons of trash, 9.2tons of fresh manure can be made and thus the sugarcane crop could easily be made self supporting for its own requirement of humus.

Sanyasi Raju (1952) reported that application of organic manure increased the potassium content of the soil. Gawronska and Kulessa (1966) stated that the effect of manure on available P was dependent upon the decomposition of the organic manure.

Mahapatra (1971) found that combined application of sugarcane trash compost and N2 fertilizer proved to be useful in increasing production of wheat crop. Bezdicek and Magee (1974) reported that application of Farmyard manure increased the yield of Soyabean. Somani and Saxena (1975) observed considerable increase in available N status of soil due to the application of slowly decomposing Farm yard manure. Dube (1976) reported that Rhiobium inoculation was essential for N2 fixation in Soyabean.

The favourable effects of trash incorporation was attributed to Co2 enrichment of the soil atmosphere which is known to help in nodulation and N2 fixation Havelka and Hardy, (1976).

Gaur and Mukurjee (1979) reported that ploughing in straw at 2.5 & 10t/h in sandy loam alluvial soil increased nodulation & pod yield of groundnut over control.

According to Gaur et al., (1980), the residual, paddy straw significantly increased the grain yield of green gram by 20-23% over control.

Incorporation of cane trash enriched with chemical fertilizers and inoculated with microbial cultures produced beneficial effects on the growth parameters and yield characters of sugarcane. (Parkhe and Shinde, 1981). Selvakumari (1981) reported that exchangeable potassium increased with continuous application of manures due to increased content of potassium released from potassic fertilizers and farm yard manure. Application of sugarcane trash at 2.5 and 5 t/h increased the grain yield of wheat. (Bangar et al., 1981).

Rote and Shinde (1982), concluded from their study that the combination of sugarcane trash with Legume and fungus culture

benefitted the process of decomposition of sugarcane trash. Laddha et al., (1984), revealed that with progressive increase in phosphorus level, the average weight of soyabean increased.

Trash spreading in sugarcane field was found effective in weed control (Ladhive, 1984) Shinde et al., (1984) found that application of sugarcane trash at 2.5 and 5 t/h. significantly increased total biomass and grain yield of gram over control. Muthuvel and Sivaswamy (1985) revealed that combined application of organic fertiliers and farm yard manure besides rhizobial seed inoculation had evidently facilitated the vigourous growth of the Red gram. Improvement in yield due to farmwastes phospho composts was recorded in moong bean by Singh (1985).

Organic wastes had an influence on the available NPK and micronutrient in soil (Krishnan, 1986). Gaur (1987) observed a maximum yield of green gram with 60kg N plus compost amended with rock phosphate, Azotobacter and phosphate solubilizer. Yadav et al., (1987,a.) observed that the yield of greengram increased significantly due to incorporation of composted sugarcane trash. Yadav et al., (1987,b.) found that incorporation of trash at 0.25 and 5 tonnes / ha with Nitrogen increased the yield of sugarcane, and the maximum yield was at 5 t/h trash with 75kg N/h.

An incorporation of sugarcane trash with Nitrogenous fertilizer improved the soil properties and ultimately increased cane yield (Rasal et al., 1987). Rasal et al., (1989) studied that the application of sugarcane trash at a rate of 5 t/h gave higher yield of mungbean i.e. 31.5% more than control. Sidu and Beri (1989), showed that application of wheat residue improved the soil physical, chemical properties and also increased the grain and strover yield of corn significantly.

Jayapaul and Ganeshraja (1990) revealed that there was a significant increase in plant height of soyabean with 120kg P2 O5/ha in a soil of medium phosphorus availability. Solaiappan and Ramiah (1990) found that application of Farm yard manure and seed treatment with Rhizobium are beneficial in the productivity of legumes. Parr et al., (1990) stated that to obtain sustainability in farming, dependence on chemical fertilizers to be minimised and recycling of farm residues to improve fertility of soils to be practised. The increase in available nutrient content in soil with trash have been reported by Srivastava and Parkash (1990).

According to Mohod et al., (1991), the use of P-solubilizing organism appears to be promising in augmenting the yield and yield components of rice in lateritic soils. Bhat et al., (1991) found that long term recycling of crop residues

improved soil fertility and increased maize yield. Nachiarammal (1991) inferred that the combination of organics with bio fertilier incorporations recorded the highest plant growth & yield in soyabean.

Rani perumal et al., (1992) analyzed post harvest soil samples of sorgham and cowpea and reported higher available NPK in compost treated plots than non-treated plots. Deepa devi (1992) reported that soil available NPK had been enchanced significantly due to the application of enriched farmyard Manure and composted sugarcane trash. Shinde et al., (1992) evidenced that chopped trash at 7.5 mt/h increased the soil available N and P over unchopped trash, farm yard manure, and control. According to Thiageshwari (1992) composted sugarcane trash is best used as a manure and is a good source of nutrient to the crops.

Thimmegowda (1993) evidenced that the seed yeild of soyabean were increased due to NPK fertilizers. Shinde et al., (1993) indicated that sugarcane trash incorporation in ratoon cane help to improve crop condition and growth which was then reflected on higher cane yield. With the decomposition of trash in the soil, the organic acids are produced which would help in solubilising the nutrient in the soil and increasing their availabilty (Yadav et al., 1993). Boramanikar and Patil (1981) showed that chopped trash along with microbial culture gave highest yield over trash alone and control.

Mathan et al., (1994) reported that organic manure alongwith seed treatment recorded the highest yield and protein content of grain of red gram. Patel (1994) showed an advantageous effect on the pod character with fertilier application, rhizobial inoculation and incorporation of phosphobacteria. Vaidhya (1994) revealed that the Rhizobium inoculation improved grain weight, pod weight, total dry matter production of shoot,root and protein content of soya. Rahman and Bhuiyan (1994) inferred that application of decomposed straw compost plus NPK increased the growth and yield of wheat and Mungbean than the application of compost alone. Lavanya (1994) reported that Grain yield and N uptake were higher when a portion of Nitrogen applied is substituted by organic matter than when the entire quality of Nitrogen is applied as urea. Sennimalai (1994) noted that the application of organic wastes viz., Pressmud, farmyard manure. Coirpith, Paddystraw and sugarcane trash had increased the PH and EC of the soil in rice.

Tran Trison (1995) observed that application of composted organic wastes showed a better effect on the grain yield, plant nutrient concentration and biometric parameters of cowpea than control, enriched composted organic wastes and farm yard manure. Taichen yang (1995) evidenced that plant height, leaf area and yield of Phaseolus vulgaris were significantly

higher with the application of organic manure. Badole and Umole (1995) indicated that seed inoculation with Rhizobium in green gram increased seed yields on par with control. Results of Bhanavase and Patil (1995) showed that size of sugarcane trash, addition of rock phosphate and use of urea biofertilizer and moisture play signifiant role in mineralisation of compost.

Kathiresan and Manickam (1995) in a field experiment found that application of 31.5 Kg. Phosphate and soil inoculation with phosphobacteria gave similar cane sugar yields as the application with 63 kg phosphate.

Ramamurthy and Shivasankar (1996) evidenced that organic matter application significantly increased the grain yield and dry matter production at various growth stages of soyabean over control. The studies of Saxena et al., (1996) recorded a significant effect in the seed yield, number of pods and dry matter production of green gram with phosphorus and potassium application. Shukla and Dixit (1996) reported that rhizobium inoculation increased plant growth and seed yield of green gram over uninoculated plots by 15% . Pachiammal (1996) indicated that with the application of organic wastes, the availability of major and minor nutrients increases, as a result of which fertility status of soil is sustained. Siddhmalai (1996) inferred that organic matter serves as a source of NPK,

Zn, Cu, and Mn Nutrition of the crop and it has a great potential in increasing crop production. Bisht and Chandel (1996) showed that addition of Farm yard manure alone in black soil increased the seed yield and protein content over NPK fertilizers. Organic wastes increased the grain and straw yield of rice significantly over the application of chemical fertilier. (Velayudham et al., 1996). Prabhakaran (1996) evidenced that nodulation was highest in soyabean with or without farm yard manure and seed inoculated with rhizobium. Vaishya et al., (1996) indicated that the use of phosphobacteria significantly increased nodulation and plant biomass over control. The studies of Verma (1996) revealed that trash mulching increased cane yield slightly over control. Vallis et al., (1996) reported that stimulated yield were higher in trash blanket systems that in burn trash systems at all levels of fertilizer N. The results of Sutton et al., (1996) confirms a positive influence on the soil micro biota due to the retention of canetrash as a blanket. Bachhav and Sabale (1996) indicate that, addition of compost to soyabean gave a seed yield of 3.3 t/h and seed protein and oil contents were the highest with 50% each of urea and farm yard manure. Data on cane yield by Chelliah (1997) revealed that 1/3rd of the total nutrients must be preferably in the organic form to increase crop productivity and application of chemical fertilizer along with farmyard manure and bio-fertiliers resulted in 23% increase in cane yield over control. According to Patra and Bhattacharya (1997), Green gram

inoculated with rhizobium increased nodulation and seed yield over control. Detroja and Patel (1997) recorded a significant increase in the growth and yield parameters of groundnut due to inoculation of phosphate solubilising micro organisms. Kumrawat et al., (1997) proved that a combination of fertilizer Rhiobium and phosphate solubilising micro organisms would be more desirable for a higher seed yield and to fulfill the need of major nutrient requirement to soyabean. Traulsen, (1997) inferred that different amount of biologically waste compost on agriculturally used soil, significantly increased organic matter content of soil.

Ming and Bessor (1997) recommended the application of compost in field and po t experiments, which proved to be a good phosphorus and Potassic fertilizer. Adhikari et al., (1997), observed that phospho, sulpho Nitro compost along with bioinoculum enhanced the decomposition process and produced well humified organic matter which is manifold than direct incorporation of organic matter. According to Yaman and Cisoy (1997), the seed weight of Soyabean can be increased by inoculation with bacteria (Rhizobium).

Combined application of Brady rhiobium and Phosphobacteria increased the growth and yield parameters of soyabean (Thamizhvendan and Sheerin, 1998). Tomar and Verma

(1998) inferred that seed yield of mungbean was increased by inoculation with rhiobia strain. Vijayakumar and Sagwal (1998) reported that, the incorporation of sugarcane trash along with Nitrogen releases nutrients after decomposition, increasing crop growth and productivity. Venugopal (1999) evidenced that sugarcane germination percentage is increased due to micro climate formed by trash mulching.

Materials and Methods

CHAPTER-III

MATERIALS AND METHODS

The methodology adopted for the present investigation in discussed in this chapter.

PROCEDURE FOR COMPOSTING:

For composting one tonne of sugarcane trash, the trash was chopped intially and composted in 3 ways.

Compost I : Sugarcane trash + Cowdung + 5 kg urea.

CompostII : Sugarcane trash + Pleurotus (150 grams) + Trichoderma (150 grams) + 5kg urea.

Compost III : Sugarcane trash + Pleurotus (150 grams) + Cowdung + Trichoderma (150 grams) + 5kg urea.

During the process of composting, moisture level was maintained and subsequent turning was done at 10 days interval for 60 days.

GERMINATION EXPERIMENT:

The seed of Vigna radiata were soaked at different concentrations of compost extract and Farm Yard manure extract for 12 hours i.e Experiment I and 24 hours i.e. Experiment II.

The treatments were:

T1 : Control

T2 : 2.5% Composted sugarcane trash.

T3 : 5% Composted sugarcane trash.

T4 : 10% Composted sugarcane trash.

T5 : 10% Farm Yard manure.

T6 : 2.5% Farm yard manure + composted sugarcane trash.

T7 : 5% Farm yard manure + composted sugarcane trash.

T8 : 10% Farmyard manure + Composted sugarcane trash.

Seeds were germinated on the germiation towels. On the 7th day the following parameters were observed and recorded.

(a) Root length

(b) Shoot length

(c) Number of lateral roots.

(d) Fresh weight

(e) Dry weight.

POT CULTURE EXPERIMENTS.

Two sets of pot culture experiments were carried out. In Experiment III, V and VII, composted sugarcane trash, chemical fertilizers and Farm Yard manure were incorporated in the treatments as follows. Simultaneously a control was also maintained.

T1 : Absolute control

T2 : Raw Sugarcane trash.

T3 : N.P.K. 100%

T4 : Farm Yard manure - 12.5 t/ha.

T5 : Composted sugarcane trash (composted with cow dung).

T6 : Composted sugarcane trash (composted with pleurotus and Trichoderma).

T7 : Composted Sugarcane trash (Composted with Pleurotus, Trichoderma and cowdung).

In Experiments IV, VI, VIII, composted sugarcane trash, biofertilizers like Rhizobium and phosphobacteria were incorporated in treatments as follows.

T1 : N.P.K. 100% (control)

T2 : 43.75 gms composted sugarcane trash.

T3 : 70gms composted sugarcane trash.

T4 : 43.75 gms composted sugarcane trash + Rhizobium.

T5 : 70 gms composted sugarcane trash + Rhizobium.

T6 : 43.75 gms composted sugarcane trash + Phosphabacteria.

T7 : 70 gms composted sugarcane trash + Phosphobacteria.

T8 : 43.75 gms Composted sugarcane trash + Rhizobium + Phosphobacteria.

T9 : 70 gms composted sugarcane trash + Rhizobium + Phosphobacteria.

Simultaneously a control with chemical fertilizer alone was also maintained.

The parameters were analysed on 3 stages such as mid Vegetative, flowering and at harvest.

On 30th day plants were uprooted and noted for the following characters like,

Root length
Shoot length
No of leaves
Internodal length
Petiole length
Fresh weight
Dry weight

At Flowering stage, the plants were uprooted and noted for the following characters like:

Root length
Shoot length
No of leaves
Internodal length
Petiole length
Number of nodules
Volume of nodules
Fresh weight
Dry weight

At harvest, the pods were collected from the plants and noted for the parameters like:

Length of pod

Circumference of Pod

Number of seeds / Pod

Weight of seeds / Plant

100 seeds / weight

STATISTICAL ANALYSIS

The data obtained from various biometrical observations and yield parameters were subjected to the statistical analysis and based on the results inferences were drawn. Whenever the treatment differences were significant, critical differences were worked out.

SOIL ANALYSIS

Post harvest soil samples were collected and analysed for the following parameters:

PH - Soil reaction

EC - Electrical conductivity

N - Nitrogen

P - Phosphorus

K - Potassium

The data obtained were recorded.

Results And Discussion

CHAPTER - IV

RESULTS AND DISCUSSION

The results pertaining to the Germination and pot culture experiments, biometrical and yield parameters observed, post harvest soil samples analysis were discussed in this chapter. The nutrient contents of raw and composted sugarcane trash is as follows:

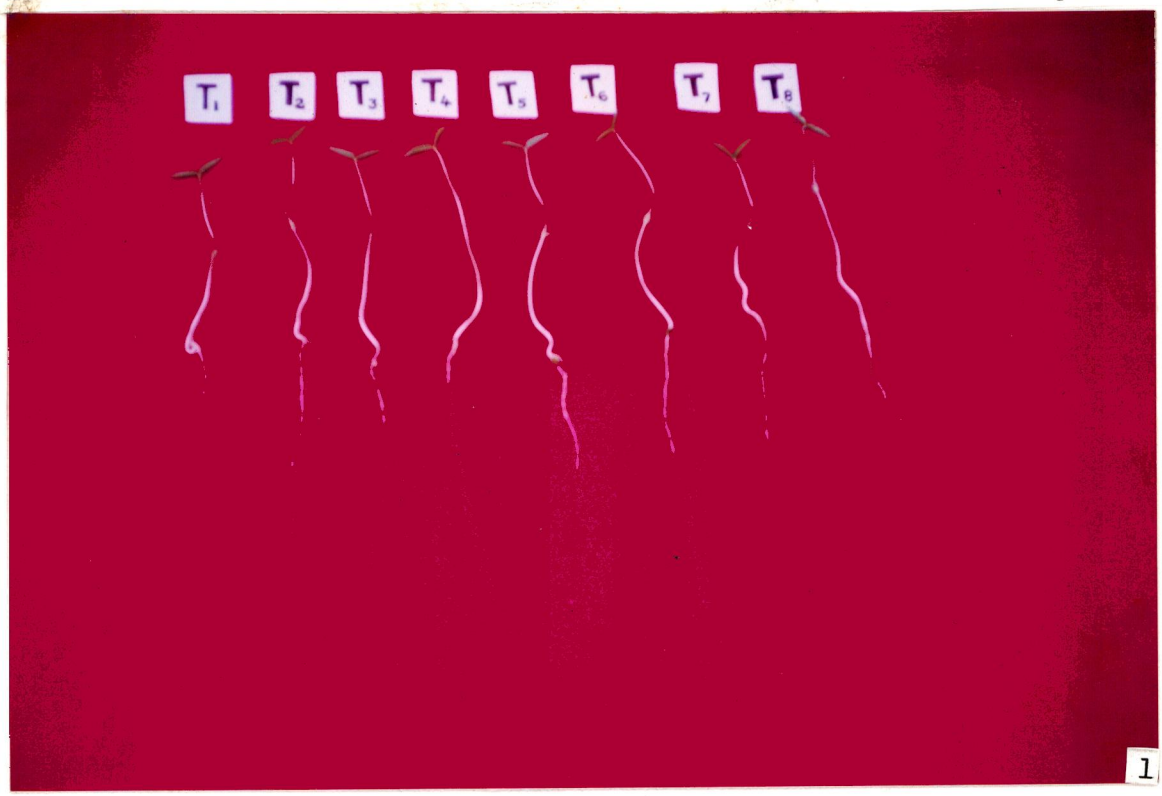
	Initial %	Composted trash %
Nitrogen	0.17	0.70
Phosphorous	0.12	0.25
Potassium	0.11	0.70
Organic Carbon	24.2	17.0
C:N Ratio	142.4:1	24:1

GERMINATION EXPERIMENT

Table I & II, plate I and Figures I-IV illustrates the seedling growth parameters.

PLATE - 1

GERMINATION EXPERIMENT ON GREEN GRAM - 12 hours soaking



GERMINATION EXPERIMENT ON GREEN GRAM - 24 hours soaking

TABLE - I

INFLUENCE OF COMPOSTED SUGARCANE TRASH ON GERMINATION OF GREENGRAM (12 Hrs SOAKING)

Treatments	Root Length (cm)	Shoot Length (cm)	No. of Lateral Rt	Fresh Wt. (gm)	Dry Wt. (gm)
T1	10.69	9.75	3.13	0.17	0.1
T2	12.5	13.75	3.25	0.36	0.2
T3	13.88	13.44	3.25	0.35	0.1
T4	12.56	11.56	3.13	0.28	0.1
T5	14	10.75	3.5	0.41	0.1
T6	12.63	12.5	3.5	0.42	0.2
T7	11.75	11.81	3.13	0.29	0.1
T8	12.88	10.31	3.88	0.31	0.1
S.Ed	7.53	7.02	1.88	0.12	0.08
C.D	0.05	0.07	0.05	-	0.2

TABLE - II

INFLUENCE OF COMPOSTED SUGARCANE TRASH ON GERMINATION OF GREENGRAM (24 Hrs SOAKING)

Treatments	Root Length (cm)	Shoot Length (cm)	No. of Lateral Rt	Fresh Wt. (gm)	Dry Wt. (gm)
T1	10.40	12.80	1.8	0.12	0.1
T2	13.10	13.50	2.8	0.22	0.18
T3	12.20	13.00	3.2	0.18	0.18
T4	12.40	13.30	4.4	0.16	0.12
T5	15.10	13.20	4.4	0.16	0.1
T6	11.20	13.40	4	0.18	0.1
T7	14.90	15.90	4	0.19	0.2
T8	12.50	15.20	2.6	0.12	0.1
S.Ed	7.92	8.44	1.68	-	0.09
C.D	0.07	0.05	0.2	-	0.11

FIG - I

INFLUENCE OF COMPOSTED SUGARCANE TRASH ON GERMINATION OF GREENGRAM (12 Hrs SOAKING)

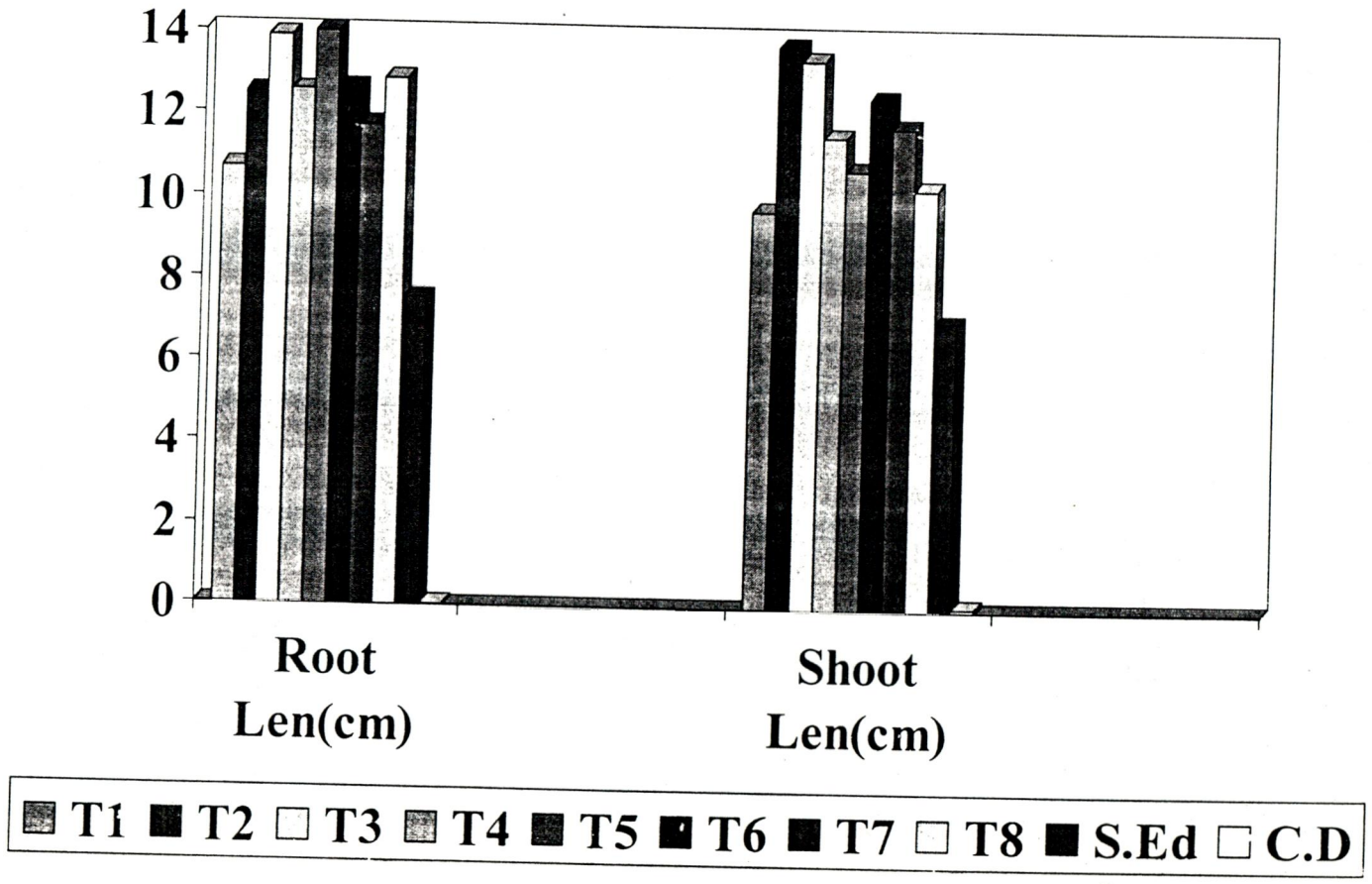


FIG - II

INFLUENCE OF COMPOSTED SUGARCANE TRASH ON GERMINATION OF GREENGRAM (12 Hrs SOAKING)

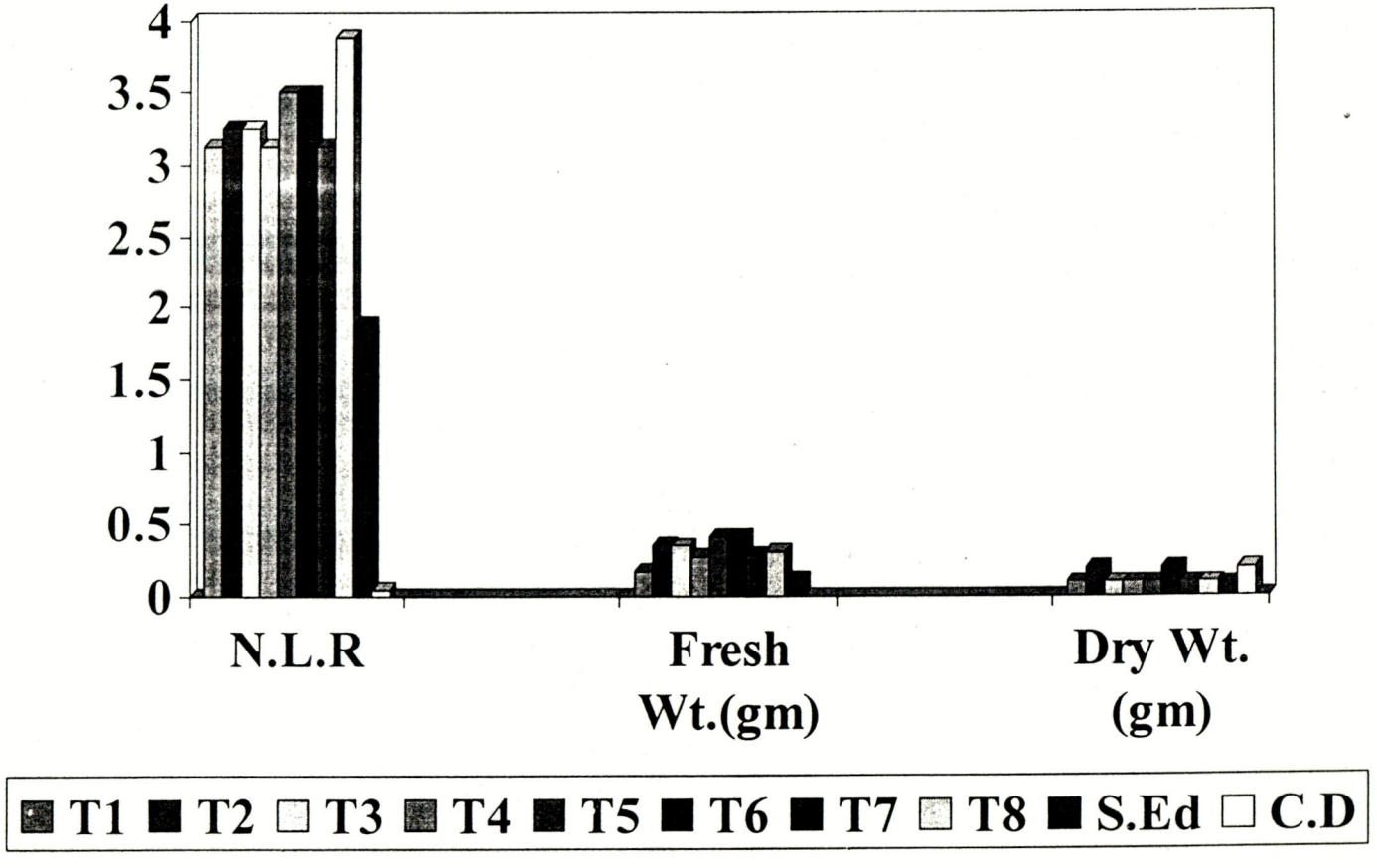


FIG - III

INFLUENCE OF COMPOSTED SUGARCANE TRASH ON GERMINATION OF GREENGRAM (24 Hrs SOAKING)

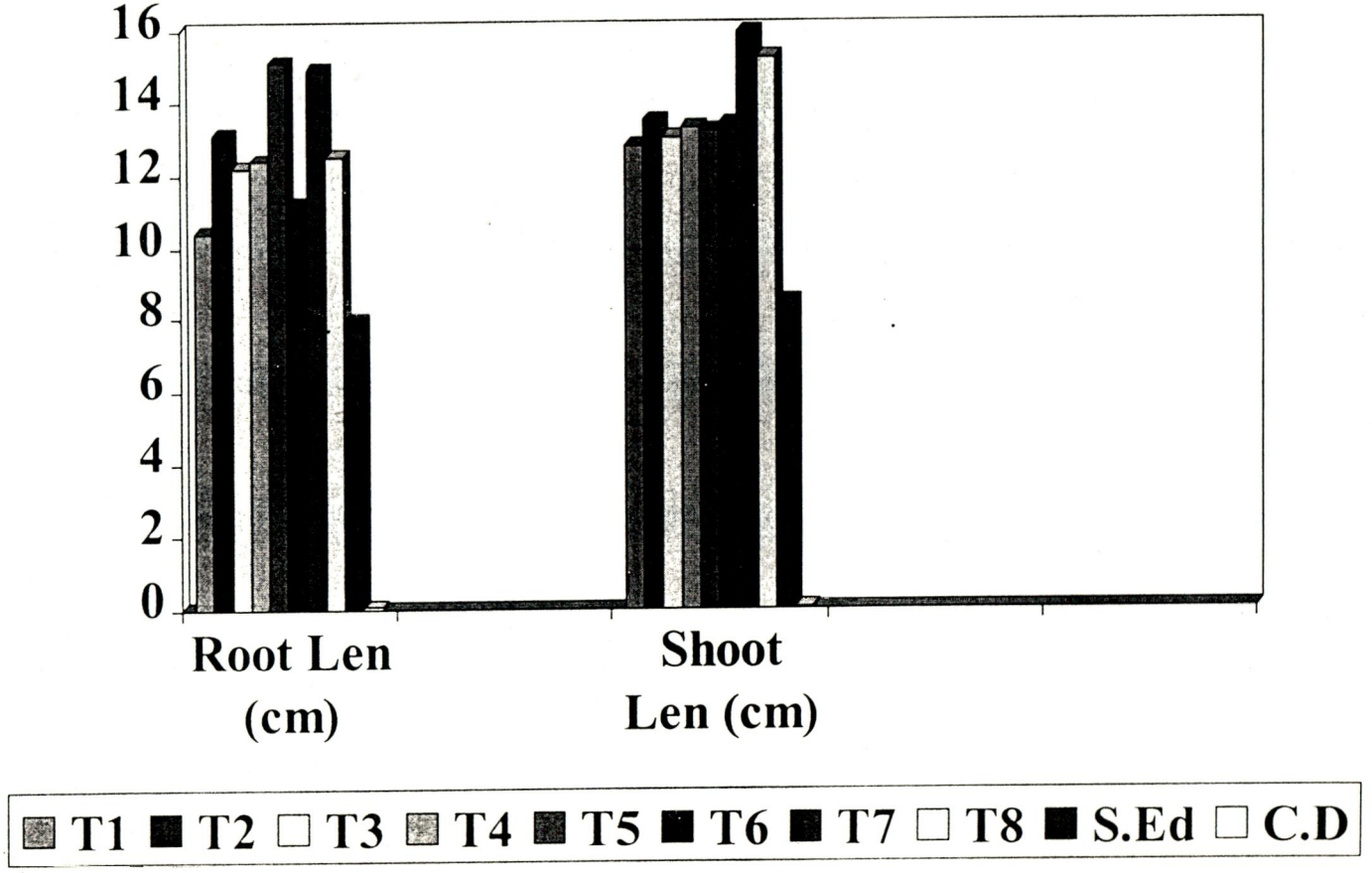
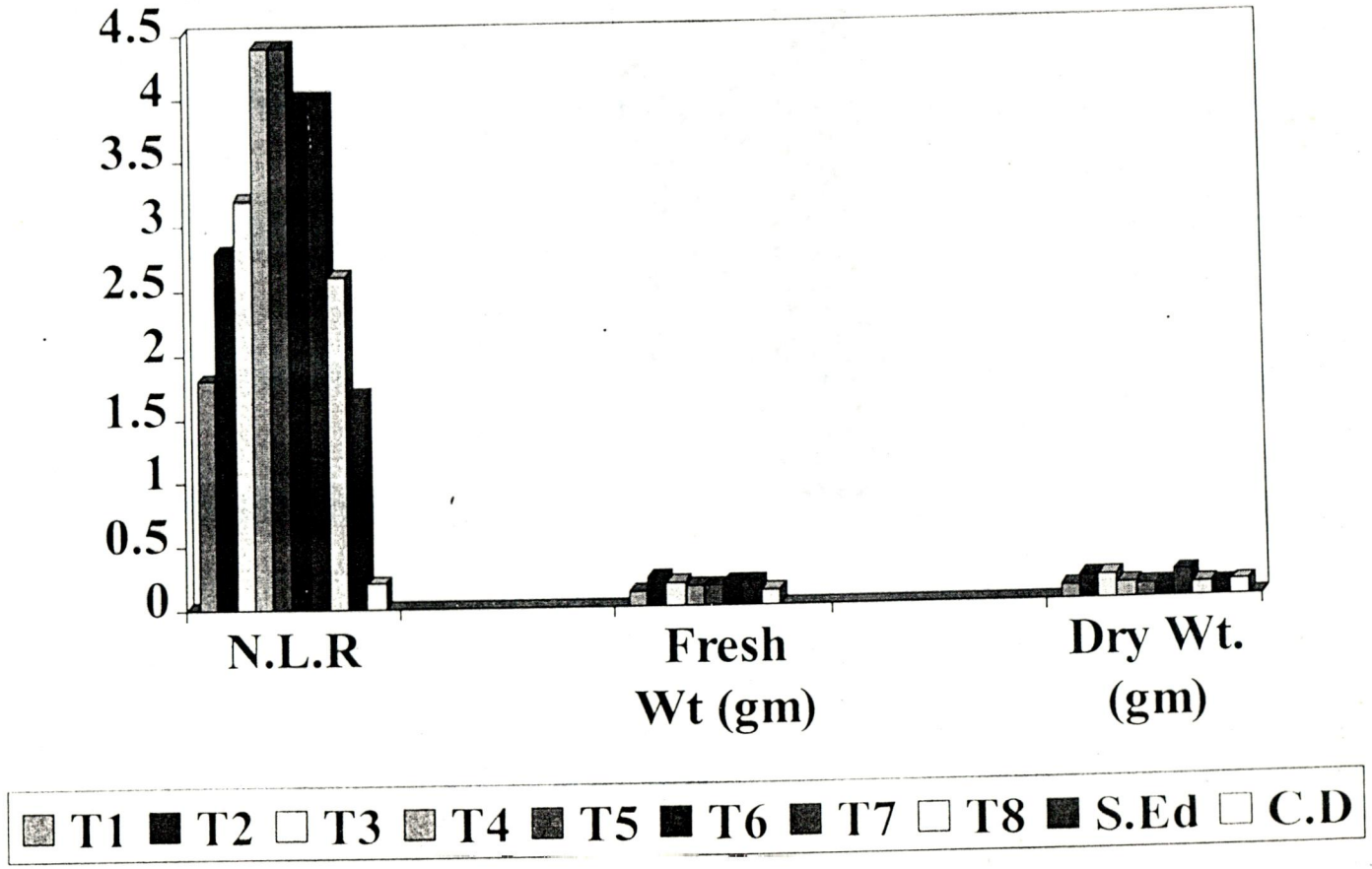


FIG - IV

INFLUENCE OF COMPOSTED SUGARCANE TRASH ON GERMINATION OF GREENGRAM (24 Hrs SOAKING)



Two sets of experiments were carried out. The I set experiment includes soaking of green gram seeds in the compost extract for 12 hours and in the II set experiments soaking involves 24 hours . The germinated seedlings were biometrically analysed.

The shoot length of green gram seedlings were markedly increased with 10% farmyard manure extract in both experiments I and II [14cms in 12 hours soaking and 15.1 cms in 24hours soaking when compared with the control (10.40cms)].

The root length increased significantly in 2.5% composted sugarcane trash treatment (13.75 cms in 12 hours soaking and 15.9cms in 24 hours soaking when compared to the control 12.80 cms) and 5% composted sugarcane trash treatment [13.44 cms in 12 hours and 15.90 cms in 24 hours soaking when compared with the control].

The highest number of lateral roots were recorded in T9 (10% composted trash and 10% farmyard manure combination 3.88 in 12 hours and 4.4 in 24 hours).

A significant increase in fresh weight (0.42 gms) and dry weight (0.2gms) of the seedlings was noted with 2.5% farmyard manure and composted sugarcane trash combination in 12 hours soaking experiment 2.5% composted trash significantly increased the fresh weight (0.22 gms) and dry weight (0.2 gms) in 24 hous soaking.

The above results confirms that the composted sugarcane trash extract and farmyard manure had equally raised the parameters of germinated seedlings. Similar results were reported by Rasal (1987) and Venugopal (1999) in sugarcane where, increased germination percentage was obtained with trash incorporation.

POT CULTURE EXPERIMENT

Two sets of experiments were carried out. Experiment III consist of seven treatments like NPK, 100% Raw sugarcane trash, farmyard manure and three different composts along with control.

Experiment IV includes nine treatments like composted sugarcane trash at 12.5 t/h and 25 t/h individually and in combinations with biofertilizers such as Rhizobium and Phosphobacteria. NPK 100% was maintained as a control.

STAGE I :

EFFECT OF COMPOSTED SUGARCANE TRASH ALONE AND IN COMBINATION WITH BIOFERTILIZERS ON VEGETATIVE CHARACTERS OF GREENGRAM :- (30 DAYS) [Table III & IV, Plate II & III Figures V-VIII].

1. INFLUENCE OF COMPOST ON ROOT LENGTH

EXPERIMENT III :

There had been an increase in the root length of green gram with the treatments over control expect T2 (Raw sugarcane trash). The highest value was noted with T7 (20.78 cms) trash composted with cowdung, Pleurotus and Trichoderma.

EXPERIMENT IV :

There had been an increase in the root length at a range between 8 cms (control) to 11.67 cms (T9 compost with Rhizobium and Phosphobacterium).

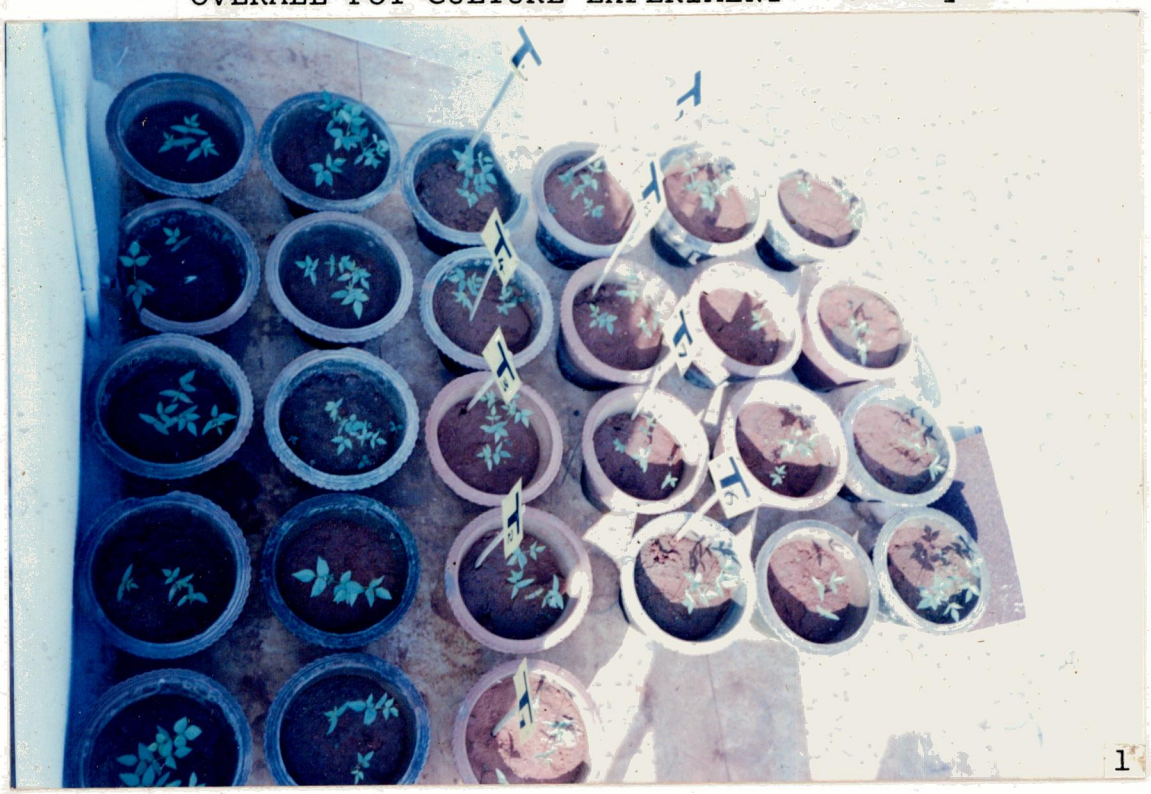
This results are in accordance with the results of Rahman and Bhuiyan (1994) who inferred that application of compost plus NPK improved the root growth of mung bean.

2. INFLUENCE OF COMPOST ON SHOOT LENGTH

There had been an appreciable influence of the treatments on the shoot length of green gram which varied from 14.44 cms (T2) to 37.67 cms (T7) when compared with the control T1 - 15.78 cms.

PLATE - 2

OVERALL POT CULTURE EXPERIMENT - 30 Days



1

PLATE - 3

EFFECT OF COMPOST ON GREEN GRAM - 30 Days

EFFECT OF COMPOST AND BIOFERTILIZERS ON GREEN GRAM - 30 Days

TABLE - III

EFFECT OF COMPOSTED SUGARCANE TRASH ON VEGETATIVE PARAMETERS OF GREENGRAM

Treatments	Root Length (cm)	Shoot Length (cm)	No. of Lateral Rt	IL (cm)	PL (cm)	PFWT (gm)	PDWT (gm)
T1	12.88	15.78	6.89	2.78	3.22	0.78	0.14
T2	18.67	14.44	8.00	2.44	2.56	0.96	0.18
T3	13.11	24.03	11.00	2.00	5.94	2.22	0.26
T4	20.00	32.89	13.78	2.11	6.67	5.24	0.50
T5	12.44	28.78	13.66	1.89	5.61	4.00	0.46
T6	16.89	30.00	14.00	2.72	6.44	3.94	0.56
T7	20.78	37.67	17.67	2.56	8.22	4.89	0.58
S.Ed	9.73	16.61	7.55	2.00	3.60	2.03	0.25
C.D	0.12	0.19	0.20	0.30	0.20	0.29	0.24

TABLE - IV

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS ON VEGETATIVE PARAMETERS OF GREENGRAM

Treatments	Root Len. (cm)	Shoot Len (cm)	No. of Lat. Roots	IL (cm)	PL (cm)	PFWT (gm)	PDWT (gm)
T1	8.00	24.67	11.0	1.5	2.38	4.67	0.53
T2	8.17	25.61	12.67	1.5	2.46	5.28	0.66
T3	8.78	25.67	14.00	2.0	2.44	5.61	0.71
T4	9.33	26.11	14.00	1.5	2.44	5.55	0.70
T5	9.78	26.89	14.00	2.0	2.64	5.78	0.76
T6	10.00	27.17	14.00	2.0	2.90	5.83	0.76
T7	10.56	27.83	17.00	2.0	2.93	6.22	0.77
T8	11.11	28.39	17.00	2.0	3.16	6.39	0.84
T9	11.67	29.11	17.00	1.5	3.17	6.37	0.88
S.Ed	5.42	14.97	8.11	0.96	2.15	3.17	0.41
C.D	0.08	0.03	0.08	0.06	0.14	0.06	0.09

FIG - V

EFFECT OF COMPOSTED SUGARCANE TRASH ON VEGETATIVE PARAMETERS OF GREENGRAM

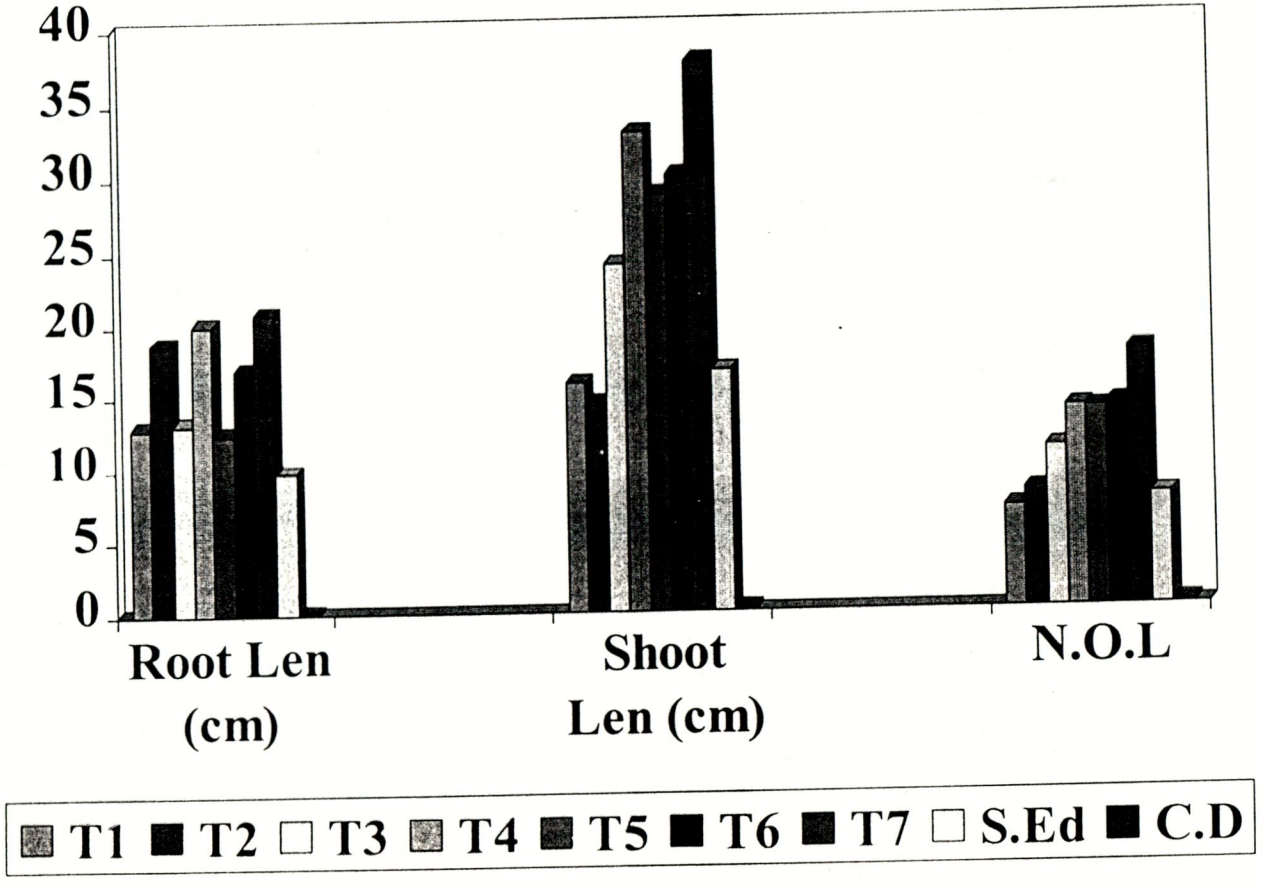


FIG - VI

EFFECT OF COMPOSTED SUGARCANE TRASH ON VEGETATIVE PARAMETERS OF GREENGRAM

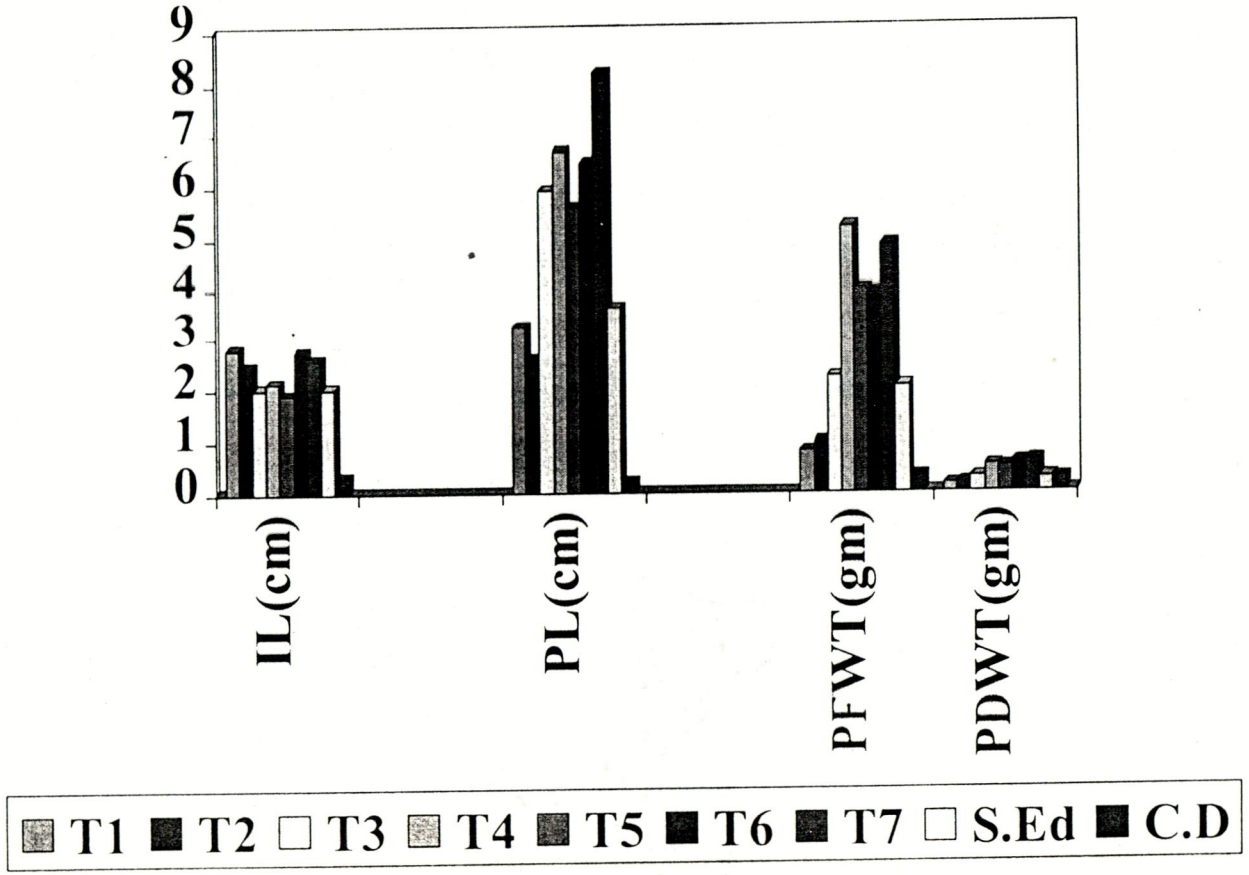


FIG - VII

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIO FERTILIZERS ON VEGETATIVE PARAMETERS OF GREENGRAM

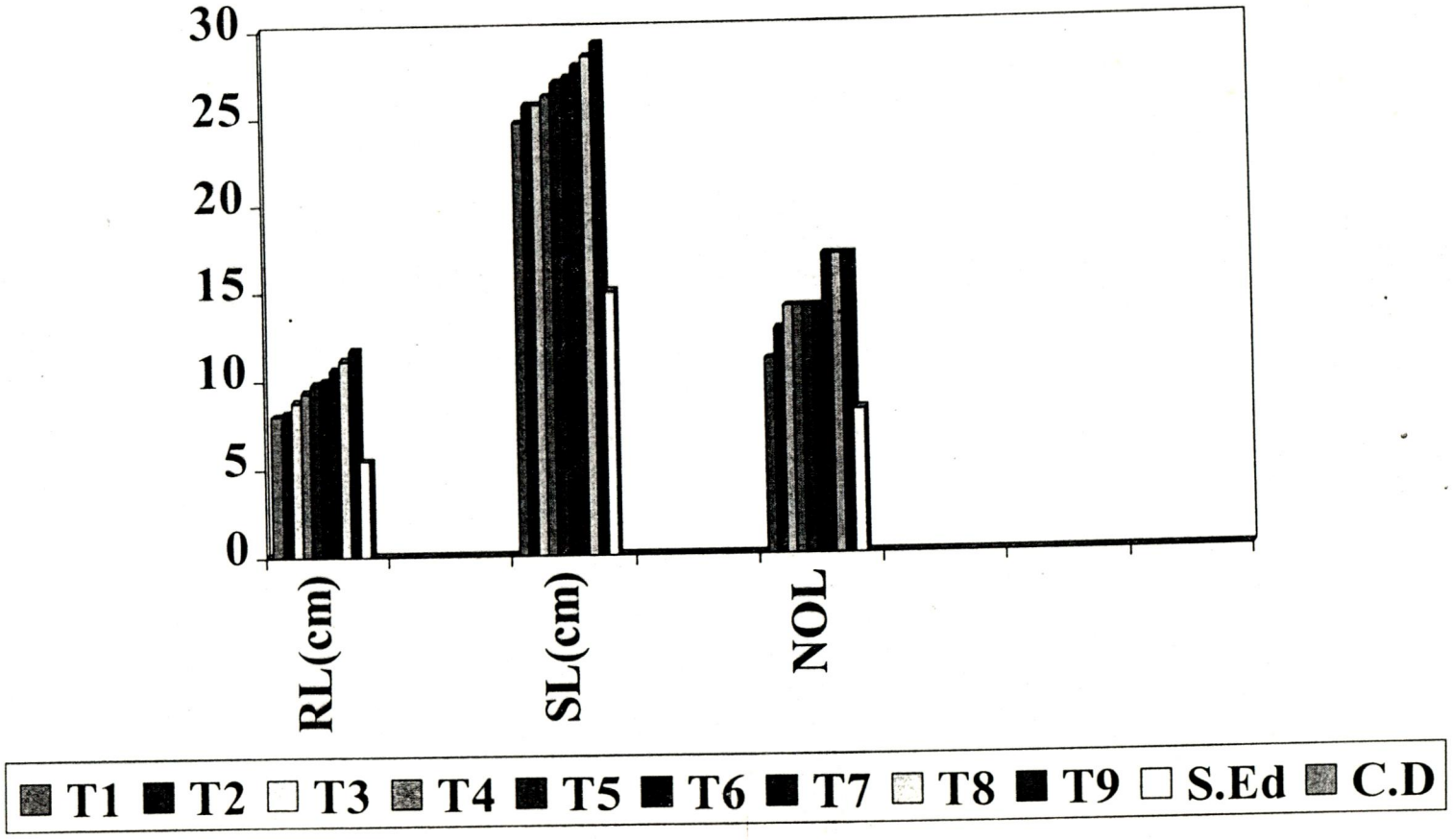
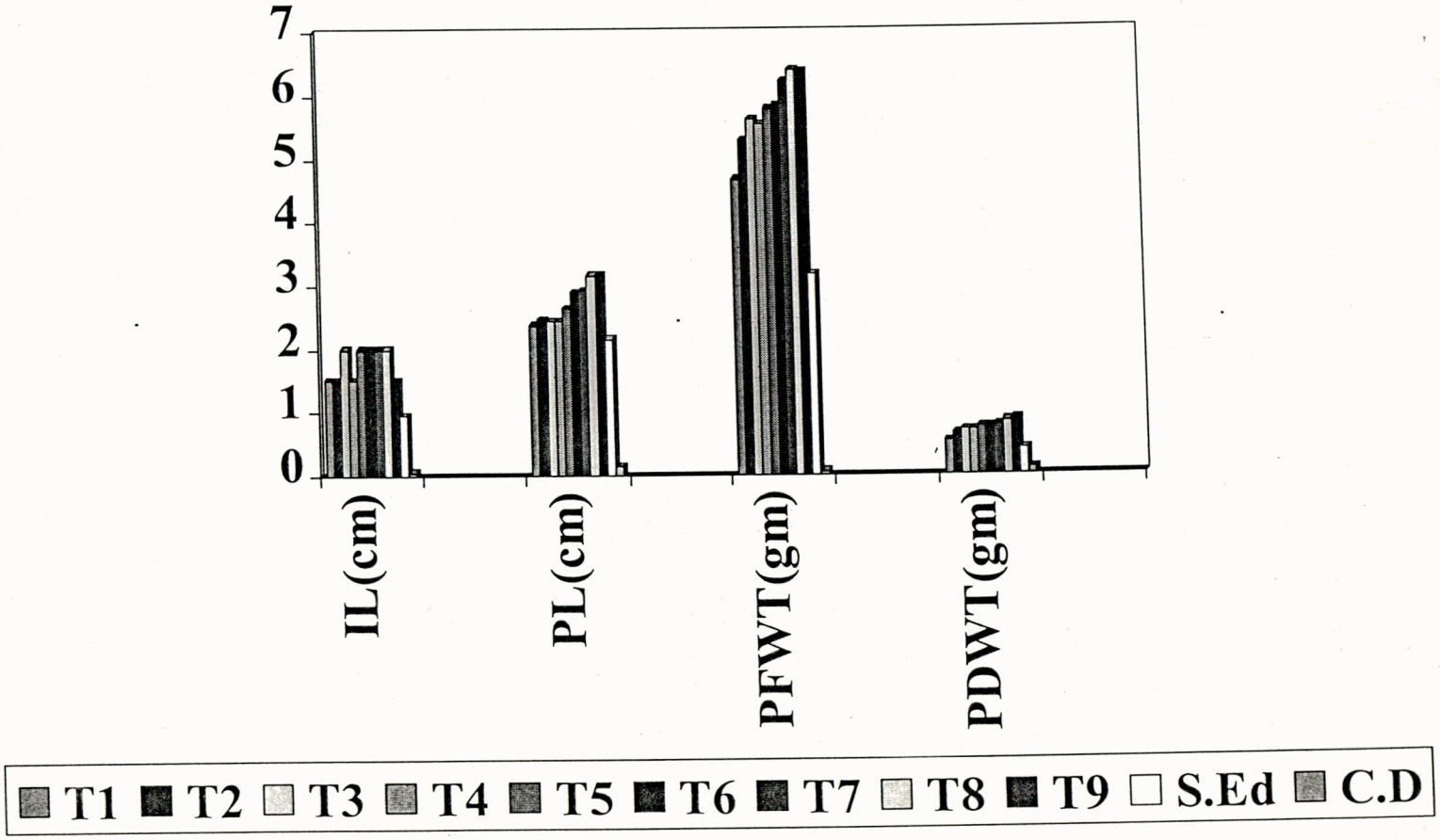


FIG - VIII

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIO FERTILIZERS ON VEGETATIVE PARAMETERS OF GREENGRAM



EXPERIMENT IV :

The treatments showed a significant increase in the shoot length when compared with control. The highest value was obtained with T9 (compost 25t/h + Rhizobium + Phosphobacterium).

Thamizhvendan and Sheerin (1998) found out that combined application of Rhizobium and Phosphobacterium increased the shoot length of Soya bean.

3. INFLUENCE OF COMPOST ON NUMBERS OF LEAVES

EXPERIMENT III :

The increase in number of leaves of green gram was the highest with T7 [(17.7) sugarcane trash composted with pleurtous cowdung and Trichoderma] when compared to all other treatments and control.

EXPERIMENT IV :

The treatments influenced a significant increase in number of leaves of green gram when compared to control.

Similar results were obtained by Sabanayagam and Savithri (1995) who found that the treatments with organic fertilizers recorded more number of leaves.

4. INFLUENCE OF COMPOST ON INTERNODAL AND PETIOLE LENGTH

EXPERIMENT - III :

The internodal and petiole length of green gram were significantly increased by the treatments. The highest value (2.72 cm) for internodal length were obtained with T6 and for petiole length (8.2cms) was obtained with T7.

EXPERIMENT - IV :

There had been a slight increase in the internodal length of green gram with all the treatments, over control. A gradual increase in the petiole length was also noted with all the treatments over control.

Similar results were obtained by Shukla and Dixit (1996) in Greengram.

5. INFLUENCE OF COMPOST ON PLANT FRESH AND DRY WEIGHT:-

EXPERIMENT III :

The plant fresh weight and dry weight were increased significantly over control. The plant fresh weight and dry weight were highest in T7. (4.89 gms - fresh weight, 0.58gms dry weight) when compared with the control (Fresh weight (0.78gm) Dry weight 0.14 gms).

EXPERIMENT - IV :

The treatments influenced the plant fresh and dry weight more significantly than control. The highest fresh weight (6.39 gms.) and dry weight (0.88gms) were recorded in T9 treatment which composed of composted sugarcane trash at 25t/h with biofertilisers.

The results obtained were in accordance with Gaur and Mukurjee (1979) in Groundnut where application of straw increased the plant dry weight.

STAGE II : EFFECT OF COMPOSTED SUGARCANE TRASH ALONE AND IN COMBINATION WITH BIOFERTILIZERS AT FLOWERING STAGE OF GREEN GRAM (50 DAYS) [Table V & VI, Plate IV, Figures IX-XII].

Two sets of Experiments were carried out Experiment V includes seven treatments Viz. NPK 100%, Farm yard manure, composted sugarcane trash along with Control. Experiment VI includes nine treatments viz. composted sugarcane trash at 12.5 t/h and 25 t/h individually and in combinations with biofertilizers. NPK 100% was maintained as control.

PLATE - 4

EFFECT OF COMPOST ON GREEN GRAM - 60 Days

EFFECT OF COMPOST AND BIOFERTILIZERS ON GREEN GRAM - 60 Days

TABLE - V

EFFECT OF COMPOSTED SUGARCANE TRASH AT FLOWERING STAGE GREENGRAM

Treatments	Root Len. (cm)	Shoot Len (cm)	No. of Lat. Roots	IL (cm)	PL (cm)	NN	VN (cu.mm)	PFWT (gm)	PDWT (gm)
T1	21.67	25.67	15.67	1.48	4.89	4.22	0.49	2.31	1.31
T2	25.33	26.00	16.33	1.91	6.00	5.44	0.46	2.50	1.44
T3	33.00	35.11	18.67	1.77	7.78	9.11	0.62	2.94	1.71
T4	53.00	49.67	22.67	1.50	11.55	14.78	0.92	4.82	2.09
T5	44.89	39.89	60.66	1.80	9.00	12.33	0.77	4.45	2.27
T6	53.11	47.11	21.33	1.70	10.78	11.78	0.83	5.50	2.42
T7	58.33	54.45	24.33	1.50	12.05	20.56	1.00	5.66	2.53
S.Ed	27.14	26.05	13.08	1.14	5.81	7.32	0.47	2.61	1.29
C.D	1.86	0.16	-	0.06	0.18	0.32	0.15	0.18	0.13

TABLE - VI

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS OF GREENGRAM AT FLOWERING STAGE

Treatments	Root Length (cm)	Shoot Length (cm)	No. of Lateral Rt	IL (cm)	PL (cm)	NN	VN (cu.mm)	PFWT (gm)	PDWT (gm)
T1	22.67	27.67	19.00	1.50	5.60	5.44	0.50	2.56	1.26
T2	25.00	30.89	24.00	2.00	6.28	8.67	0.60	3.26	1.47
T3	38.00	35.11	24.67	1.70	7.53	13.00	0.70	3.92	1.58
T4	45.89	42.78	25.00	1.50	10.39	16.67	0.80	4.46	1.89
T5	51.89	46.56	26.00	1.80	11.21	18.22	0.90	4.96	2.04
T6	57.56	49.56	26.00	1.80	11.29	19.22	0.84	6.10	2.32
T7	61.22	53.44	24.67	1.80	11.12	20.89	1.00	6.09	2.53
T8	62.11	57.28	27.67	1.50	11.96	23.00	1.10	6.26	2.62
T9	63.44	60.56	28.33	1.80	12.50	25.22	1.20	6.50	2.76
S.Ed	20.54	23.67	13.99	0.98	5.46	9.33	0.47	2.74	2.34
C.D	0.22	0.15	0.07	-	0.14	0.24	0.15	0.16	0.07

FIG - IX

EFFECT OF COMPOSTED SUGARCANE TRASH AT FLOWERING STAGE OF GREENGRAM

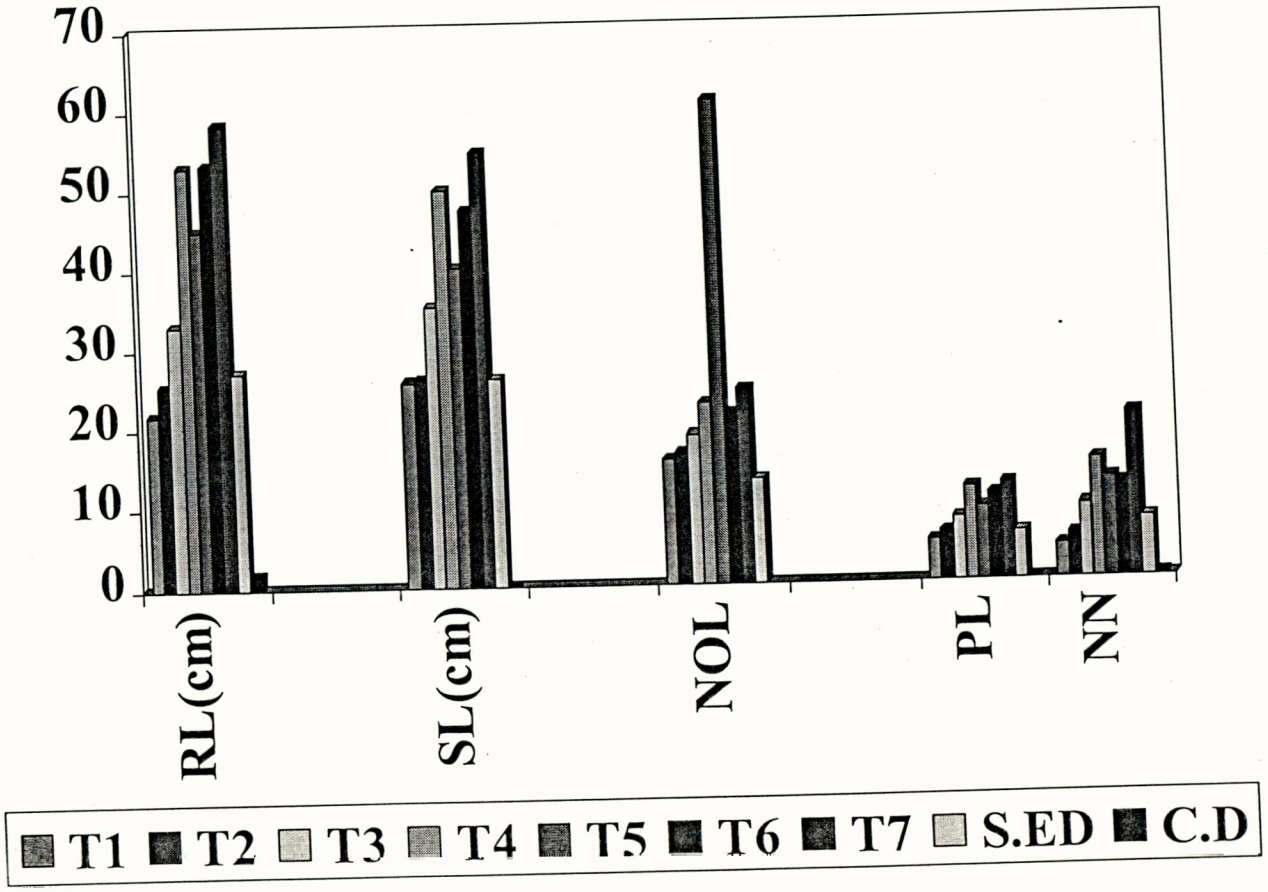


FIG - X

EFFECT OF COMPOSTED SUGARCANE TRASH AT FLOWERING STAGE OF GREENGRAM

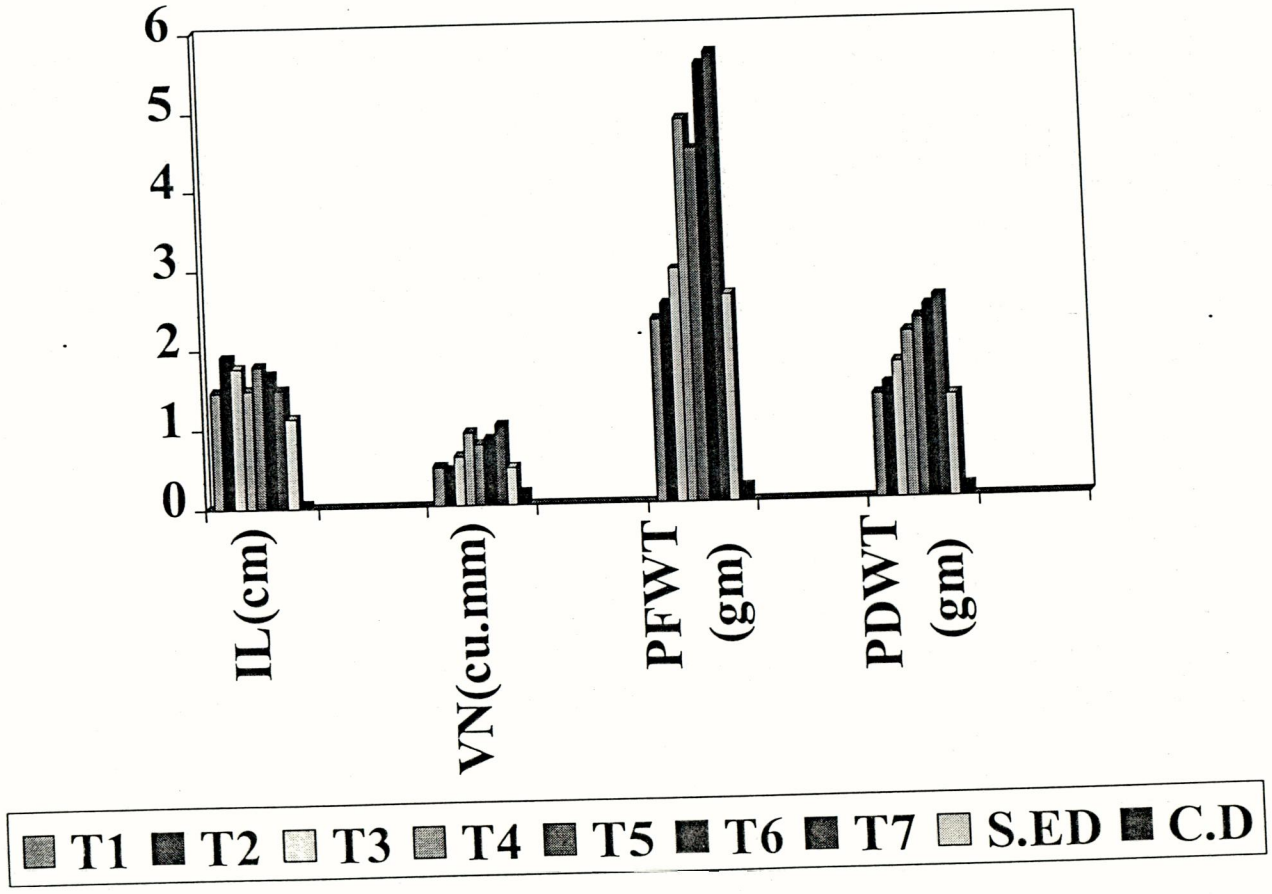


FIG - XI

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS OF GREENGRAM AT FLOWERING STAGE

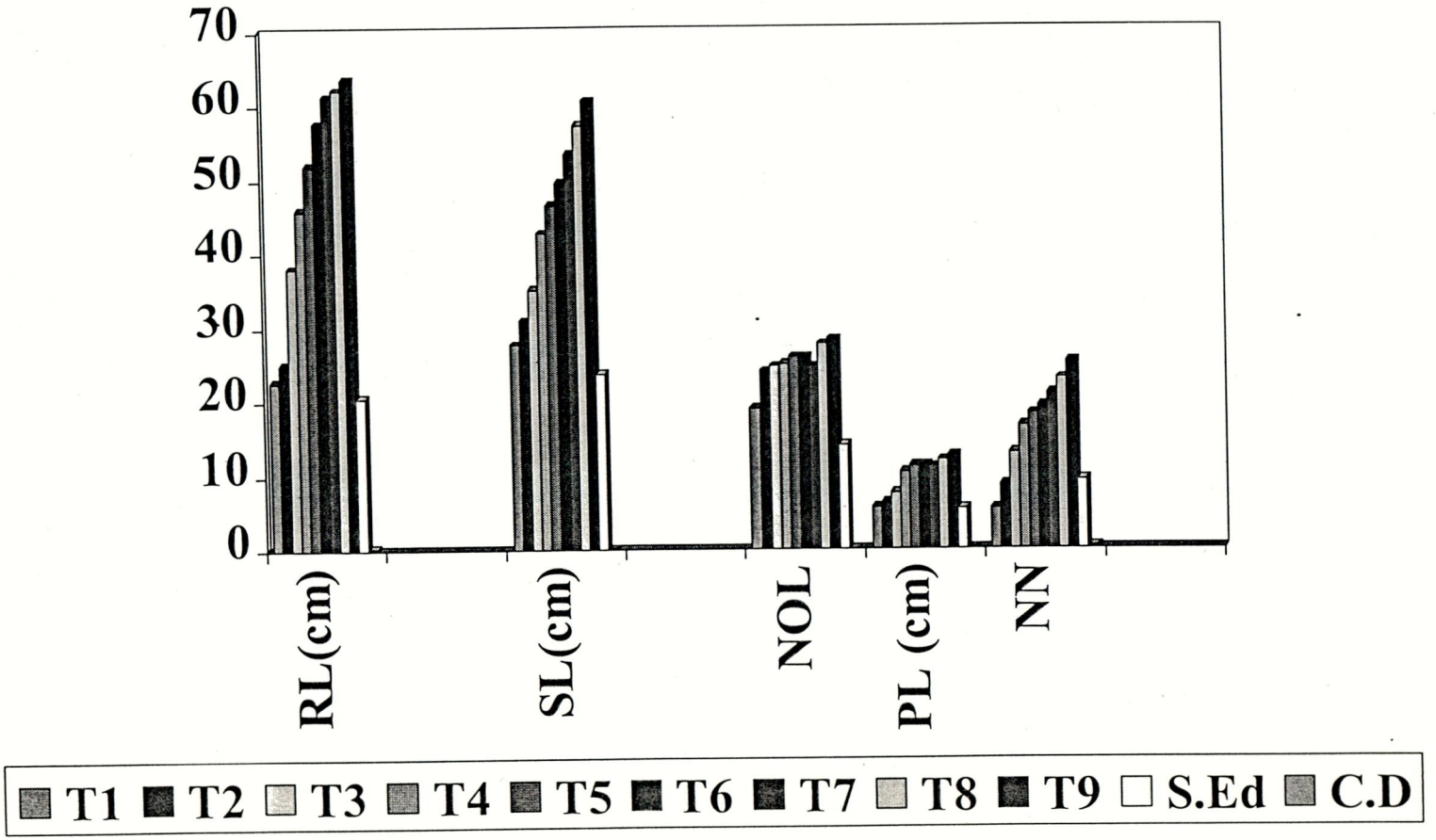
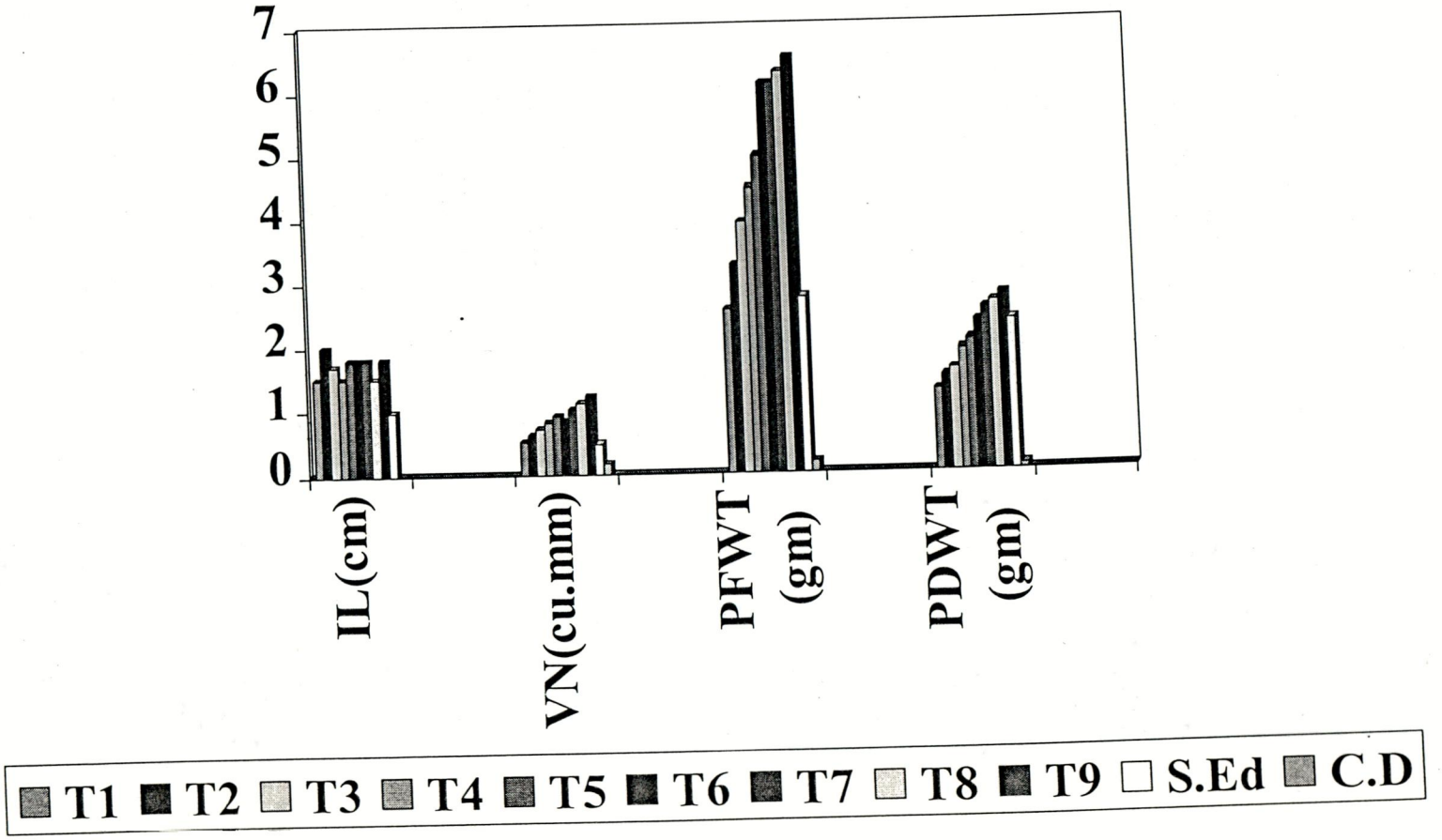


FIG - XII

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS OF GREENGRAM AT FLOWERING STAGE



INFLUENCE OF COMPOST ON ROOT LENGTH:

EXPERIMENT V :

There had been a significant increase in the root length of green gram on 60th day with the treatments over control. The root length ranges from 21.67 cms (control) to 58.33 cms (T7) when compared with the control 21.67 cms.

EXPERIMENT VI :

A significant increase in plant growth were noted with the treatments which ranges from 22.67 cms. (control) to 63.44 cms (T9)

Muthuvel and Sivaswamy (1985) inferred that root length was found to be increased with the application of inorganic fertiliers, Farmyard manure besides rhizobial seed inoculation.

2. INFLUENCE OF COMPOST ON SHOOT LENGTH:

EXPERIMENT V :

There had been an appreciable influence of the treatments on the shootlength which varied from 25.67cms. (T2) to 54.45cms (T7).

EXPERIMENT VI :

The shoot length at 60 days ranges from 27.67 cms. (control) to 60.56 cms. (T9)

This results could be attributed to the findings of Rasal et al., (1989) which evidenced that the growth of plant was improved with sugarcane trash application in mungbean.

3. INFLUENCE OF COMPOSTS ON NUMBER OF LEAVES:

EXPERIMENT V :

Though all the treatments increased the number of leaves of green gram on 60 days, the T7 recorded the highest. (24.33).

EXPERIMENT VI :

The plants treated with composts and biofertiliers showed a marked increase in number of leaves in comparision with Control.

Similar results were obtained by Muthuvel and Sivaswamy (1985) in red gram.

4. INFLUENCE OF COMPOST ON INTERNODAL AND PETIOLE LENGTH

EXPERIMENT V :

A slight increase in the internodal length of green gram was noted with plants treated with composts. An appreciable influence of treatments on petiole length of green gram was noted which varied from 4.89 cms (control) to 12.05 cms (T7).

EXPERIMENT VI :

The internodal length was marginally increased by composted sugarcane trash and biofertilizers over control. The petiole length had been increased significantly at a range of 5.6 cms (Control) and 12.5 cms (T9).

Similar results were obtained by Shinde et al., (1993) in sugarcane.

5. INFLUENCE OF COMPOST ON NUMBER OF NODULES AND VOLUME OF NODULES.

EXPERIMENT V :

An appreciable increase in the Number of Nodules was observed with treatments when compared with Control. The highest value was obtained with T7. Treatments influenced the volume of nodules over control.

EXPERIMENT VI :

Significant increase in number and volume of nodules was noted with the plants treated with compost along with biofertilizers when compared to control. T7 recorded the highest number of nodules (25.2).

Similar results were obtained by Vaishya and Dubey (1996), in which use of organic fertilizers significantly increased nodulation over control in legume.

6.INFLUENCE OF COMPOST ON PLANT FRESH AND DRY WEIGHT

EXPERIMENT V :

Plant Fresh weight and dry weight was increased with plants treated with composts when compared with control. The most significant value was obtained with T7 (5.67 gms - fresh weight and 2.53gms. - dry weight).

EXPERIMENT VI :

There had been an increase in plant fresh weight at a range of 2.56gms (control) to 6.5gms (T9) and dry weight from 1.26gms (Control) to 2.76 gms. (T9)

Laddha et al., (1984) observed an increase in average weight of Soyabean plant with application of fertilizers.

STAGE III EFFECT OF COMPOSTED SUGARCANE TRASH ALONE AND IN COMBINATION WITH BIOFERTILIZERS ON YIELD PARAMETERS OF GREEN GRAM. [Table VII & VIII, Plate V, Figures XIII-XVI].

The yield parameters like Pod length, Pod circumference, Number of Seeds/Pod weight of Seeds/Plant and 100 seeds weight were recorded for 2 sets of Experiments. Experiment

PLATE - 5

EFFECT OF COMPOST ON YIELD

EFFECT OF COMPOST AND BIOFERTILIZERS ON YIELD

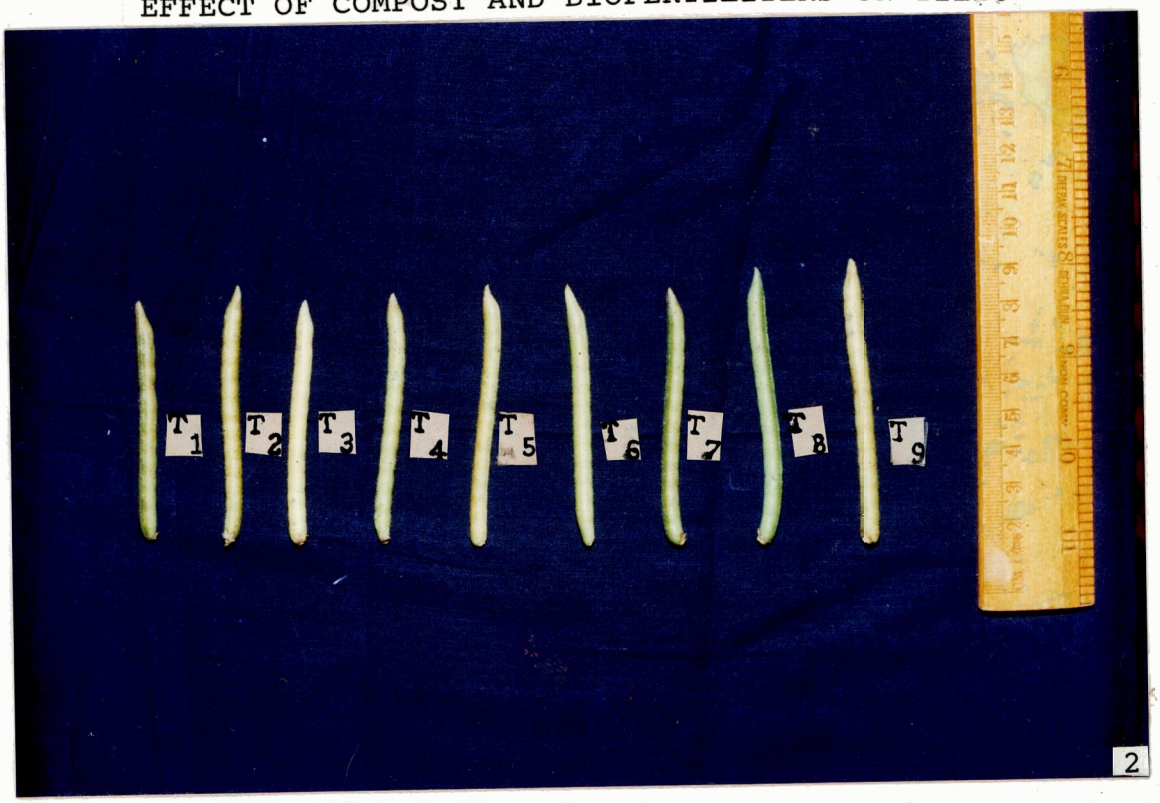


TABLE - VII

EFFECT OF COMPOSTED SUGARCANE TRASH ON YIELD PARAMETERS OF GREENGRAM

Treatments	Pod Len. (cm)	Pod Circum (cm)	No. of seeds/pod	Wt. of seeds/plant(gm)	Wt of 100 seeds (gm)
T1	4.66	1.47	11.00	1.36	2.75
T2	4.56	1.41	11.33	1.46	2.77
T3	5.32	1.59	12.00	2.12	2.78
T4	6.17	1.80	12.67	2:39	2.79
T5	5.71	1.76	12.33	2.35	2.79
T6	5.97	1.81	13.00	2.26	2.80
T7	6.51	1.86	13.22	2.79	2.82
S.Ed	3.65	1.10	8.03	1.38	2.19
C.D	0.07	0.05	0.04	0.15	-

TABLE - VIII

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS ON YIELD PARAMETERS OF GREENGRAM

Treatments	Pod Len. (cm)	Pod Circum (cm)	No. of seeds/pod	Wt. of seeds/plant(gm)	Wt of 100 seeds (gm)
T1	4.63	1.51	11.44	1.93	2.79
T2	5.50	1.69	12.00	2.38	2.79
T3	6.04	1.77	13.00	2.41	2.80
T4	6.34	1.89	14.33	2.80	2.82
T5	6.14	1.97	14.78	2.70	2.83
T6	6.36	1.72	14.44	2.78	2.80
T7	6.14	1.77	14.44	2.99	2.82
T8	7.02	2.08	15.33	2.85	2.84
T9	7.32	2.13	15.67	3.06	2.85
S.Ed	3.45	1.03	7.79	1.48	1.80
C.D	0.09	0.06	0.06	0.09	-

EIG - XIII

EFFECT OF COMPOSTED SUGARCANE TRASH ON YIELD PARAMETERS OF GREENGRAM

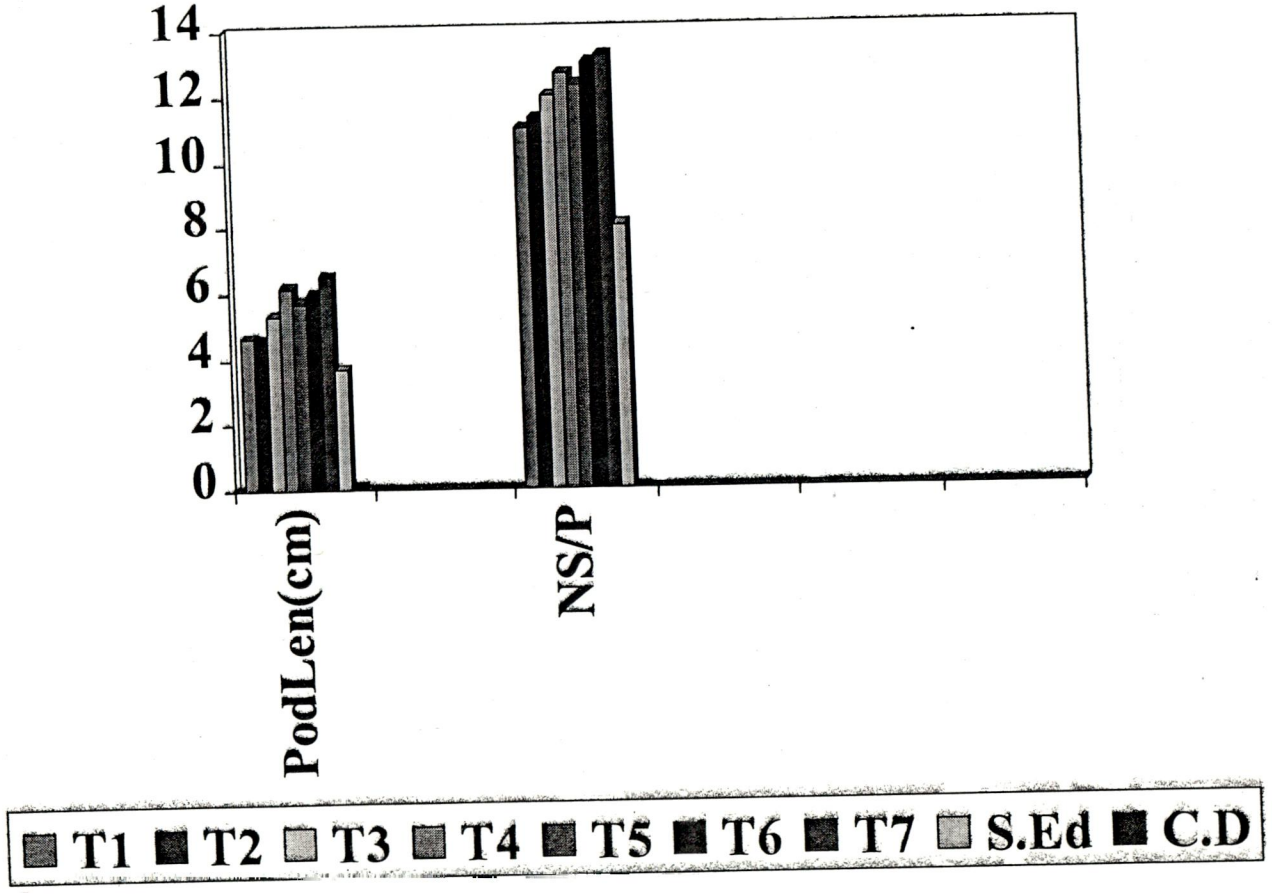


FIG - XIV

EFFECT OF COMPOSTED SUGARCANE TRASH ON YIELD PARAMETERS OF GREENGRAM

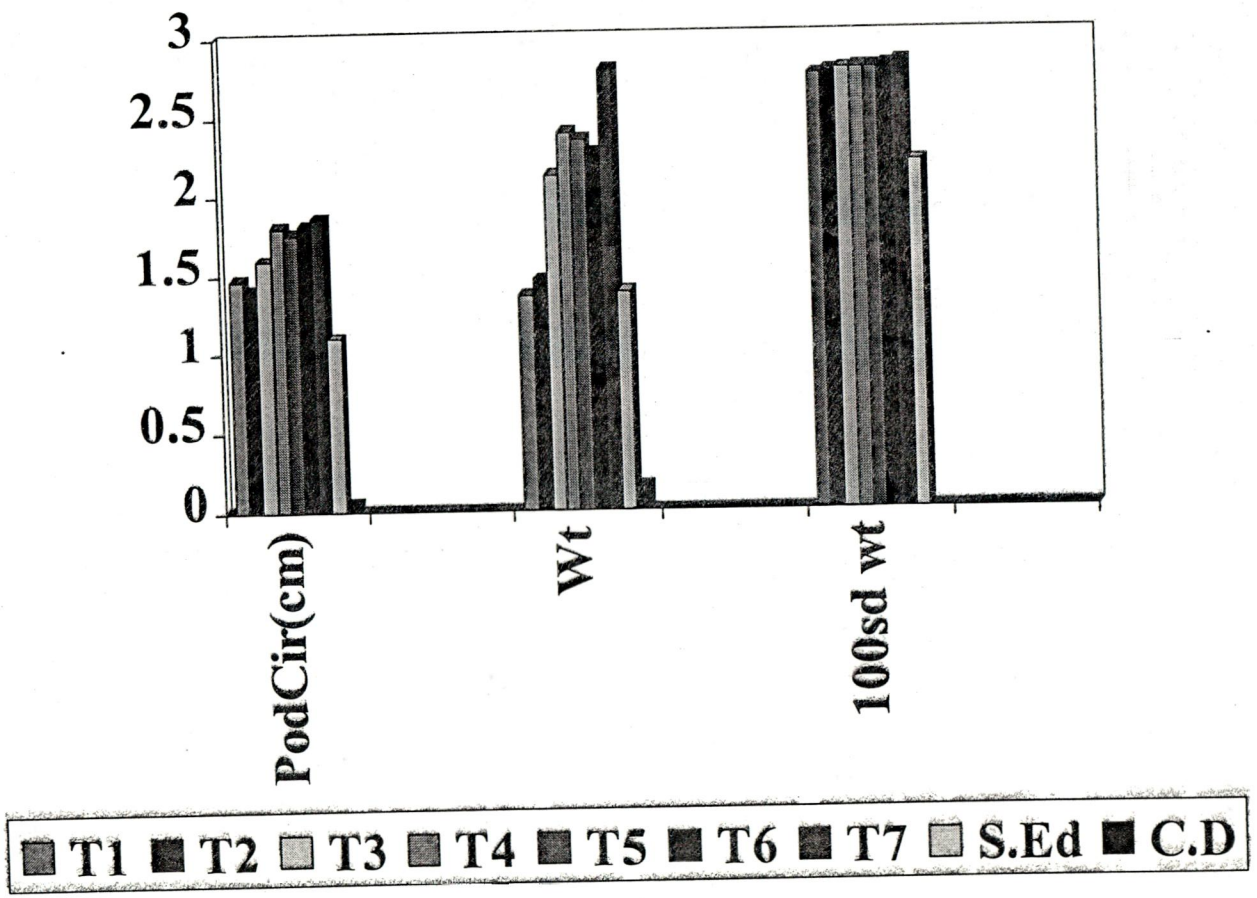


FIG - XV

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS ON YIELD PARAMETERS OF GREENGRAM

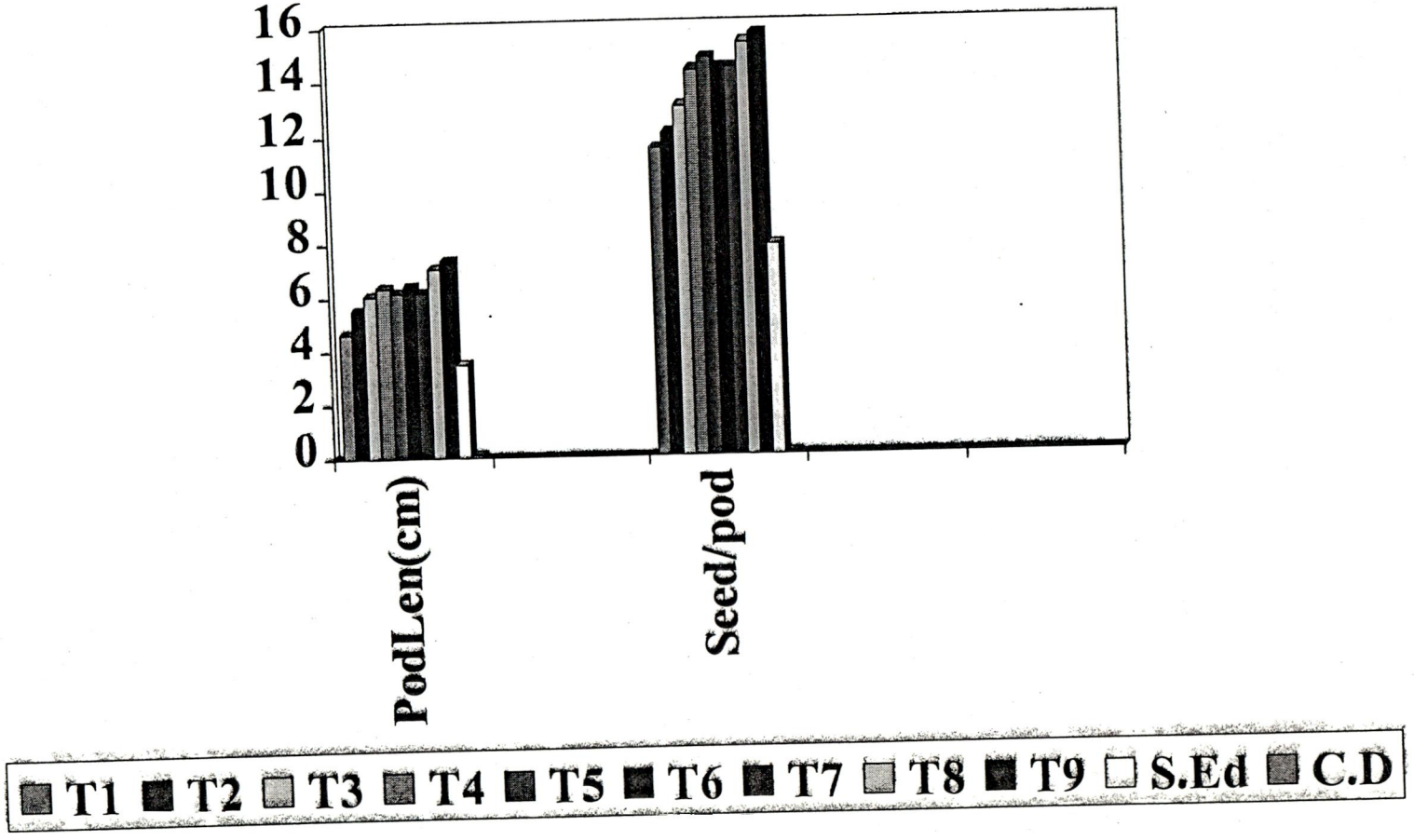
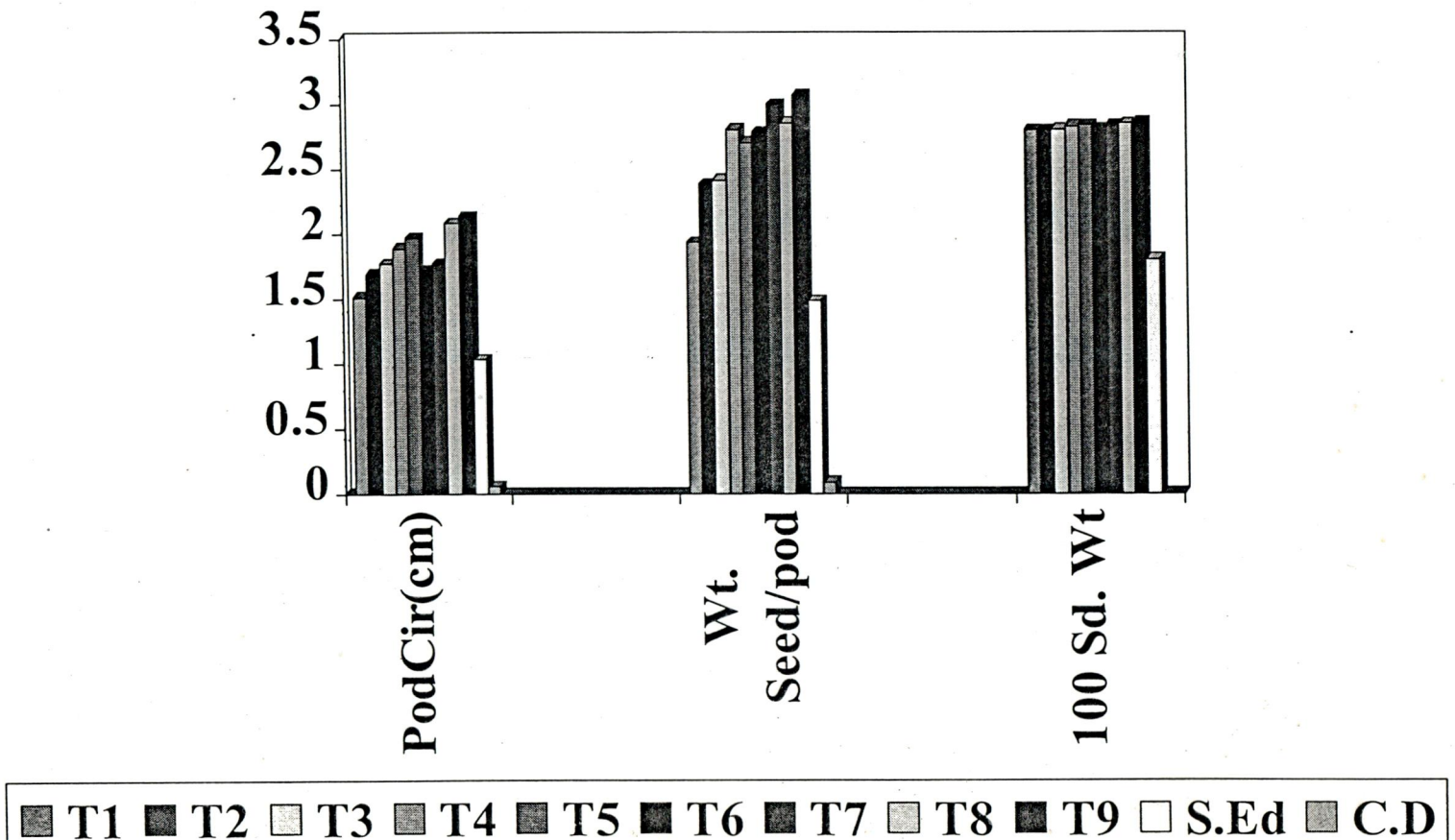


FIG - XVI

EFFECT OF COMPOSTED SUGARCANE TRASH AND BIOFERTILIZERS ON YIELD PARAMETERS OF GREENGRAM



VII includes seven treatements with NPK, raw trash, Farm yard manure and composted sugarcane trash. Experiment VIII includes nine treatments with composted sugarcane trash alone and in combination with biofertilizers.

1.INFLUENCE OF COMPOST ON POD LENGTH:-

EXPERIMENT VII :

Pod length were significantly increased by all the treatments over control, the highest being at T7 (6.51 cms) when compared to the Control (4.66 cms).

EXPERIMENT VIII :

A significant increase in pod length were noted with plants treated with composts and biofertiliers combination. The most significant increase was with T9.

Similar results were obtained by Kumrawat et al., (1997) in Soyabean.

2. INFLUENCE OF COMPOST ON POD CIRCUMFERENCE:

EXPERIMENT VII :

The pod circumference varied from 1.41 cms. (T2) to 1.86 cms. (T7) whereas in control it is 1.47 cms.

EXPERIMENT VIII :

Circumference of pod was significantly increased by composted sugarcane trash and biofertilizer treatment which varied from 1.51 cms. (Control) to 2.13 cms. (T9).

Tippanava and Desai (1992) observed similar results in Bengal gram.

3. INFLUENCE OF COMPOST ON NUMBER OF SEEDS/POD

EXPERIMENT VII :

Though all the treatments increased the number of seeds/pod, the highest number was recorded with T7 (13.2).

EXPERIMENT VIII :

The number of seeds/pod was highest at T9 (15.67). All other treatments increased significantly when compared with control.

Similar results were obtained by Solaiappan and Ramiah (1990) where fertilizers increased the number of grains per pod in pigeon pea.

4. INFLUENCE OF COMPOST ON WEIGHT OF SEEDS/PLANT

EXPERIMENT VII :

The weight of seeds/plant were favourably increased by the composted sugarcane trash treatement, when compared to control.

EXPERIMENT VIII :

Though all the treatments increased the weight of seeds/plant, the increase with T9 was highest (3.06gms), when compared with the control (1.93 gms)

Ramamurthy and Shivasankar (1996) observed similar, results in Soyabean.

5. INFLUENCE OF COMPOST ON 100 SEED WEIGHT

EXPERIMENT VII :

A slight variation was noted with the treated plants and control (2.75)gms. The T7 marked the highest value (2.82gms).

EXPERIMENT VIII :

Treatment 9 had a pronounced effect on the 100 seed weight (2.85gms) when compared to other treatments and control.

Kumrawat et al., (1997) observed the same results in Soyabean influenced by biofertilizers.

EXPERIMENT IX :

SOIL ANALYSIS

Table IX gives the available NPK status of post harvest soil samples.

TABLE – IX

AVAILABLE NPK STATUS OF THE POST HARVEST SOIL SAMPLES

Treatments	PH	E.C(dsm^{-1})	N (kg/ha)	P(kg/ha)	K(kg/ha)
Initial	8.6	0.1	78	7	325
T1	8.2	0.1	95	7	328
T2	8.2	0.1	115	8	335
T3	8.1	0.1	146	10	340
T4	8.0	0.1	123	10	353
T5	8.3	0.1	136	10	348
T6	8.1	0.1	146	12	353
T7	8.2	0.1	151	10	353
T8	8.1	0.1	147	12	363
T9	8.1	0.1	153	12	362

The initial and post harvest soil samples from all the treatments were assessed for their characteristics. The texture of the soil samples was red.

Post harvest soil samples were analysed for soil reaction (PH) and the results varied from 8.2 (control) to 8.9 (T5), where as in initial soil sample it was 8.0. The electrical conductivity results remained unaltered, 0.1 dsm-1 in all the treatments. The available nitrogen and phosphorus showed marked increase in the treatment with composted sugarcane trash and phosphobacteria. The treatment with composed sugarcane trash, Rhizobium and phosphobacteria had a significant influence on the available potassium.

The increase in available nutrient content in soil with trash have been reported by Srivastava and Parkash (1990). Krishnan (1986) reported that organic wastes had an influence on the available NPK and micronutrient in soil.

Summary and Conclusion

CHAPTER V

SUMMARY AND CONCLUSION

This research is to brighter the possibilities of using sugarcane trash in increasing crop productivity of agricultural crops. The present investigation was undertaken as a growth promotor for legumes and to find out means and solution for the profitable utilization of sugarcane trash to reduce its environmental hazards.

Composted sugarcane trash extract have in general promoted the seedling growth in greengram. 5% composted sugarcane trash increased the root and shoot length in 12 hours and 10%. Farm Yard Manure in 24 hours. The number of lateral roots have been increased by 10% Farm Yard Manure and composted sugarcane trash. Both fresh weight and dry weight were favourably increased by 2.5 Farm Yard Manure and composted sugarcane trash in 12 hours, whereas in 24 hours, 2.5% composted sugarcane trash increased the fresh weight and 5% Farm Yard Manure and composted sugarcane trash increased the dry weight.

Composted sugarcane trash with cowdung, Pleurotus and Trichoderma increased both root length and shoot length of green gram on 30 days and 50 days. Composted sugarcane trash with biofertilizers like Rhizobium and Phosphobacteria increased both root length and shoot length of green gram most significantly when compared to all other treatments. Number of leaves were increased favourably by the treatment, when compared with the control. Composed sugarcane trash with biofertilizers increased the number of leaves when compared to control. The Internodal and Petiole length were augmented by composted sugarcane trash with Pleurotus and Trichoderma on 30th day, where as raw trash increased the internodal and petiole length on 50th day. Composted sugarcane trash with cowdung, Pleurotus and Trichoderma & biofertilizers showed a significicant fresh and dry weight on 30th day and 50 day of germination .

The yield parameters like pod length, pod circumference were favourably increased by composted sugarcane trash with cowding trichoderma, pleurotus & biofertilizers. All other yield parameters like number of seeds per pod, weight of seeds per plant and 100 seeds weight were significantly increased by composted sugarcane trash alone and with biofertilizers treatment.

The available Nitrogen, Phosphorous and potassium were increased significantly with composed sugarcane trash with biofertiliers. Similarly the soil reaction (PH) was also increased. Electrical conductivity (E.C) remained the same in all the treatments when compared to the control and initial soil sample.

CONCLUSION:

The results of this investigation indicated the influence of the application of composted sugarcane trash & biofertilizers in promoting the yield and biometrical parameters of green gram.

Bibliography

BIBILIOGRAPHY

Adhikari,T.,M.C.Manna and A.K.Biswas,1997. Organic matter improves soil health an over view. Ind FAR., 47(8) : 15-16.

Bachhav, P.R, and R.N. Sabale 1996 . Effects of different sources of N2 on growth parameters, yield and quality of soyabean. J.Maharastra Agric univ., 21(2) : 244-247.

Badole,W.P. and S.R.Umole, 1995. Effect of seed treatment in conjunction with fertilizers on greengram. Indian.J. of Agron., 40(2) : 318-320

Bangar, S.G., A.B. Pawar and A.N Patil, 1981 Annual report, Icar co-ordinated project on micro biological decomposition and recycling of organic wastes.

Bezdick, D.F. and B.H. Magee 1974. Influence of organic nitrogen fixation and yield of soyabean. proc. soil, sci.soc Ame., 38 : 26-270.

Bhanavase,D.B. and P.L.Patil, 1995. Technology for production of sugarcane trash compost. Ind Far., 45 (7) 29-30.

Bhat,A.K.,V. Beri and B.S.Sidhu, 1991. Effect of long term recycling of crop residues on soil productivity J.Indian. soc. soil. sci, 39 : 380-382.

Bisht, J.K and A.S.Chandel, 1996. Effect of integrated nutrient management on yield and quality of soyabean. Annuals of agricultural research, 17(4) : 360-365.

Boramanikar, P.K. and S.A.Patil, 1993. Effect of direct incorporation of sugarcane trash in preseasonal and ratoon crop and its effect on yield and quality of sugarcane. Indian sugar, 42(12) : 856-860.

Chelliah, S., 1997. Integrated nutrient management boosts sugarcane yield. Ind.Far., 47(8) : 119-127.

Deepadevi,A.K. 1992. studies on bioconversion of organic wastes into nutrient enriched composts and their effect on soil fertility crop growth and yield of sorghum. M.Sc Thesis submitted to and approved by TNAU CBE.

Detroja, D.S. and R.K.Patel, 1997. Effect of Phosphatic fertilizer Phosphobacteria and seed size on plant growth and yield of groundnut. Indian. J. of Agron., 42(3) : 495.497.

Dube, J.N. 1976 yield response of soyabean, pea and lentil to inoculation with legume in "symbiotic Nitrogen fixation in plants" Nutman, P.S.(ed) Int.Biol.Prog. 7. cambridge univ press, London : PP : 203-207.

Ellicott, L.,V.L Cochran and R.I Papendick 1981. Wheat residues and N2 placement effects on wheat growth in a green house. soil Sci., 131 : 48-52.

Gaur,A.C. and D.Mukurjee, 1979. Note on the effect of straw on the yield of groundnut and the following wheat. Indian J.Agric Sci., 49(12) : 984-987.

Gaur,A.C., R.S. Mathur and K.V. Sadasivam, 1980. Effect of organic materials and phosphate dissolving cultures on the yield of wheat and moong crops. Indian. J. of Agron., 25:501-503.

Gaur, A.C. 1987. Recyling of organic wastes by improved techniques of composting and other methods. Resources and conservation, 13:157-174.

Gawronska and A.Kulesza., 1966. Effect of Farmyard manure and mineral fertilizers on some chemical properties of the soil and on crop yields in 3 or 4 rotations. Soil and Fert, 30:2926.

Goel,D.K. 1999. Biomass availability and combustion characteristics for co-generation in Indian sugar industry. co-operative sugar, 30(5):417-420.

Havelka, V.D. and R.W.F. Hardy, 1976. Effects of organic waste incorporation on soil enrichment. In Proc 1st Int., symp. N2 fixation Washington state univ. press.456-470.

Jayapaul,P. and V.Ganesaraja, 1990. Studies on response of soyabean varieties to Nitrogen and phosphorus. Indian.J. of Agron., 35 (3) : 329-330.

Kathiresan,G. and G.Manickam, 1995. Efficiency of phosphobacteria addition on cane yield and quality. co-operative sugar., 26 : 629-631.

Krishnan, P.V. 1986. Integrated use of organic wastes and fertilier nitrogen. M.Sc thesis submitted to TNAU CBE.

Kumarawat,B., J.Dighe and G.V.Katti, 1997. Response of soyabean to biofertiliers in black clay soils. crop res., (Hisar) 14(2):210-214.

Laddha,K.C., D.L.Lavti and L.L. Somani, 1984. Effect of organic matter addition and P fertilisation on physical properties of sandy soil and yield of soyabean. Transactions of Indian society of desert tech. and universal centre of desert studies, 9:1.

Ladhive,B.A. 1984. Weed control in sugarcane. Proc.34th DSTA convention Pune, part I - A : 41-46.

Lavanya, P.G., 1994. Rehabilitation of soil health as affected by the incorporation of fertilizers, organic / inorganic agro industrial wastes. Ph.D Thesis submitted to TNAU CBE.

Mahapatra,J. 1971. All about efficient fertilizer use. Ind Far., 4 (10) : 33-34.

Mathan, K.K., Honora, J.Francis and L.Arunachalam, 1994. Influence of integrated nutrient management on the yield, protein content and uptake of nutrients by pigeion pea (cajanus cajan). J. Indian Soc. Soil sci, 42(4) : 558-561.

Ming, U.F. and J.M.Bessor, 1997. Compost a valuable fertilizer and soil improver. Agrarforschug., 4 : 463-466.

Mohod, S.P., D.N.Gupta and A.S. Chavan, 1991. Effects of 'P' solubilising organisms on yield and N uptake by rice. J.Maharastra. Agric.univ., 16(2) : 229-231.

Muthuvel, P. and R,Sivaswamy,1985. Effect of organic, inorganic and biofertiliers on rainfed red gram. Madras Agric. J., 72(3) : 176-177.

Nachiarammal, A., 1991. Integrated nutrient management for improving quality parameters in soyabean. M.Sc thesis submitted to TNAU. CBE.

Pachiammal, 1996. Soil management of organic residue materials from field and plantation crops. Seminar submitted to department of soil sciences. TNAU. CBE.

Parkhe, D.D. and P.A. Shinde, 1981. Recycling of sugarcane trash. Direct incorporation into field soil. J.Maharastra. Agric, univ., 6 (3) : 60-63.

Parr, J.F., B.A.Stewart and R.P.Singh, 1990. Improving the sustainable of dry land farming system. A global perspective Adv. Soil Sci., 13:1-18.

Patra, D.K. and P.Bhattacharya, 1997. Influence of root nodule bacterium on N2 fixation and yield of mungbeam. J.myco pathological research. 35(1) : 47-49.

Patel, D.K. 1994. Effects of bioinoculants on yield and uptake of nutrient by soyabean in swell shrink soils of M.P.Unpublished M.Sc (Ag) thesis J.N.K.V.V. Jabalpur.

Prabhakaran, J.1996. Response of soyabean to Rhizobium and organic amendments in acid soils. Madras Agric. J., 83(2) : 132-133.

Rahman,H.H and A.H. Bhuiyan, 1994. The use of organic residues in increasing crop production in a wheat-mungbean cropping system. International symposium Dhaka, Bangladesh, 28 Nov - 2 Dec. 1994.

Ramamurthy, V.and K.Shivasankar, 1996. Effect of organic matter and phosphorus on growth and yield of soyabean. Indian.J. of Agron., 41(1) : 22-24.

RaniPerumal,P., P.Duraiswamy and Honora.F. Francis. 1992. Integrated effect of inorganic nitrogen, coirpith and bionoculants in sorghum and sorghum - pea cropping system. Proc. National seminar on utilitisation of coirpith TNAU. CBE : 100 - 111.

Rasal, P.H., V.V. Shingte and P.L. Patil, 1987. A study on direct incorporation of sugarcane trash on the yield of sugarcane.J.of Envt. Biol., 8 (4) : 180-182.

Rasal,P.H., V.V.Shingte and P.L.Patil, 1989. Effect of sugarcane trash on crop yields and soil properties. J. Maharastra. Agric. univ., 14 (1) : 79-82.

Rote, B.P. and B.N.Shinde , 1982. Composting of sugarcane trash using mixed inoculum of fungus cultures and leguminous material by open heap method. Indian sugar., 31 (11) 819-822.

Sabanayagam,V. and P.Savithri, 1995. Coirpith as potting media for flowering plants under green house condition. Abstracts. National symposium on organic farming, TNAU, Madurai, Oct. 27-28: 58-59.

Sanyasi Raju, 1952. The role of organic manures and inorgainc fertilizers in soil fertility. Madras. Agric. J., 39: 130-132.

Saxena, K.K., H.R.Verma and H.K.Saxena, 1996. Effect of Phosphorus and potassium on greengram. Indian.J.of Agron., 41 (1): 11-13.

Selvakumari, G., 1981. Studies on the effect of P.K. and FYM on soil properities, nutrition and yield of crops.Viz,sorghum and bajra in a fixed rotation. Ph.D thesis TNAU. CBE.

Sennimalai,P., 1994. Nitrogen use efficiency through integrated management in rice-rice cropping system. MSc. thesis submitted to TNAU. CBE.

Shinde,P.B., G.D.Jangale and P.L.Patil, 1984. Influence of incorporation of sugarcane on yield of wheat and gram. Maharastra sugar, 10 (2) : 56-60.

Shinde, D.B., A.M.Navale and S.B.Jadhav, 1992. Effects of microbial degradation of sugarcane trash insitu on caneyield and soil properties. In proceedings of the National seminar on organic farming. College of Agrl. Pune.Apr.18-19: 64-66.

Shinde,D.B., A.M.Navale and S.B.Jadhav,1993. A study on incorporation of sugarcane trash in ratoon sugarcane. J.Maharastra. Agric univ., 18 (2) 264-265.

Shukla,S.K. and R.S.Dixit, 1996. Nutrient and plant population management in green gram. Indian. J. of Agron., 41 (3) : 56-58.

Sidhamalai, A., 1996. Effects of organic matter on the quality of crop produce. seminar submitted to the department of soil sciences. TNAU. CBE.

Sidhu,B.S. and V.Beri, 1989. Effect of crop residue management on the yields of different crops and on soil properities. Biol.wastes, 27:15-27.

Singh, C.P., 1985. Preparation of phospho compost and its effect on the yield of moongbean and wheat. Biol.Agrl and Hortl., 2 : 223-229.

Soliappan,V. and S.Ramaiah, 1990. Effect of seed treatments, soil and foliar fertilization of N and P on yield and yield attributes of pigeon pea grown under rainfed condition. Indian.J.of Agron., 35(3) : 234-237.

Somani,L.L. and S.N.Saxena., 1975. Effect of some organic matter source on nutrient availability, humus build up, soil physical properties and wheat yield under field conditions. Ann. Arid.zone,14 (2) : 149-158.

Srivastava, P.C. and O.M. Parkash, 1990. Effect of different methods on sugarcane trash recycling. Part I : on available N2 P and K. Indian.J.Tropical Agric., 8 : 249-255.

Sutton,M.R., A.W.Wood And P.G.Saffigna, 1996. Long term effects of green cane trash retention on Herbert river soils. In sugar 2000 symposium,Brisbane. Australia.

Taicheyang, 1995. Effects of organic manure on the growth and yield of common bean at fall season. Bulletin of Taichung district agricultural improvement station. Taiwan, 49 : 41-48.

Tambe,G.C and Wad Y.D., 1935. Humus manufacture from cane trash. The International Sugar journal., 37 (433) : 260-263.

Thamizhvendan.R. and S.Sheerin, 1998. Brady Rhiobium and phosphobacteria enhance soyabean yield. Kisan world., 25 (5) : 25-28.

Thiageshwari, S.,1992. Organics-composting technologies. seminar submitted to the department of soil Sciences. TNAU. CBE.

Thimmegowda,S.,1993. Effect of fertilizer levels on yield potential of pulses grown in quick succession with kharif rice under low water conditions. Mysore. J. of Agric. sci., 27 (2): 118-123.

Tippanava, C.M. and S.A.Desai, 1992. Effect of Rhizobium with cultural practices on Bengal gram production. J.Maharastra agric.univ., 17(2) : 326-327.

Tomar and Verma, 1998. Symbiosis between mungbean and rhizobia,influence of water stress. Indian. J of plt. physiol., 3 (1) : 11-16.

Tran Tri. N. Son ., 1995. Bioconversion of organic wastes for sustainable agriculture. Ph.D. thesis submitted to TNAU. CBE.

Traulsen, B.P., 1997. Risk assessment of the application of biological waste compost on agricultural land use. Agri. biological research., 50 (2) : 102-114.

Vaidhya, B.V., 1994. Response of soyabean to the application of rhizobium. P.G. Institute akola. Thesis abs., 229-231.

Vaishya, U,K,, P.N. Bapat and A.V. Dubey, 1996. Phosphate solubility efficiency of micro organisms on gram grown on vertisol. J.of Ind. Soc. of Soil sci. 44 (3) : 524-526.

Vallis,I., B.A.Keating and A.W.Wood, 1996. Simulation of the effect of trash and N-fertiliser management on soil organic matter levels and yields of sugarcane. soil and tillage research, 38 : 115-132.

Velayudham,K., S.Manoharan and R.Balasubramanium, 1996. Effect of organic wastes on growth and yield of rice. Indian.J.of Agron., 41 (4) : 82-83.

Venugopal,R. 1999. Wealth from waste. Kisan world., 26 (1) : 15-16.

Verma, H.D., 1996. Response of sugarcane to trash mulch and N2 levels. Indian sugar, 46(3) : 185-187.

Vijayakumar and O.P.Sagwal, 1998. Effect of sugartrash and fertiliser N2 applications on the nutrient status and soil

physical properties in Haryana soil. Indian sugar, vol. XLVII (12) : 967 - 971.

Yadav, D.S., S.B.Singh and R.Achal, 1987 a. Effects of enriched compost and rhiobium on the yield of greegram. J. Ind. soc. soil Sci., 40 : 71-75.

Yadav.D.V., Todi Singh and A.K.Srivastava, 1987b. Recycling of nutrients in trash with nitrogen for higher cane yield. Biol.Wastes., 20 : 133-140.

Yadhav. R.L. 1993. Nutrient management in "Agronomy of sugarcane - principloes and practices". International book distribution 10. Lucknow (India).

Yaman, M. and S.Cisoy, 1997. The effect of inoculation with bacteria Rhiobium Japanicum.L. and N2 application of yield and seed weight of soyabean.. Thesis Abs. , 7 (1) : 21-29.