4

RESULTS AND DISCUSSION

The results and discussion pertaining to the composting of agrowastes coirpith and pressmud, farmyard manure, biometric parameters of the test crops [black gram (*Vigna mungo* L.Var. ADT 5), cluster bean (*Cyamopsis tetragonolopba* L. (taub) Var. Pusa Navbahar) and green gram (*Vigna radiata* L. Var. (Co (Gg) 7))] during vegetative growth, biochemical analysis, yield parameters, leghaemoglobin content in the nodules, enzymatic studies in the soil, pre and post harvest soil samples were analysed and presented in this chapter. A survey was conducted in the following area where the coir waste was dumped viz., Kettimallanpudoor, Singanallur, Anaimalai and Poochanari.

4.1 COMPOSTING

4.1.1 Composition of the raw and composted coirpith

Lignin and Cellulose

Composting is the most suitable technique for transforming organic waste into usable agricultural amendments. In the present investigation lignin and cellulose contents of raw coirpith were 32 % and 28%. It reduces to 5% and 0% when composted with *Pleurotus sajor-caju* as shown in table- I.

Lignin and cellulose is a good index to evaluate degree of the maturity of the compost. Coirpith being a recalcitrant ligno – cellulosic product, organisms capable of producing cellulolytic and lignolytic enzymes will have the tendency to degrade it. The result is on par with the result of Keener *et al*. (2000) who also reported that during composting thermophilic microorganisms degrades fats, cellulose, hemicelluloses and some lignin and mesophilic microorganisms recolonised the composting mass which were able to degrade the remaining sugars, cellulose and hemicelluloses.

Lakshmanan and Bommaraju (2003) reported that fungi belonging to class Basidiomycetes especially mushroom fungi are capable of producing the enzymes required for ligno-cellulosic products.

TABLE - I

COMPOSITION OF RAW AND COMPOSTED COIRPITH

Chemical composition	Raw coirpith	Composted coirpith
Lignin (%)	32	5
Cellulose (%)	28	0
pH	6.49	6.07
Electrical conductivity (milli mhos cm^{-1})	3.3	6.3
Organic carbon (%)	48.70	31.11
Nitrogen (%)	0.45	0.90
Phosphorus (%)	0.02	2.15
Potassium (%)	0.62	0.90
Calcium (%)	0.44	2.43
Magnesium (%)	0.31	0.74
C:N	102:64	34:18

The result is on par with the result of Raghuvaran and Ravindranath (2012) who also reported that coirpith composted with *Pleurotus sajor - caju* promote lignin degradation effectively from 32 to 17%.

These finding were found in line with the work of Oviasogie *et al* (2013). Higher amount of lignin (30.00%) and cellulose (30.00%) content have been reported in the raw coirpith as compared to the lignin (4.80%) and cellulose (4.80%) of the composted coirpith with the nitrogenous source in the form of urea (5kg t^{-1}) or fresh poultry litter (200kg t^{-1}).

This result coincides with the result of Sunitha Kumari *et al*. (2013a) who recorded that lignin and cellulose content of the raw coirpith was 35.10% and 30.40% and after composting with *Pleurotus florida* it reduced to 12.70% and 18.05%.

Disposal of coirpith into the environment causes environmental pollution and health hazards due to the presence of high lignin content. Lignin is strong as compared to cellulose and hemicellulose. From the present study it is evident that it can be recycled properly by composting which serves as a good source of plant nutrients for sustainable crop productivity and soil fertility.

pH

pH generally gives an approximate index of compost maturation. The pH value of the raw coirpith was 6.49 and as the decomposition progressed, a decrease in pH of 6.07 was observed in the composted coirpith (Table - I). The pH value of the compost is considered to be an indicator of process of decomposition and stabilization. Manure composts tend to have near neutral pH values, while composts under maturation tend to be more acidic. Averagely mature composts have pH between 6 and 8 and the composts prepared have pH in this range indicating maturity of the compost.

The present result coincides with the result of Tiquia *et al*. (2002). They observed a decrease in pH from 9.43 to 8.35 in fungal consortium inoculated urban solid waste compost over 40 days period of composting. Similar result was observed by Sunitha Kumari *et al*. (2013a) who also observed a decrease in pH from 7.4 to 7.1 during decomposition of coirpith with *Pleurotus florida*. The significant decrease in pH in the composted coirpith might be due to the formation of organic and inorganic acids during the decomposition of the organic matter.

EC

The EC value of the raw coirpith was found to be 3.3 millimhos cm^{-1} and as the degradation process exceeds it increases to 6.3 millimhos cm^{-1} in the composted coirpith (Table -1). The electrical conductivity (EC) reflects the salinity of an organic amendments. High salt concentration may cause phytotoxicity problems and therefore EC is a good indicator of the suitability and safety of a compost for agricultural purpose.

Similar result was observed by Kayikcioglu and Okur (2011) who also reported a increase in EC from 70 dSm^{-1} to 89 dSm^{-1} on the 17^{th} and 19^{th} weeks of composting of tobacco waste.

The present result coincides with the result of Shyamala and Belagali (2012) who observed an increase in EC from 2.4 dSm^{-1} to 7.7 dSm^{-1} at different maturity stages (10, 20, 30, 40, 50 and 60 days) of Municipal Solid Waste Compost (garbage and sewage).

These high values could be due to the effect of the concentration of salts as a consequence of the degradation of organic matter. In the thermophilic stage, a large amount of nutrients are consumed as a result of the high microbiological activity. At the later stages of composting, lower temperatures and slower microbial growth induce accumulation of nutrients in soluble phase, thus increasing the EC.

Organic carbon

In the present investigation it is evident that the initial OC content showed a decreasing trend of biodegradation. A significant decrease in OC of 31.11% was observed during decomposition of coirpith against the initial value of 48.70% (Table – I).

The present result coincide with the result of Sengar *et al*. (2009) who reported maximum reduction in organic carbon content from 35.12% to 15.14% during degradation of bagasse. The result is also in par with Ayesha Parveen and Padmaja (2010) who observed maximum decreased in organic carbon content from 34.07% to 24.45% in uninoculated Municipal solid waste (water hyacinth) and to 21.09% in fungal consortium inoculated sample.

Similar result was obtained by Viji and Neelanarayanan (2014) who obtained a maximum reduction in organic carbon content from 43.29 to 10.08 in vermicompost utilizing coirpith (pre-digested with *Pleurotus* sp.) and cow dung in 50:50 concentration. Reduction in OC content of the composted coirpith might be due to the decomposition process by the microflora which led to the loss of carbon in the form of CO_2 from the substrates during the decomposition and mineralization of organic waste by forming a stabilized end-products, a slow released fertilizer for crops.

Total nitrogen content

The present study revealed that the total nitrogen content showed an increasing trend during decomposition. The initial nitrogen content of raw coirpith was 0.45% and there was an increase in nitrogen content to 0.90%. Nitrogen is an important nutrient for composting process and its quantity determines the microorganism population growth (Table-I).

Similar result was obtained by Sunitha Kumari *et al*. (2013a) who observed a maximum increase in nitrogen content from 0.39% to 0.99% by *Pleurotus florida* inoculated coirpith sample.

The present observation is in accordance with the findings of Prabhakaran and Manivannan (2014) who observed a increase in total nitrogen content from 1.40 to 2.69 in poultry droppings wastes amended with bagasse inoculated with fungal consortium (*Aspergillus flavus*, *Aspergillus niger*, *Trichoderma viride* and *Phanerochaete chrysosporium*) after 30 days of decomposition.

The drastic increase in total nitrogen content in the biocompost was not only due to increment of nutrients but also due to the mineralization of organic matter by microorganisms. The increase in total nitrogen content adds agricultural significance to the composted coirpith because organic manure was a welcoming trait for sustaining the yield of agriculture crops.

Total phosphorus content

Data presented in table – I in the present study stated that the total phosphorus content showed an increasing trend from 0.02 to 2.15% in coirpith waste during biodegradation.

The present observation is in accordance with the findings of Suresh Kumar and Ganesh (2012) who observed a increase in total phosphorus content from 0.19 to 0.68% in coirpith waste inoculated with *Pleurotus sajor - caju* and panchagavya.

The present result coincides with the result of Prabhakaran and Manivannan (2014). who obtained an increased total phosphorus of 1.72 from 0.98 in poultry droppings wastes amended with bagasse inoculated with fungal consortium (*Aspergillus flavus*, *Aspergillus niger*, *Trichoderma viride* and *Phanerochaete chrysosporium*) on 30^{th} day.

The increase in phosphorus content during microbial composting might be due to the composted coirpith which constitutes of important macro and micro nutrients, and provides decomposable organic matter by increasing soil aggregation and also releases organic acids which in turn improves the phosphorus availability.

Total potassium content

It is evident from table – I that the initial total potassium content showed an increasing trend of biodegradation. A significant increase in total potassium content of 0.90% was observed during decomposition of coirpith against the initial value of 0.62%.

The present observation is in accordance with the findings of Suresh Kumar and Ganesh (2012) who also observed an increase in total potassium content from 0.85% to 4.18% in coirpith waste inoculated with *Pleurotus sajor-caju* and cow urine.

Similar result was obtained by Reghuvaran and Ravindranath (2012) who observed an increase in total potassium content from 0.28% to 0.42% and 0.28% to 0.41% by lignocellulolytic fungi (*Pleurotus sajor-caju*) inoculated coirpith sample over 15th and 30th day of degradation.

The present result coincides with the result of Sunitha Kumari *et al*. (2013a) who obtained an increased total potassium content of 0.81% from 0.61% in *Pleurotus* composted coirpith.

The apparent increase in potassium content might be due to higher mineralization rate as a result of enhanced microbial and enzyme activities leading to decrease in volume of the compost.

Calcium and magnesium content

A perusal of data presented in table – I in the present study revealed an increasing trend in total calcium and magnesium content of the raw and composted coirpith. A significant increase from 0.44 to 2.43 and 0.31 to 0.74% was recorded. Calcium has strong influence on ion absorption by soil particle and on the availability of other elements.

Magnesium is closely related to calcium and is absorbed in the soil as anion. It involves in energy conversion and phosphorous metabolism. The percentages of calcium and magnesium for the various samples studied have been observed to increase as the time of composting increased. This shows that the composted material obtained when used for growing plants will have the capability to supply other elements for the solid and the ion absorption by soil particle will be enhanced8. The composted material also helps in energy transfer and phosphorous metabolism.

Similar result was obtained by Suresh Kumar and Ganesh (2012) who observed a maximum increased in total calcium and magnesium content from 0.82% to 3.20% and 0.24% to 2.41 % by *Pleurotus sajor caju*, coirpith and cow urine.

The result is also on par with Viji and Neelanarayanan (2014) who reported an significant increase in total calcium and magnesium content from 0.09% to 5.26% and 0.35% to 2.34% in vermicompost produced by *Eudrilus eugeniae*, *Perionyx excavates*, *Eudrilus fetida* and control utilizing coirpith (pre-digested with *Pleurotus* sp.) and cow dung in 50 : 50 concentration.

Microbial composting plays an important role in microbial mediated nutrient mineralization in wastes. Microorganisms plays an important role in transformation of plant metabolites into more available forms of calcium and magnesium by microbial association with compost to produce quality compost with high agronomic value.

C:N

C:N ratio is one of the most important parameters that determine the extent of composting and degree of compost maturity. C:N ratio of the compost materials narrowed down from 102:64 to 34:18 with the advancement of the period of decomposition as depicted in table - I.

This is an accordance with the findings of Jayapriya and Saseetharan (2007) who reported a drastic reduction in C: N ratio from 30: 1 to 19: 1 in MSW (Muncipal solid waste) biocompost. Zhang *et al*. (2011) also observed a significant decrease in C: N ratio from 31: 1 to 17: 1 after 60 days of composting agricultural waste. The present result coincides with the result of Muthurayar and Dhanarajan (2013) who obtained a drastic reduction in C: N ratio from 162: 1 to 21.8: 1 during degradation of coirpith, vegetable market waste and poultry waste along with cow dung.

This results agreed with the findings of Sunitha Kumari *et al*. (2013a) who observed decrease in C: N ratio from 113: 1 to 33.8: 1 by *Pleurotus florida* inoculated coirpith sample. A decrease in C: N ratio implies an increase in the degree of humification of organic matter. As the decomposition progressed, due to the losses of carbon mainly as carbon dioxide, in the process of respiration, the carbon content of the compostable material decreased with time and production of mucus and nitrogenous excrement enhanced the level of nitrogen, which lowered the C:N ratio.

4.1.2 Composition of the raw and composted pressmud

pH and EC

Initial pH and EC of a substrate are two factors, which determine the suitability of a substrate to be used for growing plants. The pH value of the pressmud gradually increased from 7.2 to 7.84. The electrical conductivity (EC) also showed an increasing trend from 3.3 to 6.3 millimhos cm^{-1} during microbial degradation of pressmud. The pH and EC values are given in table-II.

The present result coincides with the result of Prakash and Hemalatha (2013) who observed an increase in pH from 7.12 to 7.65 and EC from 1.20 to 1.42 dSm^{-1} over 60 days of degradation of pressmud subjected to vermicomposting using *Eisenia fetida.*

The present result coincide with the result of Ahmad *et al.* (2012) who observed an increase in pH from 7.8 to 8.0 and EC from 0.57 to 0.68 dSm^{-1} during decomposition of pressmud with conventional manure (garden soil, silt and leaf mould [1:1:1, v/v/v]). Probable reason for high pH with pressmud may be due to higher calcium level present in pressmud and an increase in EC with pressmud might be due to the presence of higher salts and heavy metal concentrations.

TABLE - II

COMPOSITION OF RAW AND COMPOSTED PRESSMUD

Chemical composition	Raw pressmud	Composted pressmud
pH	7.2	7.84
Electrical conductivity (milli mhos cm-1	3.3	6.3
Organic carbon (%)	32.2	13.1
Nitrogen (%)	1.1	1.68
Phosphorus (%)	1.44	2.51
Potassium (%)	0.64	2.94
Calcium (%)	4.47	7.64
Magnesium (%)	0.95	2.23
C:N	32:2	13:1

Organic carbon

It is evident from present study that the initial organic carbon content showed a decreasing trend from 0 to 60 days of decomposition. A significant decrease in organic carbon of 13.1% was observed in composted pressmud against the initial value of 32.2%. (Table-II)

The present result coincides with the result of Joshi and Sharma (2010) who reported reduction in organic carbon to 29.05 from 29.67 in thermophilic bacteria inoculated pressmud over a period of 60days.

The result is also on par with Bhosale *et al*. (2012) who also observed a maximum decrease in organic carbon content of 40.65% from 43.78% over 30 days degradation of waxed pressmud into composted waxed pressmud. The decrease in organic carbon content in the composted pressmud might be due to the mineralization of organic matter and degradation process by the microorganisms which led to the formation of stable end products, a slow released fertilizer for the crops.

Total nitrogen content

A perusal of data presented in table-II examined that the total nitrogen content showed an increasing trend from 0 to 60 days of decomposition with *Pleurotus sajor-caju*. A significant increase from 1.1 to 1.68% was recorded.

The present observation is in accordance with the findings of Kumaresan *et al*. (2003) who observed an increase in total nitrogen content from 1.12% to 1.26% in *Pleurotus sajor - caju* inoculated pressmud substrate over 60 days of decomposition.

Similar result was obtained by Sarker *et al*. (2013) who observed a maximum increase in total nitrogen content during composting of pressmud using bacterial consortium ranged from 1.59% to 2.89% with incubation period of 49 days.

The apparent increase in total nitrogen content during composting in the biocompost might be a direct manifestation of mass loss, carbon loss and also due to the mineralization of organic matter by the microorganisms.

Total phosphorus content

Total phosphorus content showed an increasing trend from 1.44% to 2.51% over 60 days of decomposition with *Pleurotus sajor - caju*. The result is also on par with Prakash and Hemalatha (2013) who reported a significant increase in total phosphorus from 3.08% to 3.98% in pressmud inoculated with *Eisenia fedita* after 60 days of decomposition (Table-II).

The present study coincides with the result of Sarker *et al*. (2013) who obtained an increase total phosphorus content during composting of pressmud using bacterial consortium from 0.58% to 1.46% with incubation period of 49 days.

The increase in total phosphorus content in the composted pressmud might be due to the microbial activity which enhanced the phosphorus content of the compost leading to decrease in volume of the material.

Total potassium content

The total potassium content increased significantly with the increase in the period of decomposition. Increase in total potassium content was observed in pressmud from 0.64% to 2.94%. (Table-II)

Similar result was obtained by Kumaresan *et al.* (2003) who observed an maximum increase in total potassium content from 1.20% to 1.25% by lignocellulolytic fungi (*Pleurotus sajor-caju*) inoculated pressmud sample over 60 days of degradation. It also coincides with the result of Prakash and Hemalatha (2013) who obtained an increase in total potassium content of 1.30% to 1.72% in pressmud sample inoculated with *Eisenia fedita* after 60 days of decomposition.

The increase in total potassium content might be due to the mineralization of the organic matter present in pressmud which can be used as a fertilizer for the crops. The water solubility of potassium decrease with humification so that potassium solubility during the decomposition was subjected to further immobilization factor.

Calcium content

The initial total calcium content showed an increasing trend from 4.47 to 7.64 % over 60 days of decomposition with *Pleurotus sajor-caju*. (Table – II)

The present result also coincides with result of Joshi and Sharma (2010). They observed an increase in total calcium content from 0.204 to 0.250 in thermophilic bacteria inoculated pressmud over a period of 60 days.

A similar result was obtained by Cifuentes *et al.* (2013) who reported an increase in total calcium content from 7.80 to 19% during composting trials in which bagasse was substituted with waste sugarcane in the mixture with pressmud over 140 days.

The increase in total calcium content might be due to the mineralization of the organic matter present in the waste by the microorganisms which plays an important role in transformation of plants metabolites into more available forms

Magnesium content

The total magnesium content of the waste ranged from 0.95 to 2.23% which might be due to the more availability of the organic matter rich in magnesium content which are formed due to the biodegradation of the waste by the microorganisms. (Table-II)

The present finding is in conformity with the finding of Joshi and Sharma (2010) who recorded an increased in total magnesium content from 0.088% to 0.64% in the vermicomposted pressmud over a period of 60 days and with the result of Prakash and Hemalatha (2013) who observed a gradual increase in total magnesium content from 0.36% to 0.72% in pressmud sample inoculated with *Eisenia fedita* after 60 days of decomposition.

The result is on par with the result of Cifuentes *et al.* (2013) who reported an increase in total magnesium content from 0.99% to 31% during composting trials in which bagasse was substituted with waste sugarcane in the mixture with pressmud over 140 days.

C:N ratio

C:N ratio is known to be used as an index for maturity of organic waste decomposition which narrowed down with the advancement of the period of the decomposition. The carbon to nitrogen ratio affects the speed of the composting process and the volume of materials finished.

The initial C:N ratio of the waste used for composting ranged from 32.2 to 13.1. During composting, microorganisms utilize the carbon as a source of energy and the nitrogen for building the cell structure (table-II). This study agreed with findings of the work done by Kumaresan *et al*. (2003) who observed a reduction in C: N ratio from 14.3:1 to 12.3:1 by lignocellulolytic fungi (*Pleurotus sajor-caju*) inoculated pressmud sample over 60 days of degradation. The present result also coincides with the result of Padmaja and Leena Lavanya (2006). They obtained a drastic reduction in C: N ratio from 85:1 to 18: 1 during degradation of coirpith with *Humicola grisea Eraaen.*

The present result is in accordance with the result of Joshi and Sharma (2010) who observed a significant reduction in C: N ratio from 26.25:1 to 18.15:1 over a period of 60days in thermophilic bacteria inoculated pressmud. This is in accordance with the findings of Prakash and Hemalatha (2013) who reported a drastic reduction in C: N ratio from 27.58 to 13.33 percent in pressmud sample inoculated with *Eisenia fedita* after 60 days of decomposition.

4.2. POT CULTURE EXPERIMENT

A pot culture experiment was conducted with black gram (*Vigna mungo* L. Var. ADT 5), cluster bean (*Cyamopsis tetragonoloba* (L) Taub Var. Pusa Navbahar) and green gram (*Vigna radiata* L.Var. (Co (Gg)7)) as the test crops to estimate the importance of composted coirpith, composted pressmud and farmyard manure. The composts effect on test crops was compared against the control.

A number of biometric observations, biochemical analysis, yield parameters, leghaemoglobin content, soil dehydrogenase and urease activity were recorded at different stages during the growth of black gram (*Vigna mungo* L. Var. ADT 5), cluster bean (*Cyamopsis tetragonoloba* (L) Taub Var. Pusa Navbahar) and green gram (*Vigna radiata* L. Var. (Co (Gg) 7)) as influenced by different organic manure at different time intervals of 25, 45, 55 and 75 DAS (Days After Sowing) were statistically scrutinized.

4.2.1 BIOMETRIC CHARACTERS

4.2.1.1 Effect of composted coirpith, composted pressmud and farmyard manure on vegetative parameters of test crops.

4.2.1.1a Root length

Black gram

There was a gradual increase in root length from 25 to 55 DAS in all the treatments (from T_1 to T_{12}) as revealed in table -III and plate -VIII & IX. A significant increase in root length is noted in all the treatments when compared to the control.

Among the treatments (from T_1 to T_{12}) maximum increase in root length was recorded in T_2 (15.12 cm), T_6 (12.44 cm), and T_{10} (12.44 cm) on 25 DAS, T_{11} (18.67 cm), T_2 (18.33 cm) and T_5 (15.22 cm) on 45 DAS and T_2 (18.50 cm), T_9 (18.33 cm) and T_{12} (18.30 cm) on 55 DAS when compared to control T_1 (6.49 cm, 8.32 cm, 9.37 cm) .

TABLE - III

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Root length(cm)			Shoot length(cm)			Number of leaves			Number of nodules		
	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS
T_1	6.49	8.32	9.37	20.19	20.33	25.36	6.78	7.56	10.44	0.66	1.55	1.22
T_2	15.12	18.33	18.50	20.69	25.78	27.38	8.78	16.11	12.67	14.00	24.40	18.80
T_3	8.29	13.22	14.39	22.89	31.89	32.00	8.67	10.22	14.17	2.66	4.40	3.77
T_4	8.28	9.44	10.39	21.89	22.78	23.78	8.44	15.33	16.11	4.66	5.55	2.88
T_5	10.27	15.22	15.56	23.00	24.44	26.40	7.00	12.89	16.89	1.33	6.44	1.33
T_6	12.44	13.28	13.37	23.22	33.44	34.78	17.00	14.33	15.00	5.66	8.55	2.77
T_7	7.29	9.29	11.44	23.33	32.22	34.00	9.44	15.33	19.78	5.11	6.33	4.22
T_8	7.44	15.11	15.89	24.28	27.56	30.00	9.00	21.78	24.00	1.44	1.72	1.44
T_9	11.11	14.33	18.33	27.56	28.22	33.22	9.00	19.00	23.78	3.00	5.50	2.77
T_{10}	12.44	12.50	15.31	24.67	33.56	36.00	13.00	18.56	20.00	1.33	2.55	1.33
T_{11}	9.89	18.67	18.20	25.89	29.67	35.89	6.89	12.44	18.00	0.66	2.22	1.66
T_{12}	9.56	10.44	18.30	22.00	23.44	25.38	12.89	15.33	16.00	1.66	2.44	1.77
SED	0.03075			0.03572			0.03167			0.02684		
CD(0.05)	0.06130			0.07121			0.06314			0.05350		
CD(0.01)	0.08137**			0.09451**			0.08380**			0.07101**		

** - Significant at 1% (P<0.01), DAS - Days After Sowing

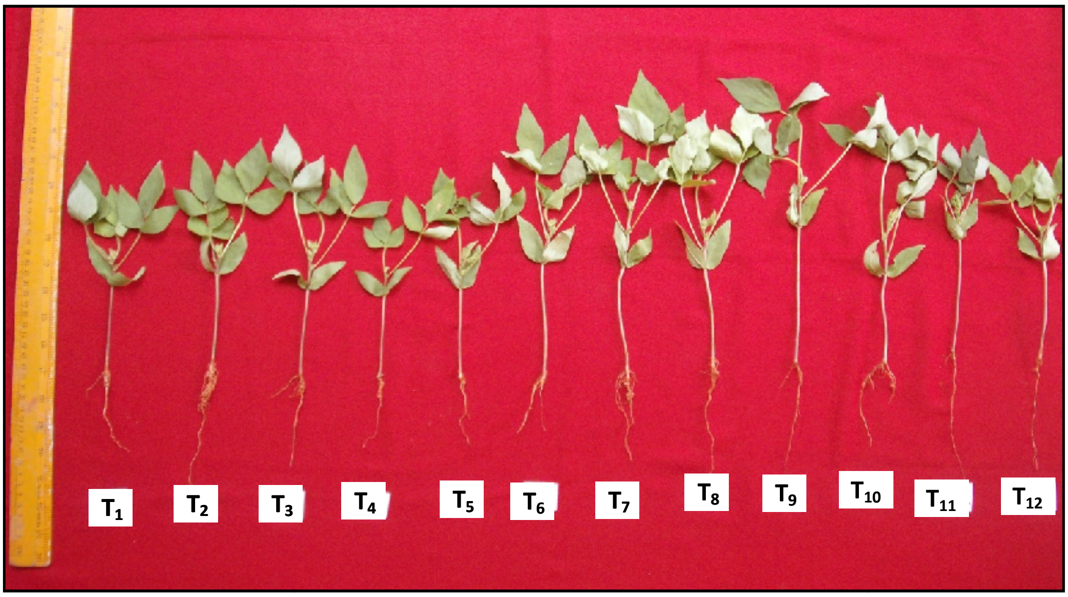
T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

PLATE - VIII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5) on 25 DAS

Black gram

25 DAS



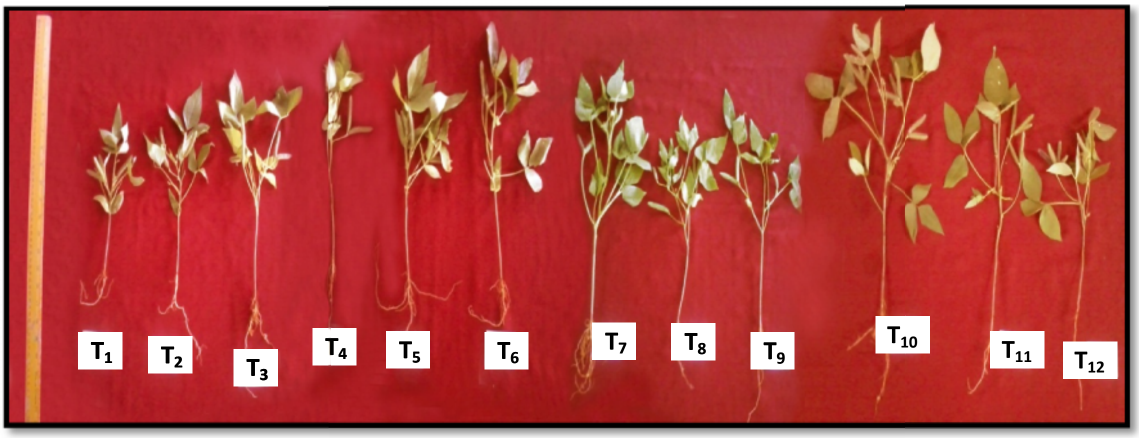
T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

PLATE - IX

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5) on 45 and 55 DAS

45DAS

55DAS



T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

Cluster bean

The root length was significantly increased in T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK), T_{12} (composted coirpith (6.5t ha^{-1}) +composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) and T_9 (composted coirpith (12.5t ha^{-1}) + 25%NPK) on 25 DAS (13.08cm, 12.66cm, 10.72 cm) when compared to control T_1 (5.00 cm), T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure) (6.5t ha^{-1})), T_6 (composted coirpith (12.5t ha^{-1}) + 50%NPK) and T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) on 45 DAS (29.31cm, 23.49cm, 22.72cm) when compared to control T_1 (13.60 cm), T_5 (NPK 100%), T_7 (composted pressmud (12.5t ha^{-1}) + 50%NPK) and T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) on 55 DAS (65.44cm, 60.56cm, 58.44 cm) as compared to the control T_1 (31.89 cm) shown in table - IV & plate -X & XI .

TABLE - IV

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	Root length(cm)			Shoot length(cm)			Number of leaves			Number of nodules		
	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS
T_1	5.00	13.60	31.89	31.11	35.59	43.22	5.00	8.11	9.44	0.44	1.00	0.44
T_2	7.94	16.36	38.11	28.84	37.60	46.01	9.89	10.67	10.89	0.89	0.67	0.56
T_3	5.00	16.88	44.33	31.67	47.88	48.41	7.11	14.11	14.67	0.78	1.33	1.33
T_4	6.20	18.46	49.24	32.67	37.63	48.31	7.89	10.89	13.22	0.78	0.78	0.44
T_5	8.28	15.62	65.44	37.56	42.08	50.56	8.11	14.89	15.89	1.00	1.56	1.11
T_6	5.56	23.49	45.00	27.17	44.37	55.44	19.00	22.22	24.67	1.11	1.56	1.33
T_7	7.44	22.72	60.56	36.94	45.23	54.78	5.00	27.00	33.11	0.89	1.89	1.11
T_8	9.83	19.17	47.89	24.22	46.59	57.67	11.89	18.00	19.11	1.22	1.33	0.56
T_9	10.72	15.31	42.22	32.56	38.40	59.33	6.67	10.33	17.89	1.00	1.66	1.22
T_{10}	8.42	16.27	58.44	34.33	35.63	54.33	7.33	28.44	34.56	1.11	2.22	1.56
T_{11}	13.08	15.31	34.33	36.78	47.86	58.24	13.33	32.89	33.67	0.89	4.11	1.89
T_{12}	12.66	29.31	42.11	35.22	46.30	52.36	7.67	21.22	25.89	0.56	1.11	0.33
SED	0.02776			0.02750			0.04865			0.02365		
CD(0.05)	0.05540			0.05482			0.09699			0.04714		
CD(0.01)	0.07353**			0.07276**			0.12873**			0.06257**		

** -Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

PLATE - X

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) on 25 DAS

Cluster bean

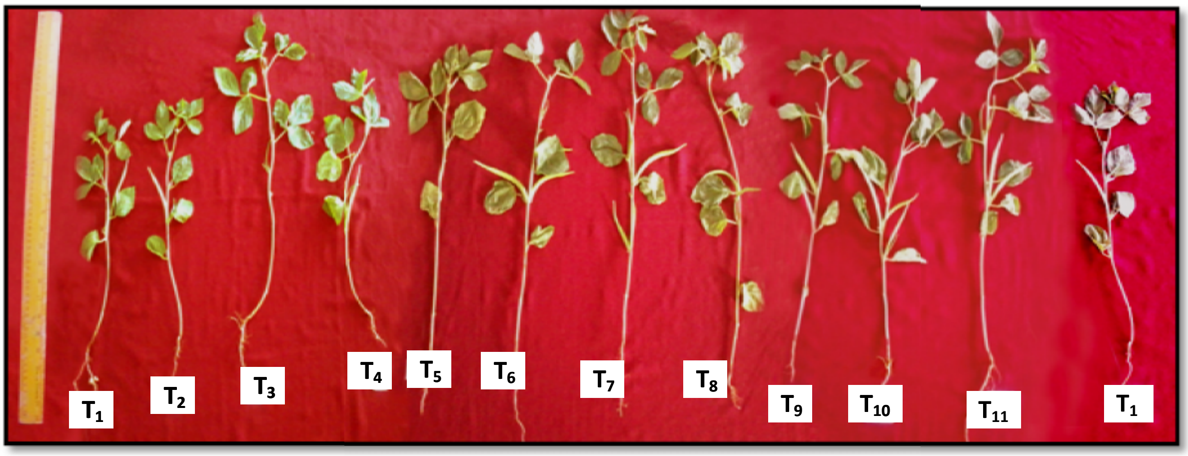
25DAS

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

PLATE- XI

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) on 45 and 55 DAS

45DAS



55DAS

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

Green gram

There was a gradual increase in root length from 25 to 55 DAS in all the treatments (from T_1 to T_{12}) as revealed in table-V & plate- XII & XIII.

Among the treatments (from T_1 to T_{12}) maximum increase in root length was recorded in T_2 (13.47 cm), T_5 (13.37 cm) and T_4 (11.38 cm) on 25 DAS, T_2 (24.78 cm), T_5 (16.74 cm) and T_{10} (16.67 cm) on 45 DAS and T_4 (24.27 cm), T_8 (19.78 cm) and T_6 (19.39 cm) on 55 DAS when compared to control T_1 (2.44 cm, 5.67 cm, 9.11 cm) .

The result is in agreement with the result of Saraswathy *et al*. (2004) who reported enhanced root length of 22.5 cm with the combined application of NPK (0:25:0)+ composted coirpith at 12.5 t $ha^{-1}$when compared to NPK (12.5:25:0 kg ha^{-1}) of 15.3 cm in green gram.

The result is in agreement with the results of Ewulo *et al*. (2008) who observed increase in root length of tomato plant with the application of poultry manure at 50t ha^{-1} of 35.8 cm at Federal College of Agriculture site (FECA) and 34.9cm at Federal University of Technology site (FUTA) Akure, Southwest Nigeria when compared to control T_1 (22.9cm and 21.9 cm).

A Similar result was obtained by Vijaya *et al*. (2008) who reported that the application of garden soil + vermicomposted coirpith enhanced the root length of 26 cm over control of 22 cm in *Andrographis paniculata* after 30 day.

The result is in agreement with the result of Reghuvaran and Ravindranath (2010) who reported increased root length in four different medicinal plants (*Phyllanthus. amaranthus*, *Andrographis paniculata, Bacopa monneiri* and *Piper longum*) with the application of 25% garden soil and 75% composted coirpith (biodegraded with *Pleurotus sajor caju* and *Azospirillum*) confirming that the composted coir pith with nitrogen fixing bacteria is as an effective potting medium for cultivation of medicinal plants.

The present findings is in conformity with Abdissa *et al*. (2012) who found a significant increase in tap root length of 13.37 cm over control of 12.88 cm in sweet potato with the application of farmyard manure at 20 t ha^{-1} .

TABLE – V

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))

Treatment	Root length(cm)			Shoot length(cm)			Number of leaves			Number of nodules		
	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS
T_1	2.44	5.67	9.11	24.56	28.67	29.33	6.77	8.55	10.66	0.11	1.22	0.22
T_2	13.47	14.67	14.78	30.67	34.44	36.78	7.00	12.66	18.33	0.33	2.88	0.33
T_3	6.56	6.78	12.56	36.44	43.78	51.67	7.11	20.77	18.77	0.66	8.66	0.33
T_4	11.38	13.40	13.67	36.44	35.56	42.44	9.33	10.66	10.66	0.88	7.66	7.00
T_5	13.37	16.74	18.44	37.89	45.56	48.44	8.00	10.66	10.87	0.55	1.44	0.77
T_6	9.40	11.44	19.39	28.00	47.32	48.67	9.66	10.55	11.55	0.66	1.25	0.77
T_7	8.44	8.88	11.41	27.89	35.00	46.89	12.88	12.55	14.11	0.55	3.66	1.55
T_8	10.44	14.56	19.78	25.00	44.40	45.22	10.88	10.99	11.11	0.44	2.44	2.00
T_9	6.46	24.78	14.89	31.44	31.56	34.22	7.55	10.44	14.88	0.44	2.88	1.88
T_{10}	10.34	16.67	24.27	32.89	46.78	48.89	10.44	11.00	13.11	0.44	1.55	0.88
T_{11}	8.67	9.44	10.78	37.78	43.33	45.67	12.22	13.00	13.44	0.33	2.00	0.55
T_{12}	9.56	10.33	17.11	36.67	46.89	48.44	12.77	14.55	17.11	0.55	1.55	0.66
SED	0.04295			0.02698			0.02854			0.02334		
CD(0.05)	0.08563			0.05378			0.05690			0.04652		
CD(0.01)	0.11365**			0.07138**			0.07552**			0.06175**		

** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

PLATE - XII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7)) on 25 DAS

Green gram

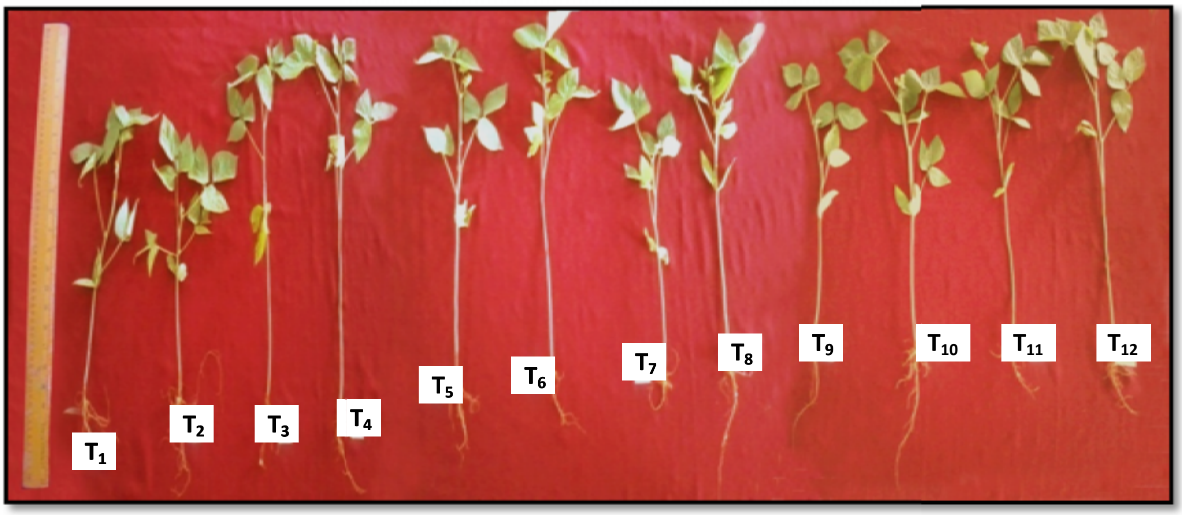
25 DAS

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

PLATE - XIII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7)) on 45 and 55 DAS

45 DAS



55 DAS

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

A Similar result was obtained by Ghulam *et al*. (2012) who reported that the application of pressmud at 15 t ha^{-1} enhanced the root length of 12.3 cm over control of 9.3 cm in lentil.

The result is in agreement with the result of Badar and Qureshi (2014) who reported increased root length of 28.0 cm on 30^{th} day and 29.66 cm on 60^{th} day in sunflower plants in *Trichoderma hamatum* inoculated rice husk (5kg) as compared to the control (20.5 cm, 23.96 cm).

The increase in root length might be due to the improved nutrient availability in the soil due to the application of composted coirpith, composted pressmud and farmyard manure and NPK by reducing soil bulk density and enhancing its moisture content. This improvement might have led to significant increase in root length of the plant.

4.2.1.1b Shoot length

Black gram

The shoot length of the plant increased significantly. Among the treatments, T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) on 25 DAS (27.56 cm, 25.89 cm and 24.67 cm), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK), T_6 (composted coirpith (12.5t ha^{-1}) + 50% NPK) and T_7 (composted pressmud (12.5t ha^{-1}) + 50%NPK) on 45 DAS (33.56 cm, 33.44 cm and 32.22 cm), T_{10} (composted pressmud(12.5t ha^{-1})+25% NPK), T_{11} (farmyard manure(12.5t ha^{-1}) + 25% NPK) and T_6 (composted coirpith (12.5t ha^{-1}) + 50% NPK) on 55 DAS (36.00 cm, 35.89 cm and 34.78 cm) showed increased shoot length. Lowest shoot lengths were observed in control (20.19 cm and 20.33cm) on 25 and 45 days after sowing (Table III).

Cluster bean

A significant increase in shoot length was recorded from 25 to 55 DAS in all the treatments when compared to T_1 (Table - IV).

Among the treatments a significantly enhanced shoot length of 37.56 cm was registered in T_5 (NPK 100%), 36.94 cm in T_7 (composted pressmud (12.5t ha^{-1}) + 50%

NPK) and 36.78 cm in T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) on 25 DAS, 47.88 cm in T_3 (composted pressmud (12.5t ha^{-1})), 47.86 cm in T_{11} (farmyard manure (12.5t ha^{-1})+25% NPK) and 46.59 cm in T_8 (farmyard manure (12.5t ha^{-1}) + 50%) on 45 DAS,59.33 cm in T_9 (composted coirpith (12.5t ha^{-1})+25% NPK) ,58.24 cm in T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and 57. 67 cm in T_8 (farmyard manure (12.5t ha^{-1}) + 50% NPK) on 55 DAS when compared to the control T_1 (31.11cm, 35.59cm and 43.22cm).

Green gram

A significant increase in shoot length was recorded from 25 to 55 DAS in all the treatments when compared to T_1 as shown in table- V.

Among the treatments a significantly enhanced shoot length of 37.89 cm was registered in T_5 (NPK 100%), 37.78 cm in T_{11} (farmyard manure (12.5t ha^{-1})+ 25 % NPK) and 36.67 cm in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) on 25 DAS, 47.32 cm in T_6 (composted coirpith (12.5t ha^{-1})+ 50% NPK), 46.89 cm in T_{12} (composted coirpith(6.5t ha^{-1})+ composted pressmud(6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) and 46.78 cm in T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK)on 45 DAS, 48.89 cm in T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK), 48.67 cm in T_6 (composted coirpith (12.5t ha^{-1}) + 50% NPK) and 48.44 cm in T_5 (NPK 100%) and T_{12} (composted coirpith(6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) on 55 DAS.

Similar observations were reported by Yadav and Vijayakumari (2003) in chilli who observed concomitant improvement in shoot length (76.60 cm) with the application of vermicompost + NPK over control of 48.17 cm in 90 days after sowing.

The present findings is in conformity with Kadwe *et al*. (2003) who found a significant increase in plant length of 22.47 cm over control of 19.47cm (Recommended dose fertilizer - NPK) in groundnut with the application of ¾ RDF +5t pressmud ha^{-1}.

The present finding is on par with that of Shankaraiah and Murthy (2005) who observed that the application of enriched pressmud cake (15t ha^{-1}) with recommended NPK (100%) expressed the highest shoot population of sugarcane.

The result is in agreement with the result of Hossian and Ishimine (2007) who reported enhanced plant height of 204 cm when compared to control of 166 cm in turmeric with the application of farmyard manure at 30-35t ha^{-1}.

The present finding is in conformity with Pannu *et al*. (2007) who found a significant increased in plant height of 48.00 cm and 49.60 cm in 2003 and 2004 over absolute control of 41.50 cm and 44.40cm in summer mash with the combine application of 2.50 t FYM ha^{-1}+ $1/4^{th}$ SR (State Recommendation fertilizers-12 kg N and 40 Kg P_2O_5 ha^{-1}).

The present finding is in conformity with Ibrahim *et al*. (2008) who found a significant increased in shoot length of 48.11 cm over absolute control of 41.47 cm in wheat with the application of compost at 500 Kg ha^{-1}.

The present finding is in conformity with Ahmad *et al*. (2012) who found a significant increase in stem length of 48.7cm cm in *Ruscus hypophyllum* with the application of conventional media (garden soil, silt and leaf mould [1:1:1 v/v/v]) + compost (prepared by mixing poultry manure with sewage) followed by conventional media+ pressmud of 41.5 cm over control of 26.8 cm .

The improvement in shoot length may be due to better moisture retention capacity and supply of micro nutrients and availability of major nutrients due to favourable soil conditions brought about by composted coirpith, composted pressmud and farmyard manure and NPK application. The increase in shoot length could be due to the presence of nitrogen and nutrients found in compost in available forms. Nitrogen is an active constituent of protoplasm and enzymes which act as catalyst in speeding up the cell division and photosynthetic activity which in return boosts the plant growth and plant building structures.

The increased growth rate may be due to presence of cyanobacteria and its capacity to synthesize and liberate bioactive substances such as auxins, gibberellins, cytokinins, vitamins, polypeptides, amino acids, which promote plant growth and development. The increase in shoot length might be due to the overall conducive ambient conditions created by the application of composted coirpith, composted pressmud and farmyard manure and NPK which in return enhance the plant growth and plant building structures.

4.2.1.1c Number of leaves

Black gram

A substaintial increase in the number of leaves/plant were recorded in T_8 (farmyard manure(12.5t ha^{-1})+ 50% NPK), T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) and T_{10} (composted pressmud (12.5t ha^{-1})) on 25 DAS (24.00, 23.78, 20.00), T_8 (Farmyard manure (12.5t ha^{-1}) + 50% NPK), T_9 (composted coirpith (12.5t ha^{-1})+25% NPK) and T_{10} (composted pressmud (12.5t ha^{-1}) + 25%NPK) on 45 DAS (21.78,19.00,18.56), T_8 (farmyard manure + 50% NPK), T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) and T_{10} (composted pressmud (12.5t ha^{-1})) on 55 DAS (24.00, 23.78, 20.00) as depicted in table-III.

Cluster bean

An appretiable increase in the number of leaves/plants were recorded in all the treatmenrs (T_1 to T_{12}) from 25 to 55 DAS as depicted in table -IV.

Numbers of leaves were more in T_6 (composted coirpith (12.5t ha^{-1}) + 50% NPK) , T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_8 (farmyard manure (12.5t ha^{-1}) + 50% NPK) on 25 DAS (19.00, 13.33, 11.89) , T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) and T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) on 45 DAS (32.89, 28.44, 27.00), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) on 55 DAS (34.56,33.67, 33.11) when compared to control.

Green gram

An appretiable increase in the number of leaves/plants were recorded in all the treatments (T_1 to T_{12}) from 25 to 55 DAS as depicted in table-V.

Numbers of leaves were more in T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK), T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) and T_{11} (Farmyard manure (12.5t ha^{-1}) + 25 % NPK) on 25 DAS (12.88, 12.77, 12.22), T_3 (composted pressmud), T_{12} (composted coirpith (6.5t ha^{-1})+ composted pressmud (6.5t ha^{-1})+ farmyard manure(6.5t ha^{-1})) and T_{11} (farmyard manure(12.5t ha^{-1}) + 25% NPK) on 45 DAS (20.77, 14.55, 13.00), T_3 (composted pressmud(12.5t ha^{-1})), T_2 (composted coirpith(12.5t ha^{-1})) and T_{12} (composted coirpith(6.5t ha^{-1})+ composted pressmud (6.5t ha^{-1}) + farmyard manure(6.5t ha^{-1})) on 55 DAS (18.77, 18.33, 17.11) when compared to control T_1 (6.77, 8.55, 10.66).

Similar result was obtained by Hossain and Ishimine (2007) who observed substantial increase in number of leaves/plant (23.8) of turmeric when compared to control (20.8) by the application of goat manure at 30 - 35 t ha^{-1}.

Similar result was obtained by Olabode *et al*. (2007) who found a substantial increase of number of leaves/ plant of Okra by the application of freshly crushed and grounded dried *Tithonia diversifolia* in both rainy (14.1 and 12.7) and dry season (8.9 and 9.1). This result is in line with the observations of Thankamani *et al*. (2007) who reported that the application of coirpith and granite powder (1:1) along with the biofertilizer (*Azospirillium* sp. and *phosphobacteria*) promote the number of leaves (5.7) of black pepper.

The present finding is in conformity with Akparobi (2009) who found a significant increase in number of leaves/plant of 141.56 over absolute control of 91.00 in *Amaranthus cruuentus* with the application of farmyard manure at 35t ha^{-1} in 10 weeks after planting.

This result is on line with the result of Prakash and Hemalatha (2013) who reported that the application of vermicompost and plant growth promoting *Rhizobacteria* isolated from vermistabilised pressmud enhanced the number of leaves of black gram by 4, 8, 14, 24, 29 and 36 on 15th, 30th, 45th, 60th, 75th and 90th day as compared to the uninoculated control (3, 8, 12, 18, 28 and 28).

The present finding is in conformity with Uddin *et al*. (2014) who found a significant increase in number of leaves/plant of 21.46 over absolute control of 19.40 in wheat with the application of compost at 500 kg ha^{-1}. Similar result was obtained by Ng'etich *et al*. (2012) who observed substantial increase in number of leaves/plant (59.8) by the application of farmyard manure at 11.5 t ha^{-1} in season 1 as compared to season 2 (42.5) at 15.0 t ha^{-1} in spider plant.

Leaves are the photosynthetic part of the plant. The incorporation of the composted coirpith, composted pressmud and farmyard manure readily available nitrogen and organic matter and also increased the microbial population. This might have improved the physical and biological properties of the soil resulting in better vegetative growth coupled with better partitioning of photosynthates in vegetative parts.

4.2.1.1d Number of nodules

Black gram

Maximum number of nodules were recorded in T_2 (composted coirpith(12.5t ha^{-1})) on 25, 45 and 55 DAS (14.00, 24.40, 18.80) when compared to the control (0.66, 1.55,1.22). (Table-III)

Cluster bean

Number of nodules showed a significant increase upto 45 DAS and decreased gradually on 55 DAS. Maximum numbers of nodules were recorded in T_8 (farmyard manure(12.5t ha^{-1})+ 50% NPK) followed by T_6 (composted coirpith (12.5t ha^{-1}) + 50% NPK) and T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) on 25 DAS (1.22, 1.11, 1.11), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) followed by T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) and T_7 (composted pressmud (12.5t ha^{-1})+ 50% NPK) on 45 DAS(4.11, 2.22, 1.89), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) followed by T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) and T_6 (composted coirpith(12.5t ha^{-1}) + 50% NPK) on 55 DAS (1.89, 1.56, 1.33) as compared to control T_1 (0.44, 1.00, 0.44). (Table-IV)

Green gram

Number of nodules showed a significant increase up to 45 DAS and reduced gradually up to 55 DAS. Maximum numbers of nodules were recorded in T_4 (farmyard manure(12.5t ha^{-1})) followed by T_3 (composted pressmud (12.5t ha^{-1})), T_6 (composted coirpith(12.5t ha^{-1}) + 50% NPK), T_5 (NPK 100%), T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) and T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure(6.5t ha^{-1})) on 25 DAS (0.88, 0.66, 0.66, 0.55, 0.55, 0.55) , T_3 (composted pressmud(12.5t ha^{-1})), T_4 (farmyard manure(12.5t ha^{-1})) and T_7 (composted pressmud

(12.5t ha^{-1})+ 50% NPK) on 45 DAS (8.66, 7.66, 3.66) and T_4 (farmyard manure (12.5t ha^{-1})), T_8 (farmyard manure(12.5t ha^{-1})+ 50% NPK) and T_9 (composted coirpith (12.5t ha^{-1})+ 25% NPK) on 55 DAS (7.00, 2.00, 1.88).(Table-V)

The present finding coincides with the result of Kadwe *et al*. (2003) who also observed that the application of ¾ RDF +5t pressmud ha^{-1}increased number of nodules in groundnut (0.55). Similar result was obtained by Basir *et al*. (2008). They observed a significant increase in number of nodules of 75 in chickpea with the application of FYM (15 t ha^{-}1) which was higher than that of control of 70.

This result is in line with the observations of Anuradha *et al*. (2011) who reported that the application of farmyard manure at 15 t ha^{-1} enhanced the number of nodules of chickpea of 75 as compared to the control of 70.

Similar result was obtained by Saini and Chongtham (2011). They observed a significant increase in number of nodules of 62.00 in soyabean with the application of N_{50}+ N_{50} FYM which was significantly higher than that of N_{125} and was statistically at par with that of N_{100} and N_{75}.

A similar result was obtained by Chaudhari *et al*. (2013) who also observed a significant increase in nodules of 27.3 in summer green gram with the application of recommended dose nitrogen through vermicompost and soil application of panchagavya (4%) at 15 and 30 DAS.

The present finding coincides with the result of Thomas *et al*. (2013) who also observed that the application of coir pith (95 Kg) + poultry manure (5 Kg) + lime (0.5 Kg) + rock phosphate (0.5 Kg) increased number of nodules in cowpea (65.1).

Application of composted coirpith, composted pressmud and farmyard manure might have improved the biological properties of the soil and increased the activities of beneficial micro - organisms which resulted in the enhancement of the root nodules. Increase in number of nodules might be due to the organic manure which releases certain specific phytochemicals that might be beneficial to root nodulation thereby aiding in nitrogen fixation.

4.2.1.1e Number of flowers/plant

Black gram

An appreciable increase in the number of flowers/plant was observed on 45 DAS as elucidated in table -VI.

Number of flowers/plant showed a significant increase in T_5 (NPK 100%), T_6 (composted coirpith (12.5t ha^{-1}) + 50%) followed by T_3 (composted pressmud (12.5t ha^{-1})), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) on 45 DAS (3.33, 3.33, 3.00, 3.00) compared to control T_1 (1.00).

Cluster bean

An appreciable increase in the number of flowers/plant was observed in all the treatments in 45DAS as elucidated in table- VII.

The number of flowers / plant showed a maximum increase in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) on 45 DAS (5.67, 4.67, 3.67) when compared to control T_1 (1.00).

Green gram

An appreciable increase in the number of flowers/plant was observed in all the treatments in 45DAS as elucidated in table -VIII.

The number of flowers / plant showed maximum increase in, T_8 (farmyard manure (12.5t ha^{-1}) + 50% NPK) and T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) followed by T_5 (NPK 100%) and T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) on 45 DAS (7.67, 6.33, 4.67, 4.67) when compared to control T_1 (1.00).

This is also in agreement with the results obtained by Padmaja and Jessy Paulose (2011) who reported an increase in number of flowers which varied from 10.33 to 15.33 in green gram with the application of WH-GM (water hyacinth – green manure) 210mg over the control T_1 (from 2.67 to 5.33).

TABLE VI

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Number of flowers/plant	Number of pods/plant	Fresh weight(gm)			Dry weight(gm)		
	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS
T_1	1.00	1.33	1.30	3.57	12.14	0.41	1.24	1.28
T_2	1.33	2.00	2.41	10.81	22.14	0.66	1.67	2.03
T_3	3.00	3.67	2.43	13.69	32.24	0.63	3.52	5.33
T_4	1.67	3.33	2.64	6.85	17.44	0.62	3.01	4.95
T_5	3.33	4.00	2.27	12.59	23.56	0.67	3.58	3.66
T_6	3.33	5.00	1.64	7.87	18.89	1.34	2.31	3.91
T_7	2.00	6.67	1.71	15.31	26.50	0.47	3.07	4.83
T_8	1.67	4.67	2.13	4.31	16.53	0.64	1.25	1.52
T_9	2.33	6.33	1.77	4.60	15.79	0.47	1.45	1.91
T_{10}	2.33	9.00	4.56	6.30	37.34	1.36	1.68	3.58
T_{11}	3.00	11.00	4.64	7.45	21.63	1.35	2.17	2.77
T_{12}	2.00	7.33	2.55	6.17	14.33	0.64	2.00	2.24
SED	0.1467	0.0236	0.02838			0.02603		
CD(0.05)	0.3028	0.0486	0.05658			0.05190		
CD(0.01)	0.4126**	0.0663**	0.07510**			0.06888**		

** - Significant at 1% ($P<0.01$), DAS - Days After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE - VII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	Number of flowers/plant	Number of pods/plant	Fresh weight (gm)			Dry weight (gm)		
	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS
T_1	1.00	1.00	2.31	3.42	16.73	0.23	0.75	0.80
T_2	1.33	2.33	2.94	11.59	19.51	1.48	5.84	6.74
T_3	2.00	3.33	2.96	10.21	33.63	0.64	4.03	9.58
T_4	1.67	3.67	3.31	9.53	38.53	1.43	3.82	9.47
T_5	2.33	4.00	4.75	4.87	41.79	1.40	1.72	13.76
T_6	3.67	3.00	6.18	6.19	68.23	0.74	1.84	19.17
T_7	2.00	2.67	2.60	8.15	74.20	0.92	3.26	18.20
T_8	3.00	3.67	3.55	5.85	50.28	1.02	2.42	4.46
T_9	1.33	3.00	3.86	4.90	54.00	1.52	1.55	8.56
T_{10}	3.67	1.33	2.86	12.17	74.58	0.88	5.82	26.00
T_{11}	4.67	2.00	5.46	9.81	99.96	1.82	3.27	26.85
T_{12}	5.67	4.00	4.99	7.48	97.78	1.94	3.05	25.00
SED	0.0262	0.0244	0.02730			0.02739		
CD(0.05)	0.0542	0.0503	0.05441			0.05459		
CD (0.01)	0.0738**	0.0686**	0.07222**			0.07246**		

** -Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE - VIII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON VEGETATIVE PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))

Treatment	Number of flowers/plant	Number of pods / plant	Fresh weight(gm)			Dry weight(gm)		
	45DAS	55DAS	25DAS	45DAS	55DAS	25DAS	45DAS	55DAS
T_1	1.00	1.33	1.18	1.65	5.83	0.36	0.47	0.48
T_2	1.67	4.00	2.39	4.93	23.14	0.58	2.68	2.83
T_3	2.00	4.00	1.78	6.73	21.68	0.55	2.45	2.61
T_4	3.67	2.00	1.34	2.70	26.63	0.82	0.98	2.35
T_5	4.67	4.33	2.11	5.19	32.19	0.69	1.80	3.48
T_6	3.67	5.67	2.01	4.53	22.23	0.59	1.37	2.15
T_7	4.67	2.33	2.68	6.14	32.18	1.00	1.58	1.68
T_8	7.67	4.00	2.65	11.62	22.23	0.81	4.56	5.76
T_9	6.33	4.67	2.01	4.18	23.13	0.30	1.65	1.69
T_{10}	2.00	5.00	4.93	6.66	29.58	2.00	2.67	2.71
T_{11}	3.67	3.33	4.87	13.36	35.18	2.04	2.23	3.01
T_{12}	3.33	2.67	4.82	5.08	63.54	1.82	1.97	5.59
SED	0.0257	0.0230	0.02667			0.02771		
CD(0.05)	0.0531	0.0474	0.05316			0.05524		
CD(0.01)	0.0723**	0.0646**	0.07056**			0.07332**		

** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

The present result is in accordance of Senthilkumar and Sevagurunathan (2012) who found a significant increase in number of flower/plants of cow pea and green gram inoculated with bacterial biofertizers (*Rhizobium+ Phosphobacteria+ Azospirillum*).

The present result is in accordance of Sowmyamala and Nagaraju (2013) who found a significant increase in number of flowers/plant of *Gaillardia* with the application of 100 percent of recommended dose of NPK (150: 80: 60 kg ha^{-1}) with pressmud at 10t ha^{-1}.

Similar result was obtained by Prakash and Hemalatha (2013) who reported an increase in number of flowers (8 to 12) from 60 to 90 days in black gram with the application of vermicompost and plant growth promoting *Rhizobacteria* isolated from vermistabilised pressmud.

The present result is in accordance with Gupta *et al*. (2013) who found a significant increase in biometric parameters of *Gloriosa superba* with the application of vermicompost at rate of 4t ha^{-1} and ½ NPK at 120: 50: 75 of 30.50 when compared to the control of 13.83.

This is also in agreement with the results obtained by Mehdizadeh *et al*. (2013) who reported an increase in number of flowers of 104 in tomato crop with the application of municipal waste compost at rate of 20 t ha^{-1}.

Increased in number of flowers /plant might be due to the application of composted coirpith, composted pressmud, farmyard manure and NPK in the soil which releases macro and micronutrients boosting the photosynthetic activity of the crop throughout the vegetative and reproductive phase. Agrowastes undergoes slow decomposition and mineralization which help in the release of nitrogen to meet the requirement of crop at the critical stage. Increased in number of flowers /plant might be due to the application of composted coirpith, composted pressmud, farmyard manure and NPK in the soil as a source of high concentration of nutrient which can be effectively harnessed as a substitute of organic manure to enhance the growth of the crops.

4.2.1.1f Number of pods/plant

Black gram

It can be inferred from table- VI that the number of pods per plant showed a gradual increase in all the treatments as compared to the control.

A substantial increase in number of pods/plant were examined in T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK), T_{10} (composted pressmud (12.5t ha^{-1}) + 25%NPK) and T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) on 55 DAS (11.00, 9.00, 7.33) as compared to the control T_1 (1.33).

Cluster bean

A substantial increase in number of pods/plant was registered in T_5 (NPK 100%), T_{12} (composted coirpith(6.5t ha^{-1})+ composted pressmud(6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})), followed by T_4 (farmyard manure(12.5t ha^{-1})), T_8 (farmyard manure (12.5t ha^{-1}) + 50% NPK) and T_3 (composted pressmud (12.5t ha^{-1})) on 55 DAS (4.00, 4.00, 3.67, 3.67, 3.33) when compared to control T_1(1.00) (Table- VII).

Green gram

A substantial increase in number of pods/plant was registered in T_6 (composted coirpith (12.5t ha^{-1}) + 50% NPK), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) followed by T_9 (composted coirpith (12.5t ha^{-1})+ 25% NPK) on 55 DAS (5.67, 5.00, 4.67) when compared to control T_1(1.33). (Table- VIII)

A similar result was obtained by Sridevi and Vijayalakshmi (2006). They reported that the application of composted pressmud (5t ha^{-1}) + composted coirpith (5t ha^{-1}) + *Rhizobium* enhanced the number of fruits per plant (8.00) in *Dolichos lablab* over the control (2.00).

A similar result was obtained by Premsekhar and Rajashree (2009). They reported that the application of farmyard manure at the rate of 20 t ha^{-1} produced the higher yield of Okra (19.3). The result is on par with the result of Gupta *et al*. (2013) who also reported that the application of vermicompost at rate of 4t ha^{-1} and ½ NPK at 120: 50: 75 produced the best number of fruits/plant (6.63) in *Gloriosa superba*.

The result is on par with the result of Suge *et al*. (2011) who also reported that the application of 100% research recommended rates(640 Kg N ha^{-1}, 102 Kg P ha^{-1}) + FYM produced the best number of fruits/plant (49.17 - 2009 short rain and 44.17- 2010 long rain) in eggplant (*Solanum melongena* L.).

The present finding coincides with that of Viharnaa and Seran (2012) who showed that the application of cow and poultry manure (3:2) as a basal fertilizer gave higher yield of fruits in okra of 8.5 as compared to the control of 6.8. Similar result was obtained by Uddin *et al*. (2014). They reported that the application of cocodust at 15t ha^{-1}+ N_{120} P_{50} K_{100} S_{14} $Zn_{1.5}$ and B_2 Kg ha^{-1}produced the highest yields of strawberry (26.33) as compared to the control (19.67).

The increased in fruits might be due to the addition of composted coirpith, composted pressmud and farmyard manure as suitable organic manure in the soil which improved the soil physical and chemical properties that encourages better root development, increased nutrient uptake and water holding capacity which leads to the higher fruit yield and better fruit quality.

4.2.1.1g Fresh and dry weight

Black gram

It is inferred from table- VI that there was an appreciable increase in fresh and dry weight of plant from 25 to 55 DAS in all treatments.

A significant increase in fresh weight was maximum in T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK), T_{10} (composted pressmud (12.5t ha^{-1}) + 25%NPK) followed by T_4 (farmyard manure (12.5t ha^{-1})) on 25 DAS (4.64gm,4.56gm, 2.64gm) as compared to the control T_1 (1.30gm), T_7 (composted pressmud (12.5t ha^{-1})) + 50% NPK), T_3 (composted pressmud (12.5t ha^{-1})) and T_5 (NPK 100%) on 45 DAS (15.31gm, 13.69gm, 12.59gm) as compared to the control T_1 (3.57gm), T_{10} (composted pressmud (12.5t ha^{-1}) + 25%NPK), T_3 (composted pressmud (12.5t ha^{-1})) and T_7 (composted pressmud (12.5t ha^{-1})) on 55 DAS (37.34gm, 32.24gm, 26.50gm) as compared to the control (12.14gm) .

Dry weight was more in T_{10} (composted pressmud (12.5t ha^{-1}) + 25%NPK), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_6 (composted coirpith (12.5t ha^{-1})+50%NPK) on 25 DAS (1.36gm, 1.35gm, 1.34gm) as compared to the control T_1 (0.41gm), T_5 (100% NPK) followed by T_3 (composted pressmud (12.5t ha^{-1})) and T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) on 45 DAS (3.58gm, 3.52gm, 3.07gm) as compared to the control T_1 (1.24gm), T_3 (composted pressmud (12.5t ha^{-1})) followed T_4

(farmyard manure (12.5t ha^{-1})) and T_7 (composted pressmud (12.5t ha^{-1}) + 50% NPK) on 55 DAS (5.33gm, 4.95gm, 4.83gm) as compared to the T_1 (1.28gm).

Cluster bean

A remarkable increase in the fresh and dry weight of plant was observed from 25 to 55 DAS in all the treatments (from T_1 to T_{12}) (Table- VII).

The maximum fresh weight was registered in T_6 (composted coirpith(12.5t ha^{-1})+ 50% NPK), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) on 25 DAS (6.18gm, 5.46gm, 4.99gm), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK), T_2 (composted coirpith (12.5t ha^{-1})) and T_3 (composted pressmud (12.5t ha^{-1})) on 45 DAS (12.17gm, 11.59gm, 10.21gm), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK), T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) and T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) on 55 DAS (99.96gm, 97.78gm, 74.58gm) as compared to control T_1 (2.31gm, 3.42gm, 16.73gm).

The maximum dry weight was found in T_{12} (composted coirpith (6.5t ha^{-1})+ composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})), T_{11}(farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) on 25 DAS (1.94gm, 1.82gm, 1.52gm), T_2 (composted coirpith (12.5t ha^{-1})), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) and T_3 (composted pressmud (12.5t ha^{-1})) on 45 DAS (5.84gm, 5.82gm, 4.03gm), T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK), T_{10} (composted pressmud (12.5t ha^{-1})+ 25% NPK) and T_{12} (composted coirpith(6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) on 55 DAS (26.85gm, 26.00gm, 25.00gm) when compared to control T_1 (0.23gm, 0.75gm, 0.80gm).

Green gram

A remarkable increase in the fresh and dry weights of fruit/plant was observed from 25 to 55 DAS in all the treatments from T_1 to T_{12} as shown in table –VIII.

The maximum fresh weight was registered in T_{10} (composted pressmud (12.5t ha^{-1})+ 25% NPK), T_{11} (farmyard manure(12.5t ha^{-1}) + 25% NPK) and T_{12}

(composted coirpith(6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) on 25 DAS (4.93gm, 4.87gm, 4.82gm), T_{11} (Farmyard manure(12.5t ha^{-1})+ 25 % NPK) , T_8 (farmyard manure (12.5t ha^{-1}) + 50% NPK) and T_3 (composted pressmud (12.5t ha^{-1})) on 45 DAS (13.36gm, 11.62gm, 6.73gm), T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud(6.5t ha^{-1})+ farmyard manure(6.5t ha^{-1})),T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) and T_5 (NPK 100%) on 55 DAS (63.54gm, 35.18gm, 32.19gm) as compared to control T_1(1.18gm, 1.65gm, 5.83gm).

The maximum dry weight was found in T_{11} (farmyard manure(12.5t ha^{-1}) + 25% NPK), T_{10} (composted pressmud (12.5t ha^{-1}) + 25% NPK) and T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure(6.5t ha^{-1})) on 25 DAS (2.04gm, 2.00gm, 1.82gm), T_8 (farmyard manure (12.5t ha^{-1}) + 50% NPK), T_2 (composted coirpith (12.5t ha^{-1})) and T_3 (composted pressmud(12.5t ha^{-1})) on 45 DAS (4.56gm, 2.68gm, 2.45gm), T_8 (farmyard manure (12.5t ha^{-1})+ 50% NPK), T_{12} (composted coirpith(6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1})+ farmyard manure (6.5t ha^{-1})) and T_5 (NPK 100%) on 55 DAS (5.76gm, 5.59gm, 3.48gm) when compared to control T_1 (0.36gm, 0.47gm, 0.48gm).

The present finding is in conformity with Yadav and Vijayakumari (2003) who reported that the application of vermicompost (23.3 gm) + NPK (5.9: 2.9: 2.9 gm) per pot significantly enhanced the fresh weight and dry weight (1.61 and 0.13 gm) on 30 DAS, vermicompost + farmyard manure (8.14 and 0.89gm) on 60 DAS and in vermicompost alone (29.63 and 4.94 gm) on 90 DAS when compared to control.

The present finding coincides with the result of Sridevi and Vijayalakshmi (2006) who reported that the application of composted pressmud (5t ha^{-1}) + composted coirpith (5t ha^{-1}) + *Rhizobium* enhanced the plant fresh weight and plant dry weight (9.69gm and 2.69gm) on 30 DAS and (13.10gm and 4.50gm) on 45 DAS of *Dolichos lablab* over the control.The present finding is in conformity with Padmaja and Sangeeth Adlene (2009) who reported that the application of EM – SW compost 80 t ha^{-1} significantly enhanced fresh and dry weight of plant from 6.30 to 34.70 gm and from 2.50 to 16.50 gm in cow pea when compared to control.

The present finding is in conformity with Ayesha Parveen (2011) who reported that the application of MSW+WH biocompost enhanced the fresh and dry weights of 5.86 and 3.83gm over control (2.14 and 0.74gm) at 120 DAS. The present finding coincides with the result of Mehdizadeh *et al*. (2013) who reported that the application of municipal waste compost at rate of 20 t ha^{-1} was significant in enhancing fresh weight (shoots – 195.2gm, roots – 62.3gm) and dry weight (shoots - 51.2gm, roots - 13.5gm) of tomato crop.

The enhancement of fresh and dry weight of plant might be due to the fact the composted coirpith, composted pressmud and farmyard manure supplied nutrients in available forms. Apart from this, the micro-organisms present in the soil and compost manufacture amino acid, vitamin, enzyme and plant growth promoting substances for the enhancement.

4.3 BIOCHEMICAL CHARACTERS

4.3.1 Effect of composted coirpith, composted pressmud and farmyard manure on protein content in leaves of test crops.

4.3.1a Black gram

An increasing trend in protein content was noticed in the leaves of all the treatments from 25 to 45 DAS and after that there was a decrease in its content on 55 DAS. (Table- IX)

Among the treatments, T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) registered maximum protein content of 58.22 (25 DAS) and 76.22 (45 DAS) mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) of 53.49 and 75.05mg gm^{-1} tissue on 25 and 45 DAS and after that the protein content in leaves declined gradually on 50.94 mg gm^{-1} tissue and 49.15 mg gm^{-1} tissue on 55 DAS when compared to the control T_1 (26.85, 36.16, 21.68 mg gm^{-1} tissue).

4.3.1b Cluster bean

An increasing trend in protein content was noticed in all the treatments from 25 to 45 DAS and after that there was a decrease in its content in the leaves (Table- X)

TABLE - IX

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON PROTEIN CONTENT IN LEAVES OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Protein content(mg/gm tissue)		
	25DAS	45DAS	55DAS
T_1	26.85	36.16	21.68
T_2	44.08	65.32	31.67
T_3	28.03	43.30	42.23
T_4	33.95	44.94	38.51
T_5	26.94	43.30	30.98
T_6	36.79	57.32	42.14
T_7	46.48	67.77	40.67
T_8	41.67	68.03	41.85
T_9	53.49	75.05	49.15
T_{10}	36.41	72.77	36.41
T_{11}	40.50	66.41	33.41
T_{12}	58.22	76.22	50.94
SED	0.3154		
CD(0.05)	0.43976		
CD(0.01)	0.5217**		

** - Significant at 1% ($P<0.01$); DAS - Days After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

TABLE - X

EFFECT OF COMPOSTED PRESSMUD, COMPOSTED COIRPITH AND FARMYARD MANURE ON PROTEIN CONTENT IN LEAVES OF CLUSTER BEAN

(*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	Protein content(mg/gm tissue)		
	25DAS	45DAS	55DAS
T_1	40.05	43.85	31.67
T_2	48.81	54.68	42.22
T_3	54.95	64.76	35.95
T_4	50.22	73.68	35.29
T_5	43.77	45.76	34.07
T_6	55.68	61.32	38.49
T_7	67.32	70.94	42.14
T_8	56.84	76.50	40.68
T_9	68.73	81.21	45.80
T_{10}	59,59	74.59	36.40
T_{11}	66.94	70.41	41.85
T_{12}	76.40	87.12	50.95
SED	0.11240		
CD(0.05)	0.22124		
CD(0.01)	0.29146**		

** - Significant at 1% (P<0.01); DAS - Days After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

Among the treatments, T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) registered maximum protein content of 76.40 and 87.12 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) of 68.73 and 81.21 mg gm^{-1} tissue on 25 and 45 DAS and after that the protein content in leaves declined gradually to 50.95 mg gm^{-1} tissue and 45.80 mg gm^{-1} tissue on 55 DAS when compared to the control T_1(40.05, 43.85, 31.67 mg gm^{-1} tissue).

4.3.1c Green gram

An increasing trend in protein content was noticed in all the treatments from 25 to 45 DAS and after that there was a gradual decrease in its content in the leaves (Table- XI).

TABLE - XI

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON PROTEIN CONTENT IN LEAVES OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))

Treatment	Protein content(mg/gm tissue)		
	25DAS	45DAS	55DAS
T_1	31.41	36.05	21.68
T_2	42.03	44.95	35.32
T_3	49.48	65.31	42.22
T_4	42.76	72.77	38.49
T_5	39.31	43.31	31.68
T_6	60.02	67.77	42.13
T_7	61.40	70.23	40.67
T_8	61.85	66.40	41.85
T_9	63.33	75.05	49.12
T_{10}	57.44	68.39	36.41
T_{11}	46.49	57.32	33.41
T_{12}	90.22	96.44	50.95
SED	0.15252		
CD(0.05)	0.30019		
CD(0.01)	0.39548**		

** - Significant at 1% (P<0.01); DAS - Days After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

Among the treatments, T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) registered maximum protein content of 90.22 and 96.44 mg g^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) of 63.33 and 75.05 mg g^{-1} tissue on 25 and 45 DAS and after that the protein content in leaves declined gradually to 50.95 mg gm^{-1} tissue and 49.12 mg gm^{-1} tissue on 55 DAS when compared to the control T_1 (31.41, 36.05, 21.68 75.05 mg gm^{-1} tissue).

The present finding is in accordance with the observation of Bindhu (2009) who found that the application of biodynamic compost (3.5 kg) increased the protein content of soybean from 30 to 60 DAS (0.097 to 0.125 mg gm^{-1}). A similar result was obtained by Padmaja and Sangeeth Adlene (2009) who reported that the application of WM – SW compost (80t ha^{-1}) increased the protein content of cow pea (1.48 to 3.28 mg gm^{-1}) than the control.

The present finding is in accordance with the observation of Chaudhari *et al*. (2013) who found that the application of 100% recommended dose nitrogen through vermicompost + soil application of jivamrut at 15 and 30 DAS increased the protein content (24.63%) and protein yield (333.9 Kg ha^{-1}) of summer green gram. A similar result was obtained by Sunitha Kumari *et al*. (2013b) who reported that the application of vermicomposted coirpith amended with 15t ha^{-1} improves the protein content (3.12 mg gm^{-1} tissue) of the sunflower leaves when compared to the control (raw coirpith).

A similar result was obtained by Badar and Qureshi (2014) who reported that the application of Rice husk (5g) composted with *Trichoderma hamatum* (JUF1) improved the crude protein on 30th day (25.46 mg gm^{-1}) andp *Bradyrhizobium* sp-II (JUR2) on 60th day (9.63 mg g^{-1} tissue) in *Helianthus annuus* when compared to control. The present finding is in accordance with the observation of Reghuvaran and Ravindranath (2014) who found that the application of composted coirpith increased the protein content of ornamental plants in the range of 8.81mg gm^{-1} tissue (*Bauhinia purpurea*), 6.90 mg gm^{-1} tissue (*Hydechium coronarium*) as compared to the plants cultivated in soil (4.51 and 4.48 mg gm^{-1} tissue).

The increase in the protein content up to 45 DAS might be due to the elevated density of microbes present in compost which enhanced faster decomposition of organic matter there by enabling increased availability of nutrients especially nitrogen, amino acids, enzymes and vitamins. They were responsible for enhancing physiological and metabolic activities in the plant as a consequence of this, there was an increase in nitrogen uptake from the soil and its further assimilation for protein biosynthesis. The decrease in protein content at 55 DAS might be attributed to its utilization for flower and fruit formation.

4.3.2 Effect of composted coirpith, composted pressmud and farmyard manure on carbohydrate content in leaves of test crops.

4.3.2a Black gram

It can be inferred from table- XII that the total carbohydrate content in black gram leaves showed a gradual increase up to 45 DAS and declined gradually thereafter in all the treatments.

Carbohydrate content increased significantly up to 45 DAS in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) which ranged from 101.65 to 128.60 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) +25% NPK) which ranged from 81. 07 to 128.16 mg gm^{-1} tissue on 25 and 45 DAS and declined to 125.85 and 122.57 mg gm^{-1} tissue on 55 DAS against the control T_1 (the increase was from 29.06 to 109.76 mg gm^{-1} tissue on 25 and 45 DAS and declined to 43.18 mg gm^{-1} tissue).

4.3.2b Cluster bean

An increasing trend in carbohydrate content was noticed in all the treatments from 25 to 45 DAS and after that there was a decrease in its content (Table- XIII).

Among the treatments, T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) registered maximum carbohydrate content of 96.11 and 144.57 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) of 90.92 and 128.69 mg gm^{-1} tissue on 25 and 45 DAS and after that the carbohydrate content declined gradually to 120.25 mg gm^{-1} tissue and 118.52 mg gm^{-1} tissue on 55DAS when compared to the control T_1 (the increase was from 25.23 to 88.74 mg gm^{-1} tissue on 25 and 45 DAS and declined to 28.63 mg gm^{-1} tissue).

TABLE- XII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON CARBOHYDRATE CONTENT IN LEAVES OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Carbohydrate content (mg/gm tissue)		
	25DAS	45DAS	55DAS
T_1	29.06	109.76	43.18
T_2	34.65	111.72	68.38
T_3	61.91	119.61	52.51
T_4	52.71	121.25	79.64
T_5	29.62	110.21	44.73
T_6	60.37	119.73	71.54
T_7	69.14	124.43	108.90
T_8	57.10	117.54	98.35
T_9	81.07	128.16	122.57
T_{10}	46.15	114.14	112.67
T_{11}	35.19	123.56	48.55
T_{12}	101.65	128.60	125.85
SED	0.04640		
CD(0.05)	0.09132		
CD(0.01)	0.12031**		

** - Significant at 1% ($P<0.01$), DAS - Days After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

TABLE - XIII

EFFECT OF COMPOSTED PRESS MUD, COMPOSTED COIRPITH AND FARMYARD MANURE ON CARBOHYDRATE CONTENT IN LEAVES OF CLUSTER BEAN

(*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	Carbohydrate content (mg/gm tissue)		
	25DAS	45DAS	55DAS
T_1	25.23	88.74	28.63
T_2	30.04	98.86	46.58
T_3	65.85	90.38	42.76
T_4	53.05	94.53	74.19
T_5	27.42	90.27	35.09
T_6	82.94	99.80	52.06
T_7	30.93	93.45	89.93
T_8	48.22	106.25	91.47
T_9	90.92	128.69	118.52
T_{10}	90.49	127.05	109.75
T_{11}	70.25	124.31	108.11
T12	96.11	144.57	120.25
SED	1.57084		
CD(0.05)	3.09183		
CD(0.01)	4.07323**		

** - Significant at 1% (P<0.01), DAS - Days After Sowing

T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

4.3. 2c Green gram

It can be inferred from table - XIV that the total carbohydrate content in black gram leaves showed a gradual increase up to 45 DAS and declined gradually thereafter on 55 DAS in all the treatments.

TABLE - XIV

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON CARBOHYDRATE CONTENT IN LEAVES OF GREEN GRAM
(*Vigna radiata* L. Var. (Co (Gg) 7))

Treatment	Carbohydrate content (mg/gm tissue)		
	25DAS	45DAS	55DAS
T_1	29.07	34.65	26.38
T_2	43.18	111.71	68.37
T_3	46.15	119.62	110.20
T_4	61.91	128.58	123.01
T_5	29.62	109.76	48.56
T_6	57.70	121.25	51.50
T_7	60.38	139.30	124.43
T_8	69.13	117.54	71.55
T_9	81.07	144.90	128.15
T_{10}	57.10	114.14	79.65
T_{11}	35.22	140.86	123.55
T_{12}	101.66	197.68	130.34
SED	0.87251		
CD(0.05)	1.71733		
CD(0.01)	2.26244**		

** - Significant at 1% ($P<0.01$), DAS - Days After Sowing

T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

Total carbohydrate content increased significantly up to 45 DAS in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) which ranged from 101.66 to 197.68 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) which ranged from 81. 07 to 144.90 mg gm^{-1} tissue on 25 and 45 DAS and declined to 130.34 and 128.15 mg g^{-1} tissue on 55 DAS against the control T_1 (the increase was from 29.07 to 34.65 mg gm^{-1} tissue and declined to 26.38 mg gm^{-1} tissue).

A similar result was obtained by Manonmani and Anand (2002) who observed an increase in biochemical constituents such as carbohydrate in leaf tissue of lady's finger up to 60 DAS by the application of vermicompost. A similar result was obtained by Vijaya *et al*. (2008) who observed an increase in biochemical constituents such as carbohydrate (0.94 gm^{-1}) in leaf tissue of *Andrographis paniculata* after 30 days by the application of vermicomposted coirpith with the garden soil.

This result is in accordance with a result of Padmaja and Sangeeth Adlene (2009) who reported a maximum increase in total carbohydrate content in cow pea which ranged from 10.64 mg g^{-1} to 19.87 mg g^{-1} up to 60 DAS and gradually decreased to 15.99 mg g^{-1} in 90 DAS with EM SW compost (80t ha^{-1}) in corporate treatment. This result is in accordance with a result of Suresh Kumar and Ganesh (2013) who reported a maximum increase in carbohydrate content in *Arachis Hypogea* with the application of 75% NPK+ coirpith (200gm) + *Pleurotus sajo-caju* (2.5 kg)+ poultry manure (10kg).

A similar result was obtained by Gangwar and Dubey (2013) who observed an increase in biochemical constituents such as carbohydrate of 78.45% and 77.62% in 2010-11 to 2011-12 in basmati rice by the application of blue green algae (15kg ha^{-1})+ farmyard manure (5t ha^{-1})+ vermicompost (5t ha^{-1})+ neem cake (2.5t ha^{-1}).

This result is in accordance with a result of Reghuvaran and Ravindranath (2014) who found that the application of composted coirpith increased the carbohydrate content of vegetable plants in the range of 0.28 mg gm^{-1}tissue (*Lycopersicon esculentum*), 0.22 mg g^{-1} tissue (*Abelmoscus esculentus*), 0.22 mg gm^{-1}tissue (*Momordica charantia*) as compared to the plants cultivated in soil (0.31, 0.32 and 0.31 mg gm^{-1} tissue).

The increase in carbohydrate content up to 45 DAS in T_{12} treatment might be ascribed to the fact that the compost coirpith, composted press and farmyard manure increased the microbial populations which hydrolyse fat, sugars and starches into usable forms.

4.3.3 Effect of composted coirpith, composted pressmud and farmyard manure on chlorophyll content in leaves of test crops.

4.3.3a Black gram

Chlorophyll a, chlorophyll b and total chlorophyll content of black gram leaves increased significantly up to 45 DAS and then gradually declined after that in all the treatments (from T_2 to T_{12}) when compared with control T_1. (Table - XV).

The treatment T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})), showed a remarkably significant increase in chlorophyll content from 25 to 45 DAS which ranged from 0. 190 to 0.197 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) which ranged from 0.185 to 0.190 mg gm^{-1} tissue (chlorophyll a), 0.194 to 0.199 mg gm^{-1} tissue followed by 0.189 to 0.194 mg gm^{-1} tissue (chlorophyll b), 0.198 to 0.203 mg gm^{-1} tissue followed by 0.193 to 0.198 mg gm^{-1} tissue (total chlorophyll) and it decreased gradually to 0.193 mg gm^{-1} tissue followed by 0.188 mg gm^{-1} tissue (chlorophyll a), 0.197 mg gm^{-1} tissue followed by 0.192 mg gm^{-1} tissue (chlorophyll b), 0.201 mg gm^{-1} tissue followed by 0.196 mg gm^{-1} tissue (total chlorophyll) at 55 DAS. The least chlorophyll content was recorded in T_1 control.

TABLE - XV

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON CHLOROPHYLL 'a' , CHLOROPHYLL 'b' AND TOTAL CHLOROPHYLL CONTENT IN LEAVES OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Chlorophyll 'a' (mg/gm tissue)			Chlorophyll 'b' (mg/gm tissue)			Total Chlorophyll (mg/gm tissue)		
	25 DAS	45DAS	55DAS	25 DAS	45DAS	55DAS	25 DAS	45DAS	55DAS
T_1	0.032	0.037	0.035	0.036	0.041	0.039	0.140	0.045	0.138
T_2	0.145	0.150	0.148	0.149	0.152	0.153	0.153	0.158	0.156
T_3	0.154	0.159	0.157	0.158	0.163	0.161	0.162	0.167	0.165
T_4	0.178	0.183	0.181	0.180	0.187	0.186	0.186	0.191	0.189
T_5	0.140	0.145	0.143	0.144	0.149	0.147	0.148	0.153	0.151
T^6	0.146	0.150	0.148	0.149	0.154	0.152	0.153	0.158	0.156
T_7	0.162	0.167	0.165	0.166	0.171	0.169	0.170	0.158	0.144
T_8	0.182	0.189	0.185	0.186	0.191	0.189	0.190	0.162	0.193
T_9	0.185	0.190	0.188	0.189	0.194	0.192	0.193	0.198	0.196
T_{10}	0.174	0.179	0.177	0.178	0.181	0.182	0.182	0.187	0.185
T_{11}	0.065	0.173	0.071	0.172	0.177	0.075	0.176	0.181	0.179
T_{12}	0.190	0.197	0.193	0.194	0.199	0.197	0.198	0.203	0.201
SED	0.01430			0.00416			0.05023		
CD(0.05)	0.02850			0.00829			0.08012		
CD(0.01)	0.03783**			0.01100**			0.13289**		

** -Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

4.3.3b Cluster bean

Chlorophyll a, chlorophyll b and total chlorophyll content of cluster bean leaves increased significantly up to 45 DAS and then gradually declined after that in all the treatments (from T_2 to T_{12}) when compared with control T_1. (Table - XVI)

The treatment T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})), showed a remarkably significant increase in chlorophyll content from 25 to 45 DAS which ranged from 0. 159 to 0.163 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) which ranged from 0.156 to 0.161 mg gm^{-1} tissue (chlorophyll a), 0.229 to 0.234 mg gm^{-1} tissue followed by 0.215 to 0.225 mg gm^{-1} tissue (chlorophyll b), 0.230 to 0.238 mg gm^{-1} tissue followed by 0.219 to 0.224 mg gm^{-1} tissue (total chlorophyll) and it decreased gradually to 0.162 mg g^{-1} tissue followed by 0.159 mg gm^{-1} tissue (chlorophyll a), 0.233 mg gm^{-1} tissue followed by 0.218 mg gm^{-1} tissue (chlorophyll b), 0.236 mg gm^{-1} tissue followed by 0.222 mg gm^{-1} tissue (total chlorophyll) at 55 DAS. The least chlorophyll content was recorded in T_1 control.

4.3.3c Green gram

Chlorophyll a, chlorophyll b and total chlorophyll content of green gram leaves increased significantly up to 45 DAS and then gradually declined after that in all the treatments (from T_2 to T_{12}) when compared with control T_1. (Table - XVII)

The treatment T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})), showed a remarkably significant increase in chlorophyll content from 25 to 45 DAS which ranged from 0. 196 to 0.201 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) which ranged from 0.182 to 0.187 mg gm^{-1} tissue (chlorophyll a), 0.200 to 0.205 mg gm^{-1} tissue followed by 0.186 to 0.191 mg gm^{-1} tissue (chlorophyll b), 0.204 to 0.209 mg gm^{-1} tissue followed by 0.190 to 0.195 mg gm^{-1} tissue and it decreased gradually to 0.199 mg gm^{-1} tissue followed by 0.185 mg gm^{-1} tissue (chlorophyll a), 0.203 mg gm^{-1} tissue followed by 0.189 mg g^{-1} tissue (chlorophyll b), 0.207 mg gm^{-1} tissue followed by 0.193 mg gm^{-1} tissue (total chlorophyll) at 55 DAS. The least chlorophyll content was recorded in T_1 control.

TABLE - XVI

EFFECT OF COMPOSTED PRESSMUD, COMPOSTED COIRPITH AND FARMYARD MANURE ON CHLOROPHYLL 'a', CHLOROPHYLL 'b' AND TOTAL CHLOROPHYLL CONTENT IN LEAVES OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	Chlorophyll 'a' (mg/gm tissue)			Chlorophyll 'b' (mg/gm tissue)			Total Chlorophyll (mg/gm tissue)		
	25 DAS	45DAS	55DAS	25 DAS	45DAS	55DAS	25 DAS	45DAS	55DAS
T_1	0.040	0.045	0.043	0.044	0.048	0.046	0.048	0.053	0.051
T_2	0.142	0.147	0.145	0.146	0.151	0.149	0.150	0.155	0.153
T_3	0.146	0.151	0.146	0.150	0.155	0.153	0.154	0.159	0.157
T_4	0.143	0.148	0.146	0.147	0.152	0.150	0.151	0.156	0.154
T_5	0.048	0.053	0.051	0.052	0.057	0.055	0.056	0.061	0.059
T_6	0.150	0.155	0.153	0.154	0.159	0.157	0.158	0.163	0.161
T_7	0.110	0.120	0.110	0.165	0.163	0.163	0.164	0.169	0.167
T_8	0.125	0.161	0.128	0.163	0.168	0.166	0.167	0.172	0.170
T_9	0.156	0.163	0.159	0.215	0.225	0.218	0.219	0.224	0.222
T_{10}	0.095	0.115	0.098	0.099	0.137	0.105	0.103	0.108	0.106
T_{11}	0.090	0.095	0.093	0.194	0.166	0.164	0.098	0.103	0.101
T_{12}	0.159	0.163	0.162	0.229	0.234	0.233	0.230	0.238	0.236
SED	0.00935			0.01505			0.00407		
CD(0.05)	0.01863			0.03000			0.00812		
CD(0.01)	002473**			0.03982**			0.01077**		

** -Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE - XVII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON CHLOROPHYLL 'a', CHLOROPHYLL 'b' AND TOTAL CHLOROPHYLL CONTENT IN LEAVES OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))

Treatment	Chlorophyll 'a' (mg/gm tissue)			Chlorophyll 'b' (mg/gm tissue)			Total Chlorophyll(mg/gm tissue)		
	25 DAS	45DAS	55DAS	25 DAS	45DAS	55DAS	25 DAS	45DAS	55DAS
T_1	0.050	0.038	0.036	0.057	0.062	0.053	0.061	0.066	0.062
T_2	0.156	0.161	0.159	0.160	0.163	0.163	0.165	0.170	0.168
T_3	0.158	0.163	0.161	0.162	0.167	0.165	0.166	0.171	0.169
T_4	0.159	0.164	0.162	0.163	0.168	0.166	0.167	0.172	0.170
T_5	0.054	0.059	0.057	0.058	0.096	0.061	0.062	0.067	0.064
T_6	0.158	0.163	0.061	0.162	0.167	0.165	0.166	0.171	0.169
T_7	0.157	0.162	0.160	0.161	0.166	0.164	0.165	0.170	0.168
T_8	0.155	0.160	0.158	0.159	0.164	0.162	0.163	0.168	0.166
T_9	0.182	0.187	0.185	0.186	0.191	0.189	0.190	0.195	0.193
T_{10}	0.174	0.179	0.177	0.178	0.183	0.181	0.182	0.187	0.185
T_{11}	0.170	0.175	0.173	0.174	0.179	0.177	0.173	0.183	0.181
T_{12}	0.196	0.201	0.199	0.200	0.205	0.203	0.204	0.209	0.207
SED	0.00164			0.00164			0.00169		
CD(0.05)	0.00433**			0.00533**			0.00493**		
CD(0.01)	0.00433**			0.00533**			0.00493**		

** -Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

The present finding is in conformity with that of Ghosh and Das (1998) who concluded that the relative increase in chlorophyll content was due to organic manure application which plays an important role in supplying higher amount of nutrients especially nitrogen to the growing tissues that led to the synthesis of more chlorophyll. A similar result was obtained by Masilamani *et al*. (2001) who observed an increase in chlorophyll a and total chlorophyll content of 4.44 and 7.55 mg gm^{-1} tissue with soil of 10.5 pH+sand+farmyard manure at 2:1:1 ratio. Chlorophyll b content of 3.53 mg/g tissue was maximum with soil pH 9.0.

According to Padmaja and Sangeeth Adlene (2009) a remarkable increase was observed in chlorophyll a, chlorophyll b and total chlorophyll from 30 to 60 DAS in cow pea, which ranged from 0.055 to 0.058 mg gm^{-1} tissue (chlorophyll a), 0.053 to 0.060 mg gm^{-1} tissue (chlorophyll b) and 0.108 to 0.119 mg gm^{-1} tissue (total chlorophyll) respectively than the control in EM- SW (80t ha^{-1}) incorporated treatment. According to Latha *et al*. (2013) a remarkable increase in chlorophyll was observed in multicut fodder sorghum of 2.81mg/gm tissue with the application of BDS (Biomethanated Distillery Spentwash) at 37.5 Kg h^{-1}at full dose + recommended dose of nitrogen phosphorus.

The present finding is in conformity with that of Liu *et al*. (2013) who concluded that the increase in chlorophyll a (10.39 mg gm^{-1} tissue) and chlorophyll b (1.03 mg g^{-1} tissue) content was due to the composted pineapple return residue when compared to the control (chlorophyll a- 7.95, chlorophyll b- 0.79 mg/gm tissue).

The present finding is in conformity with that of Jahanshahi *et al*. (2014) who concluded that the increase in chlorophyll content in dill leaves (0.0083 mg g^{-1} tissue) was due to vermicompost (32 t ha^{-1}) application. According to Adzmi *et al*. (2014) a remarkable increase was observed in chlorophyll content in rice variety MR 219 with the application of 50% chemical fertilizer NPK+ *Bacillus spaericus* (UPMB 10) + *Pseudomonas* spp. as compared to the control (no fertilizer).

The increase in chlorophyll content up to 45 DAS in the leaves might be due to the incorporation of composted coirpith, composted pressmud and farmyard manure which enhanced the nitrogen content of the soil, which is a constituent of important compounds like amino acids, ATP, ADP, chlorophyll and enzymes. The decline in chlorophyll content after 45 DAS might be due to the breakdown of protein, ageing of the leaves and microbial cell lysis. Combined application of composted coirpith, composted pressmud and farmyard manure might have produced maximum photosynthate accumulation towards the leaf biomass, because during initial stage, leave is the most powerful sink than any other plant parts in most of the crops. In fact, leaf is the factory for the conversion of the solar energy into the chemical energy by the process of photosynthesis.

4.4 LEGHAEMOGLOBIN CONTENT

4.4.1 Effect of composted coirpith, composted pressmud and farmyard manure on leghaemoglobin content in nodules of test crops

4.4.1a Black gram

There was an significant increase in leghaemoglobin content in all the treatments up to 45 DAS and it decreased gradually on 55 DAS mentioned in table- XVIII and figure - I.

The leghaemoglobin content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.046 to 0.055 mg/gm followed by T_9 (composted coirpith (12.5t ha^{-1})+ 25% NPK) from 0.044 to 0.047 mg/gm up to 45 DAS and decreased gradually to 0.047 and 0.046 mg/gm on 55 DAS as compared to control T_1 (increased from 0.013 to 0.021 mg/gm up to 45 DAS and decreased to 0.014 mg/gm on 55 DAS).

4.4.1b Cluster bean

The data from table- XIX and figure- II revealed that there was a substantial increase in leghaemoglobin content in all the treatments up to 45 DAS and after that, it declined gradually on 55 DAS.

The leghaemoglobin content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.047 to 0.056 mg/gm followed by T_9 (composted coirpith (12.5t ha^{-1})+ 25% NPK) from 0.045 to 0.048 mg/gm up to 45 DAS and decreased gradually to 0.047 and 0.044 mg/gm on 55 DAS as compared to control T_1 (increased from 0.014 to 0.021 mg/gm up to 45 DAS and decreased to 0.014 mg/gm on 55 DAS).

TABLE - XVIII

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON LEGHAEMOGLOBIN CONTENT IN NODULES OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatments	Leghaemoglobin Content (mg/gm nodule weight)		
	25 DAS	45DAS	55DAS
T_1	0.0130	0.0210	0.0140
T_2	0.0240	0.0280	0.0260
T_3	0.0210	0.0240	0.0210
T_4	0.0200	0.0230	0.0220
T_5	0.0170	0.0200	0.0190
T_6	0.0400	0.0460	0.0410
T_7	0.0320	0.0420	0.0330
T_8	0.0300	0.0330	0.0320
T_9	0.0440	0.0470	0.0460
T_{10}	0.0420	0.0440	0.0430
T_{11}	0.0380	0.0410	0.0400
T_{12}	0.0460	0.0550	0.0470
SED	0.00163		
CD(0.05)	0.00326		
CD(0.01)	320.004		

** - Significant at 1% ($P<0.01$); DAS – Day After Sowing

T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

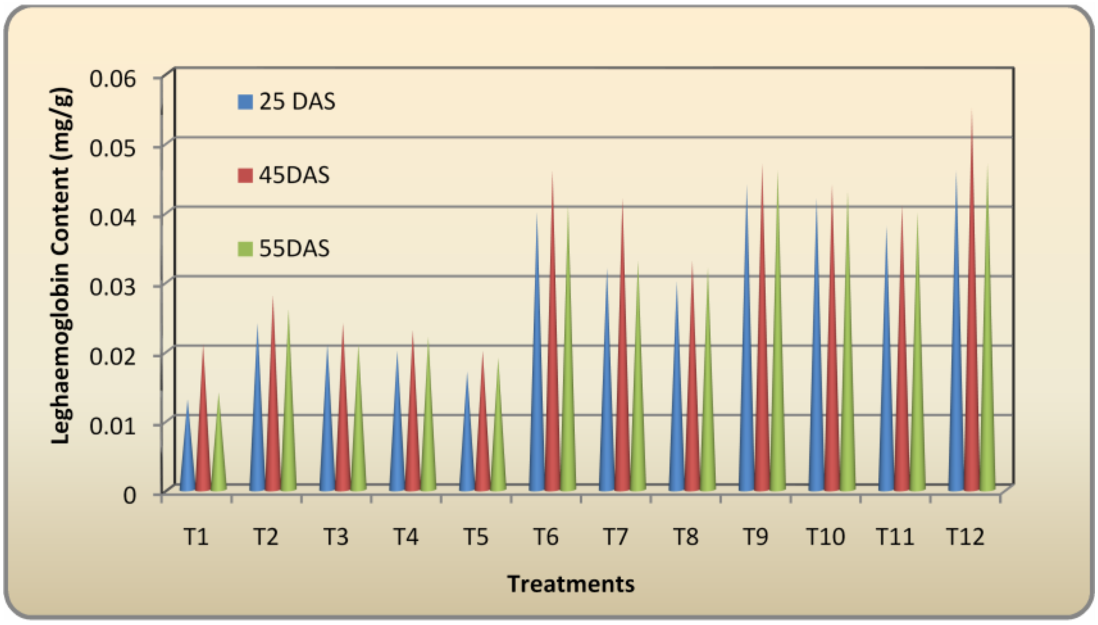
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - I

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON LEGHAEMOGLOBIN CONTENT IN NODULES OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

TABLE - XIX

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON LEGHAEMOGLOBIN CONTENT IN NODULES OF CLUSTER BEAN

(*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	Leghaemoglobin Content (mg/gm nodule weight)		
	25DAS	45DAS	55DAS
T_1	0.0140	0.0210	0.0140
T_2	0.0240	0.0290	0.0280
T_3	0.0220	0.0240	0.0230
T_4	0.0200	0.0230	0.0220
T_5	0.0180	0.0200	0.0190
T_6	0.0380	0.0470	0.0320
T_7	0.0320	0.0420	0.0330
T_8	0.0330	0.0370	0.0320
T_9	0.0450	0.0480	0.0440
T_{10}	0.0430	0.0450	0.0370
T_{11}	0.0387	0.0420	0.0410
T_{12}	0.0470	0.0560	0.0470
SED	0.00267		
CD(0.05)	0.00533		
CD(0.01)	0.00707**		

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

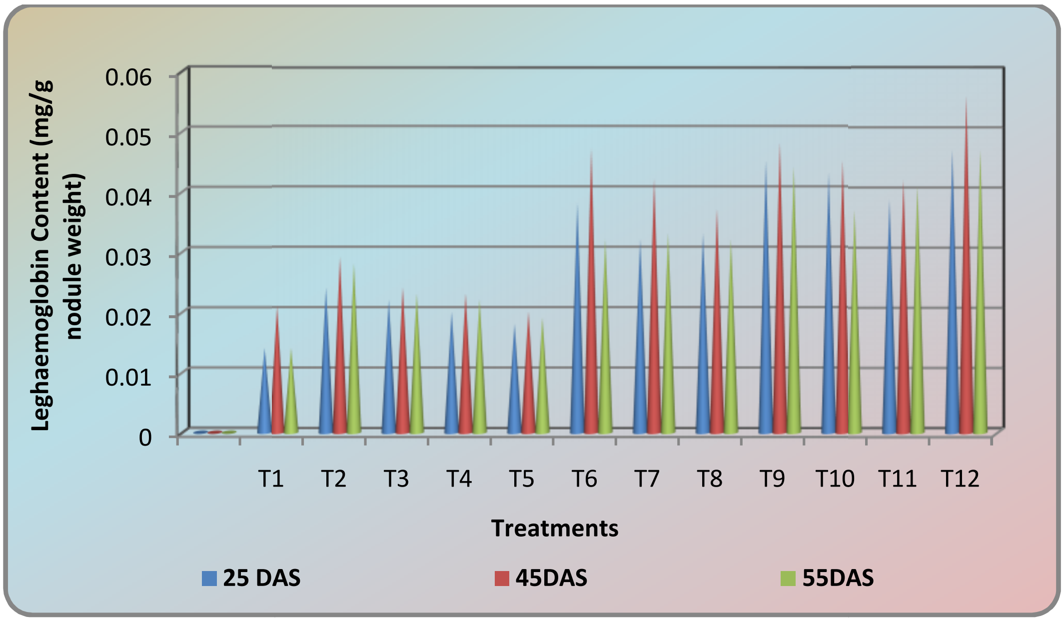
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - II

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON LEGHAEMOGLOBIN CONTENT IN NODULES OF CLUSTER BEAN

(*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

4.4.1c Green gram

It can be inferred from table - XX, figure – III a maximum leghaemoglobin content in all the treatments up to 45 DAS and after that, it declined gradually on 55 DAS.

TABLE - XX

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON LEGHAEMOGLOBIN CONTENT IN NODULES OF GREEN GRAM

(*Vigna radiata* L. Var. (Co (Gg) 7))

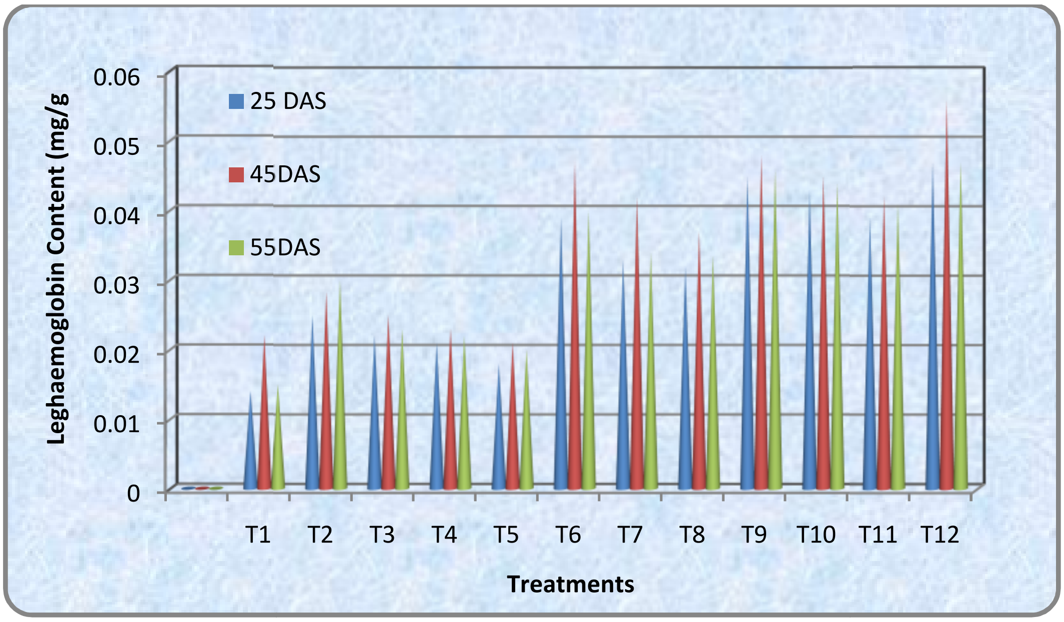
Treatment	Leghaemoglobin Content(mg/gm nodule weight)		
	25DAS	45DAS	55DAS
T_1	0.0140	0.0220	0.0150
T_2	0.0250	0.0283	0.0300
T_3	0.0220	0.0250	0.0230
T_4	0.0210	0.0230	0.0220
T_5	0.0180	0.0210	0.0200
T_6	0.0390	0.0470	0.0400
T_7	0.0330	0.0420	0.0340
T_8	0.0320	0.0370	0.0335
T_9	0.0450	0.0480	0.0460
T_{10}	0.0430	0.0450	0.0440
T_{11}	0.0390	0.0420	0.0410
T_{12}	0.0470	0.0560	0.0470
SED	0.00164		
CD(0.05)	0.00327		
CD(0.01)	0.00434**		

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - III

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON LEGHAEMOGLOBIN CONTENT IN NODULES OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

The leghaemoglobin content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.047 to 0.056 mg/gm followed by T_9 (composted coirpith (12.5t ha^{-1})+ 25% NPK) from 0.045 to 0.048 mg/gm up to 45 DAS and decreased gradually to 0.047 and 0.046 mg/gm on 55 DAS as compared to control T_1 (increased from 0.014 to 0.022 mg/gm up to 45 DAS and decreased to 0.015 mg/gm on 55 DAS).

Abira (2005) reported enhanced leghaemoglobin content from 0.0098 to 0.0256 mg/g up to 60 DAS and declined gradually to 0.0186 mg/gm up to 90 DAS over control with the application of vermicomposted fruit wastes+ *Pleurotus fluorescens*+ *Phosphobacter*.

Similar result was reported by Tamil Arasi (2006) in cowpea who observed maximum leghaemoglobin content of 1.48 to 3.28 mg/gm up to 60 DAS and decreased to 2.53 mg/gm up to 90 DAS with the application of kitchen waste compost at 80 t ha^{-1} as compared to control.

The result is on par with Kosmachevskaya *et al*. (2007) who confirmed that leghaemoglobin act as antioxidant in the leguminous nodule where its concentration is very high (near 3 mM in plant cell cytoplasm) which supports the oxidative state in symbiotic nitrogen fixing system.

Similar result was reported by Padmaja and Sangeeth Adlene (2009) who observed maximum leghaemoglobin content in *Vigna unguiculata* from 0.025 mol^{-1} cm^{-1} to 0.031 mol^{-1} cm^{-1} up to 60 DAS and declined gradually to 0.026 mol^{-1} cm^{-1} at harvest (90 DAS) with the application of EM-W compost (80 t ha^{-1}) as compared to the control.

The present result coincides with the result of Jeenie *et al*. (2010). They observed maximum leghaemoglobin content in mungbean with the combined application of *Rhizobium* (941Kg ha^{-1}) and herbicide (Fluchloralin 0.675Kg ha^{-1}) of 2.86 mg/g when compared to uninoculated unweeded control (2.18 mg gm^{-1}). The present finding is in accordance with the result of Sharma *et al*. (2011). They found highest leghaemoglobin content of 1.8 mg/g with the *Rhizobium* culture (IRG-6) in the groundnut nodules.

The present finding is in accordance with the result of Kucuk (2011) who found maximum leghaemoglobin content (1.69mg gm^{-1}) in Goynuk 98'variety of kidney bean than in the 'Şehirali 90' and 'Akman 98' variety in the nitrogen fertilized plots inoculated with *Rhizobium sp*.

The result is on par with Tagore *et al*. (2013) who observed a maximum leghaemoglobin content of 2.3 mg gm^{-1}up to 55 DAS with the combined application of *Rhizobium* and phosphate solubilizing bacteria in chickpea root nodules which remain same at 75 DAS also.

Similar result was reported by Moinuddin *et al*. (2014) in chickpea. Highest leghaemoglobin content of 3.37 mg/g was obtained with the application of phosphorus (60 kg $^{-1}$) + biological phosphorus fertilizer (*Pseudomonas striata*). The result is on par with Suryapani *et al*. (2014) who observed a maximum leghaemoglobin content of 0.278 mM in the nodules of lentil with the combined application of potassium (50 Kg ha^{-1}) and *Rhizobium leguminosarum* (strains- L-2097) at 60 DAS in both years (2007-08 and 2008-09) of study when compared to the control of 0.128 mM at 30 DAS in Year 1.

Similar findings was reported by Abd-Alla *et al*. (2014) in the nodules of *Vicia faba*. An increase of 19.7% and 32.7% in leghaemoglobin content was caused by dual inoculation of [arbuscular mycorrhizal fungi biofertilizer and *Rhizobium leguminosarum* bv.viciae STDF-Egypt 19 (HM587713)] over the plants inoculated by single inoculation with *Rhizobium leguminosarum* bv.viciae STDF-Egypt 19 (HM587713) at pH 8.5 and 9. The result is on par with Verma *et al*. (2014) who observed a maximum leghaemoglobin content of 2.00 mg/g with the application of vermicompost (6t ha^{-1}) in fenugreek.

The increase in leghaemoglobin content might be due to high nitrogenase activity by the respiring bacteroids and declined gradually after that might be due to less nitrogenase activity by the bacteria or may be used up by the plants or due to decrease in nodule number as growth of the plant progress.

4.5 YIELD CHARACTERS

4.5.1 Effect of composted coirpith, composted pressmud and farmyard manure on yield parameters of test crops.

4.5.1a Black gram

It can be inferred from the table - XXI, figure- IV & V and plate - XIV that the number of pods per plant, length of pod, weight of pod, number of seeds per pod, weight of seeds per pod, pod fresh weight and pod dry weight were maximum in T_{11} (farmyard manure (12.5t ha-1)+ 25% NPK) treatment on 75 DAS.

Maximum number of pods per plant (7.22), length of pod (5.34 cm), weight of pod (5.76gm), number of seeds per pod (6.00), weight of seeds per pod (2.87), Pod fresh weight (5.72 gm) and pod dry weight (0.38gm) was recorded over control T_1 (2.66, 3.30, 2.36, 4.55, 1.11, 2.33, 0.11).

4.5.1b Cluster bean

It can be inferred from the table - XXII , figure- VI & VII and plate - XIV that the number of pods per plant, length of pod, weight of pod, pod fresh weight and pod dry weight were maximum in T_{11} (farmyard manure (12.5t ha^{-1}) + 25% NPK) treatment and number of seeds per pod in T_6 (composted coirpith (12.5t ha^{-1})+ 50%) and weight of seeds per pod in T_7 (composted pressmud (12.5t ha^{-1}) + 50%) on 75 DAS.

Maximum number of pods per plant (8.44), length of pod (14.44cm), weight of pod (24.13 gm), number of seeds per pod (7.33), weight of seeds per pod (6.87), Pod fresh weight (24.13 gm) and pod dry weight (2.25 gm) were observed when compared to the control T_1 (1.77, 8.22, 4.33, 2.22, 0.01, 4.33, 0.33).

4.5.1c Green gram

It can be inferred from the table - XXIII , figure -VIII & IX and plate - XIV that the number of pods per plant were maximum in T_{11} (farmyard manure (12.5t ha^{-1}) + 25%), length of pod, weight of pod and pod fresh weight in T_{10}(composted pressmud (12.5t ha^{-1}) + 25% NPK), number of seeds per pod in T_5 (NPK 100%), weight of seeds per pod in T_8 (farmyard manure (12.5t ha^{-1}) + 50%NPK)and pod dry weight were more in T_2 (composted Coirpith (12.5t ha^{-1})) treatment on 75 DAS.

TABLE XXI

YIELD PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75^{th}DAY)

Treatment	Number of pods/plant	Length of pod(cm)	Weight of pod(gm)	Number of seeds/pod	Weight of seeds/pod(gm)	Pod fresh weight	Pod dry weight
T_1	2.66	3.30	2.36	4.55	1.11	2.33	0.11
T_2	3.22	4.11	2.73	3.11	0.67	1.77	0.11
T_3	3.77	3.75	1.87	4.11	1.16	1.86	0.31
T_4	1.77	3.71	3.26	5.22	1.56	3.27	0.16
T_5	3.88	3.76	1.86	4.66	1.33	1.84	0.27
T_6	1.77	3.67	1.67	3.77	1.23	1.67	0.31
T_7	1.55	3.64	1.75	4.22	1.27	1.72	0.31
T_8	2.77	3.75	3.66	4.22	1.77	3.63	0.21
T_9	1.77	3.72	2.77	3.66	1.12	2.76	0.12
T_{10}	4.33	4.22	3.73	4.55	2.03	3.72	0.24
T_{11}	7.22	5.34	5.76	6.00	2.87	5.72	0.38
T_{12}	3.14	3.93	2.78	4.35	1.47	2.68	0.24
SED	0.2839	0.0519	0.0423	0.3861	0.0041	0.0908	0.0044
CD(0.05)	0.5889	0.1076	0.0878	0.8008	0.0084	0.1882	0.0091
CD(0.01)	0.8004**	0.1463**	0.1193**	1.0884**	0.0115**	0.2558**	0.0124**

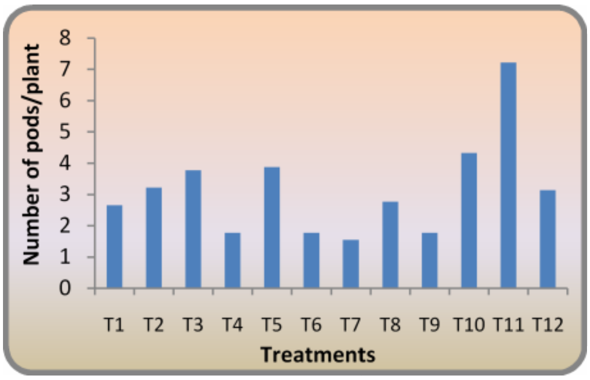
** - Significant at 1% (P<0.01),DAS – Days After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

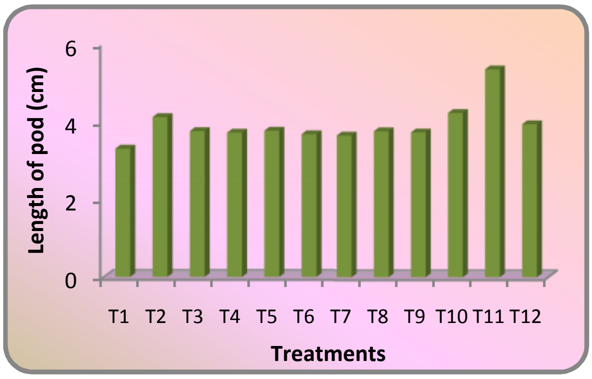
FIGURE - IV

YIELD PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5) INFLUENCED BY COMPOSTEDCOIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75thDAY)

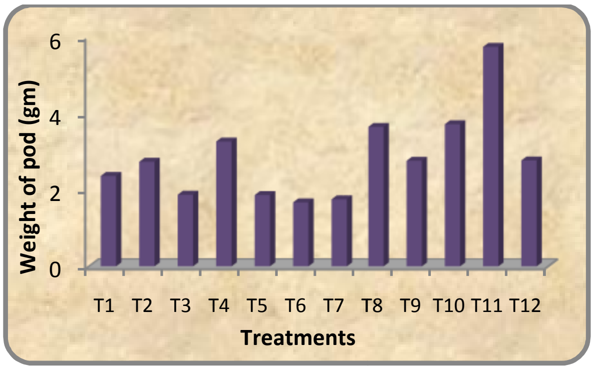
Number of pods/plant



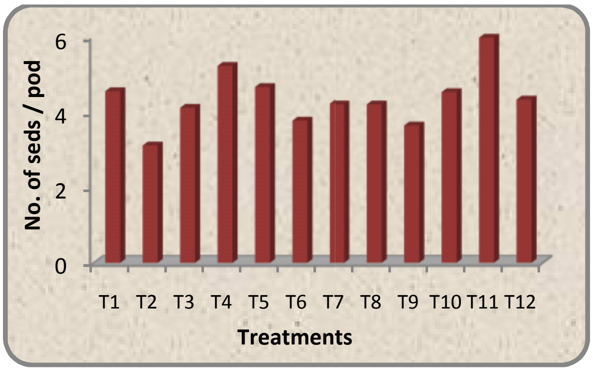
Length of pod (cm)



Weight of pod (gm)



Number of seeds/pod



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

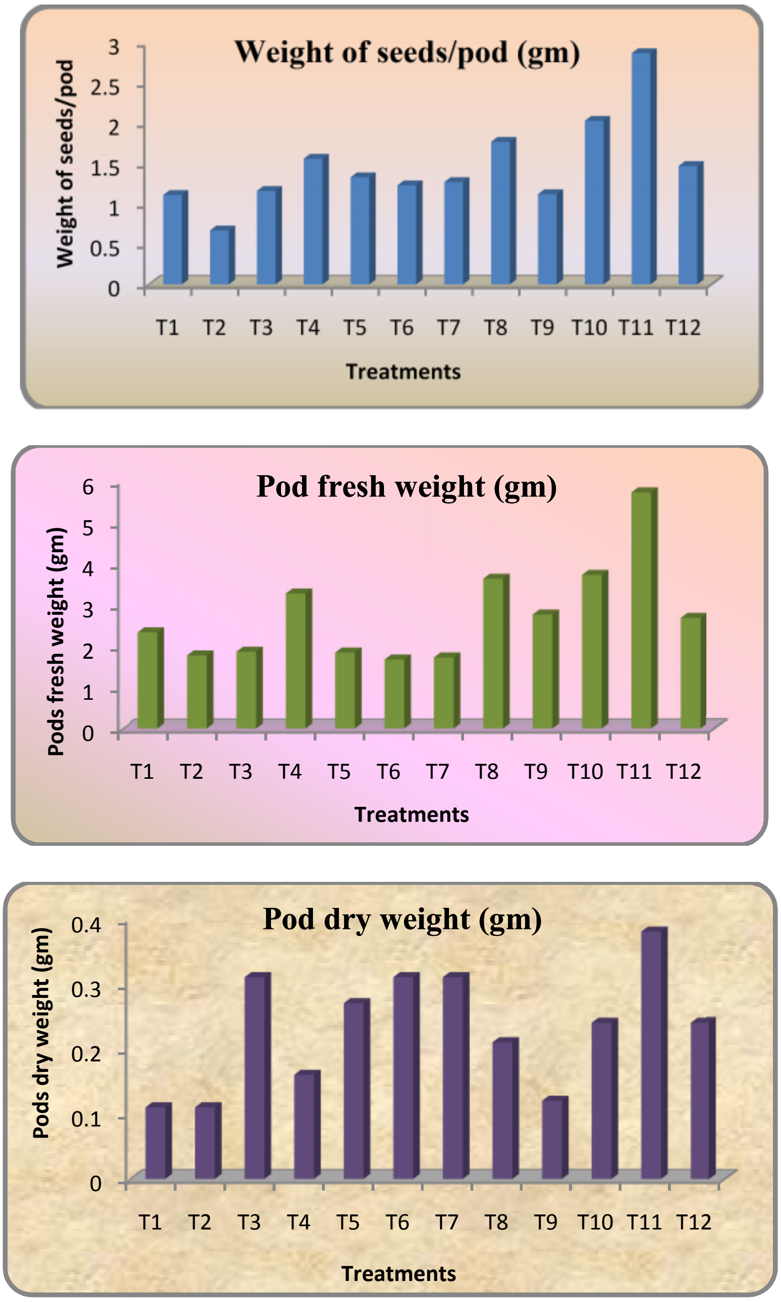
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - V

YIELD PARAMETERS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75thDAY)

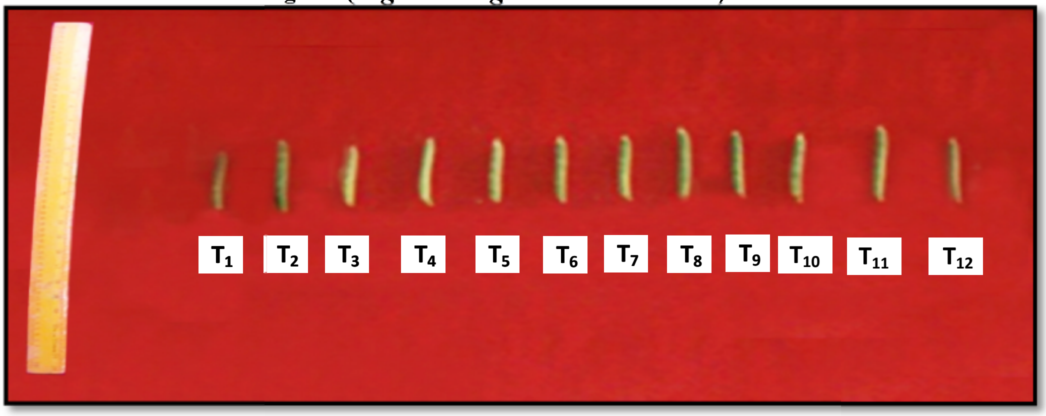


T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

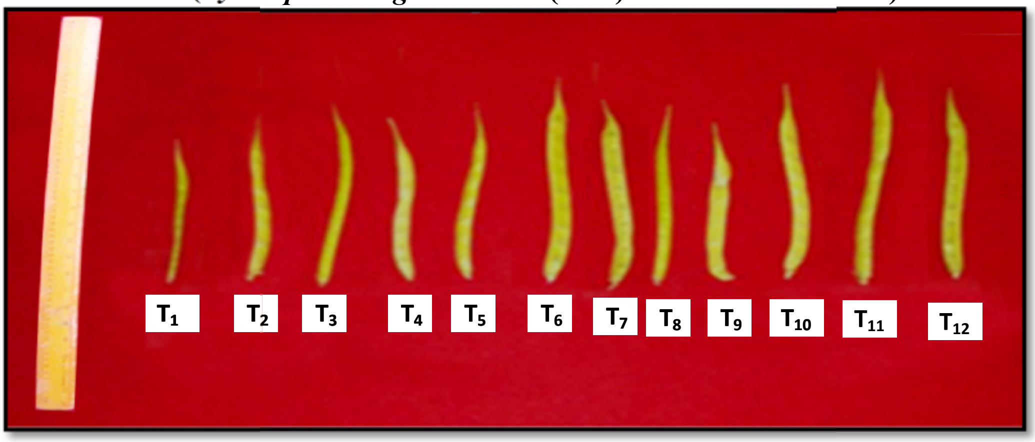
PLATE – XIV

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON YIELD PARAMETERS

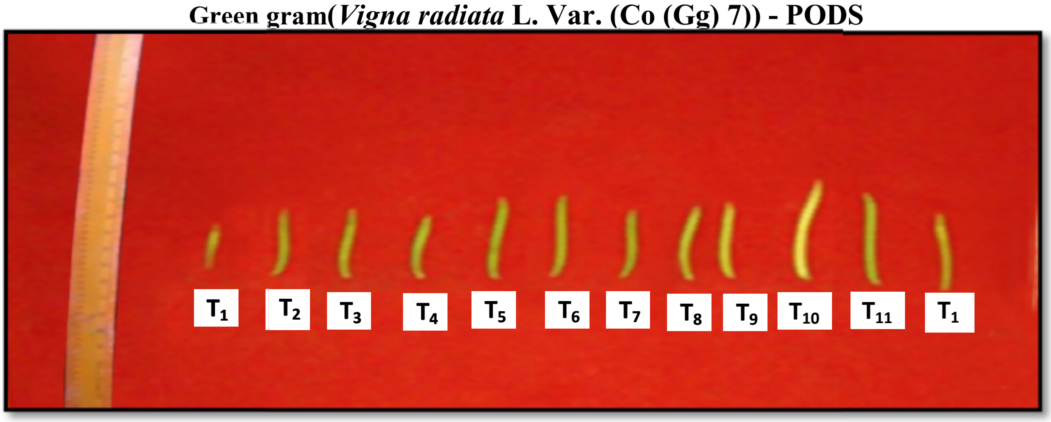
Black gram (*Vigna mungo* L. Var. ADT 5) - PODS



Cluster bean (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) - PODS



Green gram(*Vigna radiata* L. Var. (Co (Gg) 7)) - PODS



T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE – XXII

YIELD PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75^{th}DAY)

Treatment	Number of pods/plant	Length of pod(cm)	Weight of pod(gm)	Number of seeds/pod	Weight of seeds/pod(gm)	Pod fresh weight	Pod dry weight
T_1	1.77	8.22	4.33	2.22	0.01	4.33	0.33
T_2	2.00	8.33	9.64	4.33	1.61	9.67	0.36
T_3	3.11	9.77	22.63	6.22	3.46	22.64	1.37
T_4	2.88	9.22	7.24	5.77	2.86	7.27	1.24
T_5	2.44	10.26	15.87	6.33	1.92	15.87	1.49
T_6	2.77	9.55	14.10	7.33	0.63	14.12	0.53
T_7	4.22	9.35	11.73	7.22	6.87	11.72	0.76
T_8	2.88	11.21	9.73	5.66	0.42	9.72	0.84
T_9	4.22	10.38	13.33	6.00	1.87	13.55	1.05
T_{10}	6.44	10.77	19.87	6.33	1.51	19.87	1.73
T_{11}	8.44	14.44	24.13	5.22	1.16	24.13	2.25
T_{12}	4.09	10.48	15.50	5.86	1.55	15.52	1.27
SED	0.6333	0.5073	0.0876	0.6782	0.0423	0.0655	0.0061
CD(0.05)	1.3134	1.0521	0.1818	1.4065	0.0877	0.1359	0.0127
CD(0.01)	1.7851**	1.4301**	0.2471**	1.9118**	0.1192**	0.1848**	0.0173**

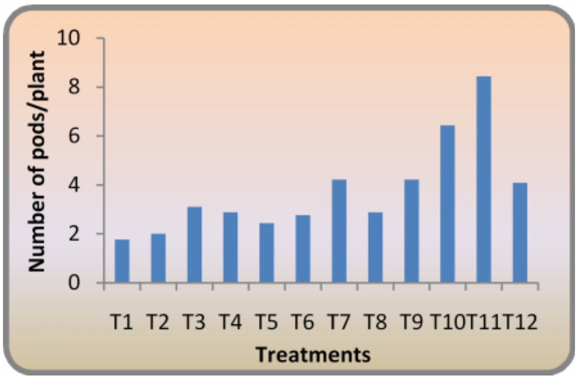
** -Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

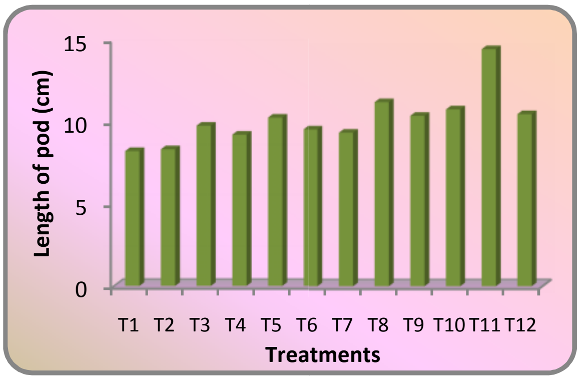
FIGURE - VI

YIELD PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75thDAY)

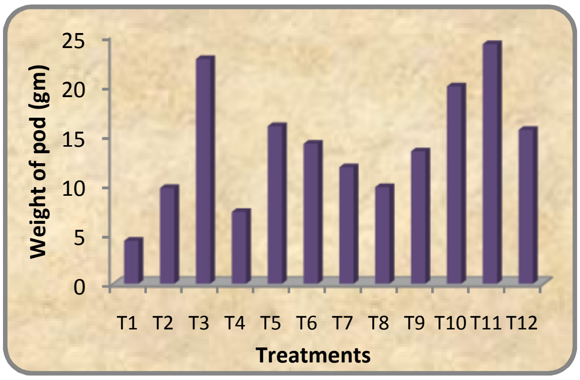
Number of pods/plant



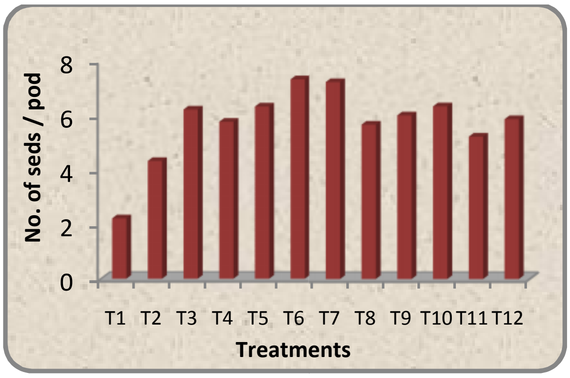
Length of pod (cm)



Weight of pod (gm)



Number of seeds/pod

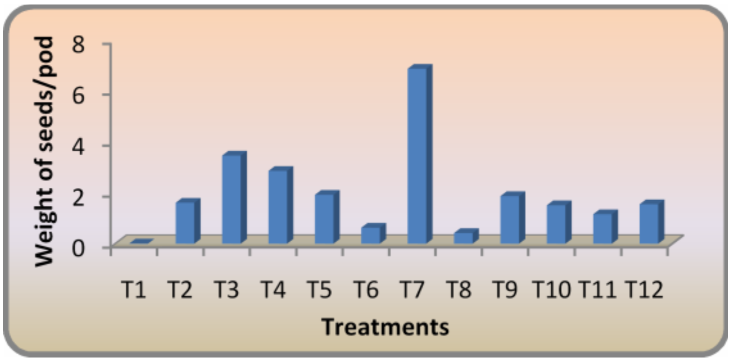


T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

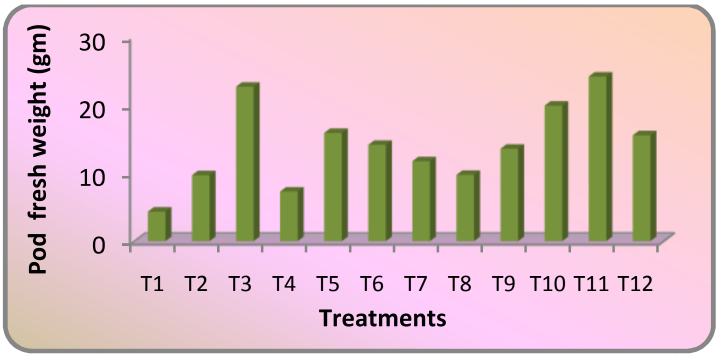
FIGURE - VII

YIELD PARAMETERS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75thDAY)

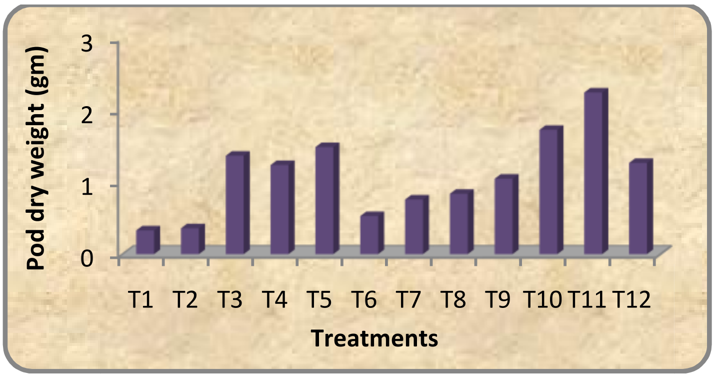
Weight of seeds/pod (gm)



Pod fresh weight (gm)



Pod dry weight (gm)



T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE - XXIII

YIELD PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7)) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75th DAY)

Treatment	Number of pods/plant	Length of pod(cm)	Weight of pod(gm)	Number of seeds/pod	Weight of seeds/pod (gm)	Pod fresh weight (gm)	Pod dry weight (gm)
T_1	0.61	0.62	0.57	2.77	0.03	0.05	0.11
T_2	2.74	6.24	2.25	7.22	0.57	1.35	0.65
T_3	3.65	5.37	2.38	3.77	1.33	3.26	0.14
T_4	3.73	4.78	2.40	4.33	0.41	2.26	0.06
T_5	3.61	5.68	3.12	8.22	2.13	3.12	0.46
T_6	2.78	5.26	0.67	3.11	0.22	3.54	0.55
T_7	2.67	5.32	2.67	7.11	1.42	2.67	0.12
T_8	2.72	5.78	3.56	6.66	4.37	3.57	0.22
T_9	1.68	5.21	1.61	5.33	0.20	1.62	0.37
T_{10}	2.76	6.27	4.92	8.00	3.46	4.93	0.03
T_{11}	4.77	5.75	3.37	7.77	1.77	3.34	0.12
T_{12}	3.27	5.77	2.72	6.09	1.59	2.71	0.25
SED	0.0779	0.0706	0.0602	0.5379	0.8626	0.0219	0.0470
CD(0.05)	0.1617	0.1465	0.1248	1.1156	1.7889	0.0451	0.0974
CD(0.01)	0.2197**	0.1991**	0.1696**	1.5164**	2.4315**	0.0615**	0.1324**

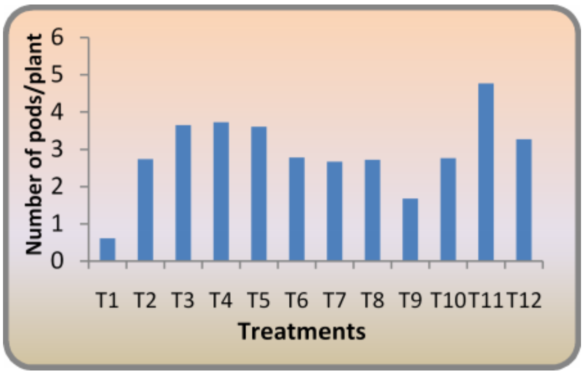
** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

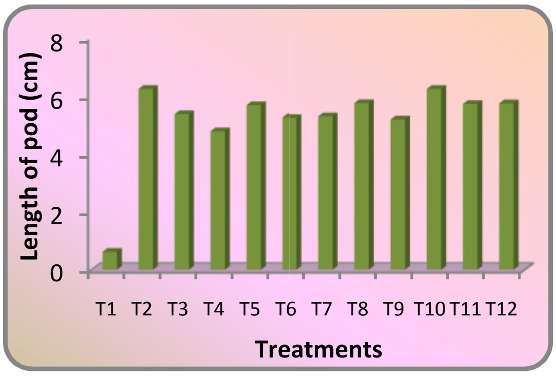
FIGURE - VIII

YIELD PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7)) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75^{th}DAY)

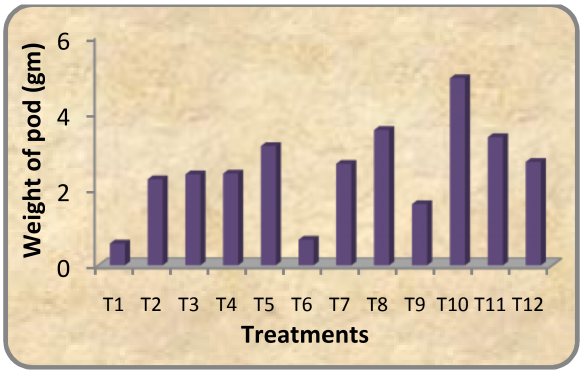
Number of pods/plant



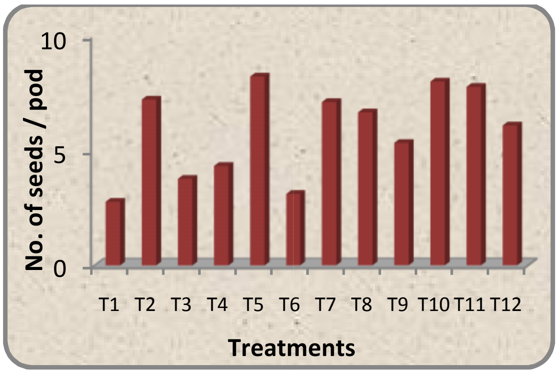
Length of pod (cm)



Weight of pod(gm)



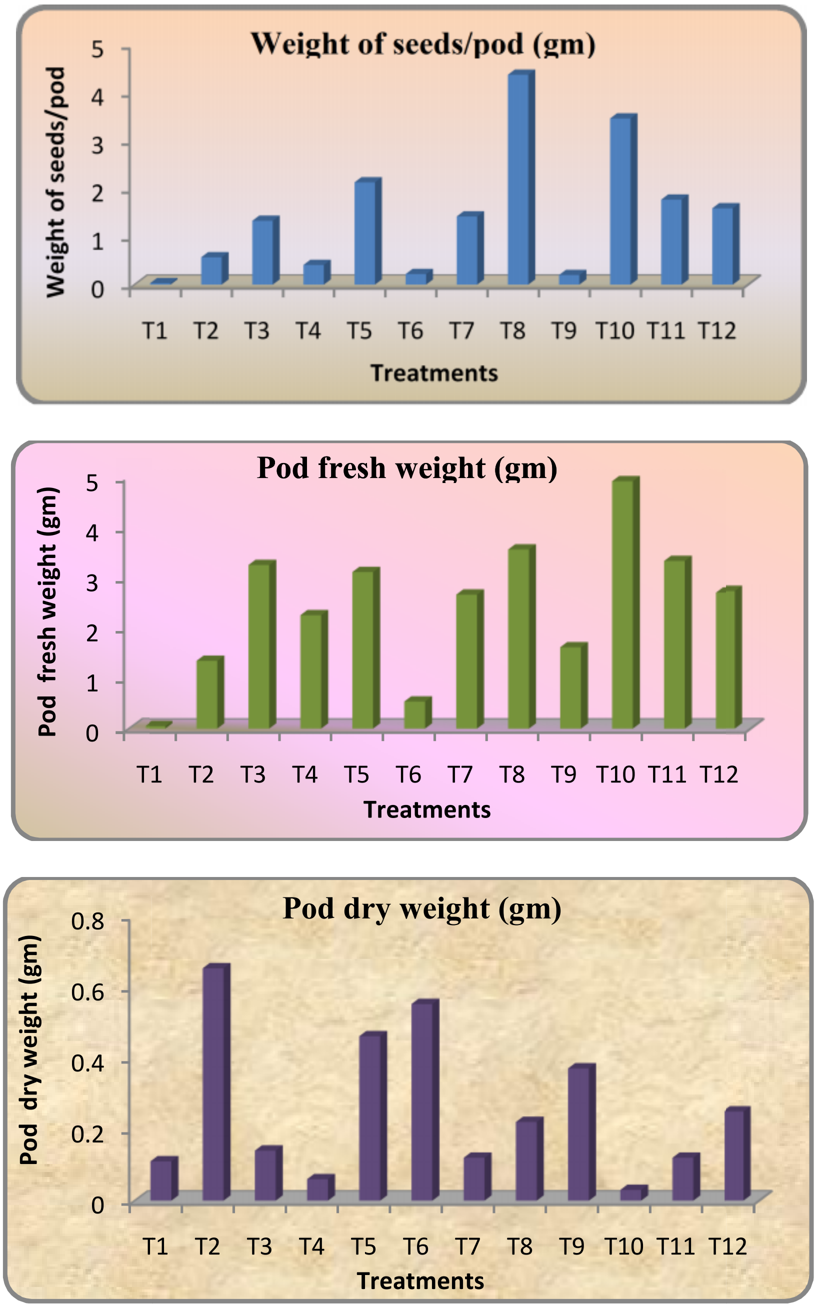
Number of seeds/pod



T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - IX

YIELD PARAMETERS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7)) INFLUENCED BY COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE (75th DAY)



T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

Maximum number of pods per plants (4.77), length of pod (6.27 cm), weight of pod (4.92 gm), number of seeds per pod (8.22), weight of seeds per pod (4.37), Pod fresh weight (4.93 gm) and pod dry weight (0.65 gm) were estimated over control T_1 (0.61, 0.62, 0.57, 2.77, 0.03, 0.05, 0.11). Similar results was observed by Satyanarayana *et al*. (2002) who found maximum grain yield of rice with application of FYM at 10t ha^{-1} and inorganic fertilizer at 120: 60: 45 kg N: P_2O_5: K_2O ha^{-1}.

The present finding coincides with the result of Radwan and Awad (2002) who reported that the combined application of composted rice straw + biofertilizer (*Bacillus megaterium, Azospirillum* and *Pseudomonas*) enhanced the number of pods per plant (29), yield of pods (75.80 gm), yield of seeds (52.72 gm) and the application of NPK (150 kg/fed+ 200 Kg/fed+ 50 Kg/fed) enhanced the weight of mono-pods (9.67 gm) in peanuts.

The present finding is in conformity with Yadav and Vijayakumari (2003) who reported that the application of vermicompost (35 gm) per pot significantly enhanced the yield parameters of chilli. Similar result was obtained by Kadwe *et al*. (2003). They observed a significant increase in number of seeds yield ha^{-1} (11.69) and harvest index % (29.98) with the integrated application of ¾ RDF (NPK - 25:50:0 kg ha^{-1}) + 5t pressmud ha^{-1} over RDF (Recommended dose fertilizer NPK 25:50:0 Kg ha^{-1}) alone.

Similar result was obtained by Padmaja and Jessy Paulose (2011). They observed a significant increase in number of pods per plant (11.33 to 16.67), length of pod (4.50 cm to 6.53 cm), single pod weight (0.23 gm to 0.45 gm) and number of seeds per pod (8.00 to 10.00) with the application of WH- GM (200mg) from 50 to 70 DAS over the control in green gram.

The present finding is in conformity with Vimera *et al*. (2012) who reported that the integration effect of NPK (50%) + FYM (50%) +biofertilizers had significant positive impact on yield per plant (1149g) as well as yield (11.05 t ha^{-1}) of king chilli. The present finding coincides with the result of Ojha *et al*. (2014) who reported that the application of farmyard manure (35 t ha^{-1}) was significant in enhancing broccoli sprout yield (5.80t ha^{-1}) and the broccoli biomass (625gm^{-2}) as compared to the control (4.15 t ha^{-1} and 345 gm^{-2}).

The present finding coincides with the result of Patel *et al*. (2014) who reported that the application of 50% recommended dose of nitrogen through castor cake +seed inoculation with *Rhizobium* and phosphate solubilizing bacteria was significant in enhancing pod length (10.9 cm), number of pods per plant (30.3) and number of seeds per pod (16.3) in fenugreek.

The present finding is in conformity with Yaduvanshi (2014) who reported that the integrated application of 100 % recommended dose of NPK (120:26:42) + pressmud (10t ha^{-1}) + gypsum (5t ha^{-1}) enhanced the mean yield of rice (5.41 t ha^{-1}) and wheat (4.52 t ha^{-1}) during 10 year cropping period (1994-2003). Similar result was obtained by Jat *et al*. (2014). They observed a significant increase in number of grain yield (2487 to 4651 Kg/ha) with the application of FYM at 10t ha^{-1} along with 100% NPK giving an increase of 87.01% over control in sorghum.

Increase in yield parameters might be due to the beneficial effect of composted coirpith, composted pressmud and farmyard manure on plant growth manifesting as increased chlorophyll production, rate of photosynthesis as well as for increasing the nitrogen and phosphorus turnover in soil through nitrogen fixation and mobilizing native soil phosphorus which resulted in better plant growth and superior yield attributes. The increase in yield characters of the crop might be due to the positive role of the organic manures with balanced supply of nitrogen throughout the life cycle of the crop which reduced the senescence and was able to furnish the increased assimilate demand of plant sinks which resulted in higher yield.

4.5.2. Effect of composted coirpith, composted pressmud and farmyard manure on protein and carbohydrate content in the pods of test crops.

4.5.2a Black gram

The protein content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) of 47.18 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) of 36.27 mg gm^{-1} as compared to control T_1 (18.27 mg gm^{-1}) (Table – XXIV)

TABLE - XXIV

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON PROTEIN AND CARBOHYDRATE CONTENT IN PODS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Protein in pods (mg/gm tissue)	Carbohydrate in pods (mg/gm tissue)
T_1	18.27	22.99
T_2	32.27	85.85
T_3	27.63	85.40
T_4	25.45	69.41
T_5	23.45	31.64
T_6	27.36	37.22
T_7	29.36	83.64
T_8	33.63	171.78
T_9	36.27	181.75
T_{10}	24.99	59.45
T_{11}	30.45	141.24
T_{12}	47.18	202.11
SED	0.0003	0.0002
CD(0.05)	0.0005	0.0005
CD(0.01)	0.0007**	0.0006**

** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

The carbohydrate content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) of 202.11 mg gm^{-1} followed by T_9 (composted coirpith (12.5t ha^{-1}) +25% NPK) of 181.75 mg gm^{-1} when compared to control T_1(22.99 mg gm^{-1}).

4.5.2b Cluster bean

The protein content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) of 26.99 mg gm^{-1} tissue followed by T_9 (composted coirpith(12.5t ha^{-1}) +25% NPK) of 26.27 mg gm^{-1} as compared to control when compared to control T_1 (20.27 mg gm^{-1}). (Table – XXV)

TABLE- XXV

EFFECT OF COMPOSTED PRESS MUD, COMPOSTED COIR PITH AND FARMYARD MANURE ON PROTEIN AND CARBOHYDRATE CONTENT IN PODS OF CLUSTER BEAN

Treatment	Protein in pods (mg/gm tissue)	Carbohydrate in pods (mg/gm tissue)
T_1	20.27	26.71
T_2	20.90	28.35
T_3	21.54	32.40
T_4	26.27	32.84
T_5	20.36	26.93
T_6	22.08	38.86
T_7	24.72	29.78
T_8	24.99	27.37
T_9	26.27	39.36
T_{10}	21.99	31.64
T_{11}	25.18	38.86
T_{12}	26.99	40.07
SED	0.002	0.009
CD(0.05)	0.005	0.017
CD(0.01)	0.006**	0.023**

** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

The carbohydrate content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) of 40.07 mg gm^{-1} followed by T_9 (composted coirpith (12.5t ha^{-1}) +25% NPK) of 39.36 mg gm^{-1} as compared to control when compared to control T_1(26.71 mg gm^{-1}).

4.5. 2c Green gram

There was an appreciable increase in protein and carbohydrate content in the pods of green gram shown in table- XXVI.

TABLE - XXVI

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE ON PROTEIN AND CARBOHYDRATE CONTENT IN PODS OF GREEN GRAM
(*Vigna radiata* L. Var. (Co (Gg)7))

Treatment	Protein in pods (mg/gm tissue)	Carbohydrate in pods (mg/gm tissue)
T_1	19.32	28.68
T_2	26.72	42.81
T_3	28.60	97.55
T_4	33.99	92.84
T_5	22.81	37.87
T_6	35.09	51.56
T_7	39.81	41.93
T_8	28.54	45.21
T_9	46.99	120.49
T_{10}	37.81	83.21
T_{11}	40.27	29.99
T_{12}	47.08	121.09
SED	0.0240	0.0028
CD(0.05)	0.0477	0.0055
CD(0.01)	0.0632**	0.0073**

** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

The protein content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) of 47.08 mg gm^{-1} tissue followed by T_9 (composted coirpith (12.5t ha^{-1}) +25% NPK) of 46.99 mg gm^{-1} as compared to control when compared to control T_1 (19.32 mg gm^{-1}).

The carbohydrate content was found to be maximum in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) of 121.09 mg g^{-1} followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) of 120.49 mg g^{-1} as compared to control when compared to control T_1 (28.68 mg gm^{-1}).

According to Zodape *et al.* (2010) a remarkable increase in protein and carbohydrate content was observed in green gram of 19.430 and 61.995 mg/g tissue with the application of 15.0% seaweed (*Kappaphycus alvarezii*) extract. The present finding is in accordance with the observation of Senthilkumar and Sivagurunathan (2012) who found that the combined inoculation of bacterial fertilizers (*Rhizobium*+ *Phophobacteria* + *Azospirillum*) increased the protein and carbohydrate content of cowpea (1.44 and 15.74 mg/g tissue) and green gram (1.17 and 15.57 mg/g tissue).

A similar result was obtained by Baviskar *et al.* (2012) who reported that the application of biocompost (5t/ha^{-1}) increased the protein content (20.30%) of cluster bean than the control. According to Reghuvaran and Ravindranath (2014) a remarkable increase in protein and carbohydrate content was noted in *Ocimus kiliandscharium* (6.95 mg/gm) grown in coirpith compost and *Bacopa monnieri* (0.36 mg/gm) recorded the highest amount of carbohydrate when grown in coirpith compost.

Similar results was obtained by Banik and Sengupta (2014) who observed increase in the seed protein content of mung bean with the application of farm compost at 4-8 t ha^{-1} by 6.5-9.0% over the fertilized control treatment. Increase in protein and carbohydrate content might be due to the effect of composted coirpith, composted pressmud and farmyard manure on microbial activity which result in higher supply of nitrogen throughout the growth period resulting in higher protein and carbohydrate content.

4.6 DEHYDROGENASE AND UREASE ENZYME STUDIES

4.6.1 Effect of composted coirpith, composted pressmud and farmyard manure on the dehydrogenase activity of the soil used for the productivity of black gram

4.6.1a Black gram

Soil enzyme activities have been used to monitor different issues of environmental quality. They have been tested as indicators of soil fertility, soil quality, pollution impacts and nutrient cycling. Soil dehydrogenase activity reflects the total range of oxidative activity of soil micro flora and is consequently used as an indicator of microbial activity.

The data from table- XXVII and figure- X revealed that there was a substantial increase in soil dehydrogenase enzyme activity upto 45 DAS and after that, it declined gradually in all the treatments.

The soil dehydrogenase activity increased to the maximum in T_{12} treatments (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.648 to 0.790 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein followed by T_9 (composted coirpith(12.5t ha^{-1}) + 25% NPK) treatment from 0.630 to 0.720 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein and decreased gradually to 0.699 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein and 0.650 µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein at harvest as compared to control T_1 (increased from 0.140 to 0.250 up to 45 DAS and decreased to 0.150µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein at harvest)

4.6.1b Cluster bean

It can be inferred from table -XXVIII, figure- XI a maximum dehydrogenase activity upto 45 DAS and after that, it declined gradually in all the treatments.

The soil dehydrogenase activity increased maximally in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.648 to 0.740 µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein followed by T_9 (composted coirpith(12.5t ha^{-1}) + 25% NPK) treatment from 0.630 to 0.740 µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein and decreased gradually to 0.520 µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein and 0.450 µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein at harvest as compared to control T_1 (increased from 0.140 to 0.200 upto 45 DAS and decreased to 0.170µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein at harvest).

TABLE - XXVII

DEHYDROGENASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

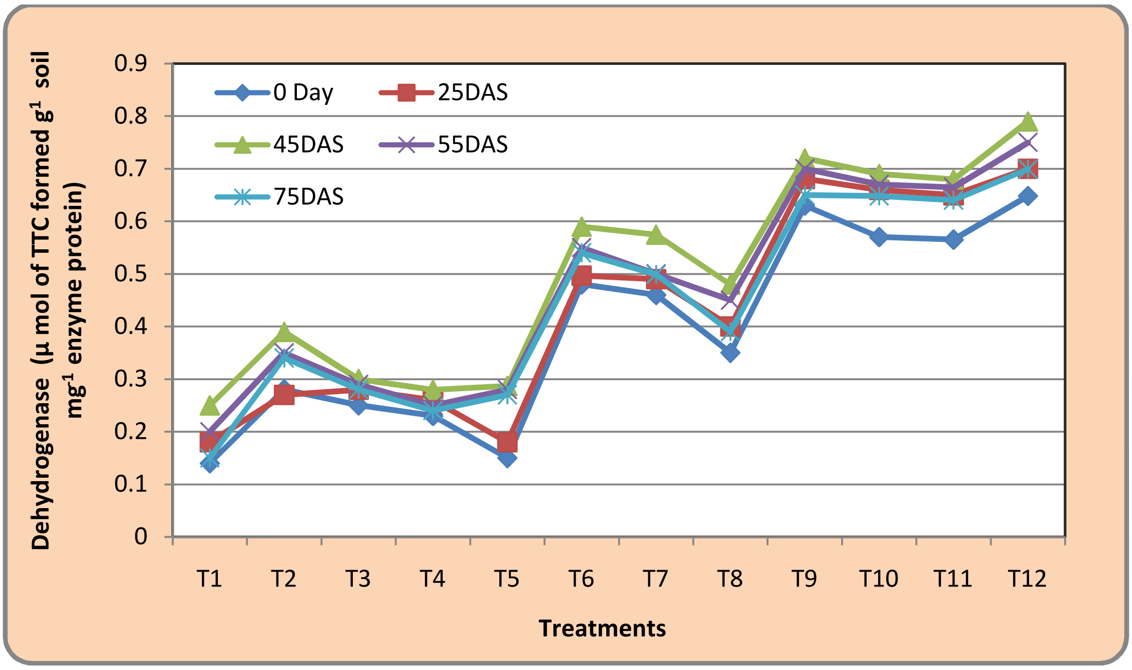
Treatment	Dehydrogenase Enzyme (µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T_1	0.140	0.180	0.250	0.200	0.150
T_2	0.280	0.270	0.390	0.350	0.340
T_3	0.250	0.280	0.300	0.290	0.280
T_4	0.230	0.260	0.280	0.250	0.240
T_5	0.150	0.180	0.287	0.280	0.270
T_6	0.480	0.497	0.590	0.550	0.540
T_7	0.460	0.490	0.575	0.500	0.499
T_8	0.350	0.400	0.480	0.450	0.390
T_9	0.630	0.681	0.720	0.700	0.650
T_{10}	0.570	0.660	0.690	0.670	0.648
T_{11}	0.565	0.650	0.680	0.665	0.640
T_{12}	0.648	0.700	0.790	0.750	0.699
SED	0.00372				
CD(0.05)	0.00737				
CD(0.01)	0.00974**				

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - X

DEHYDROGENASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

TABLE - XXVIII

DEHYDOGENASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

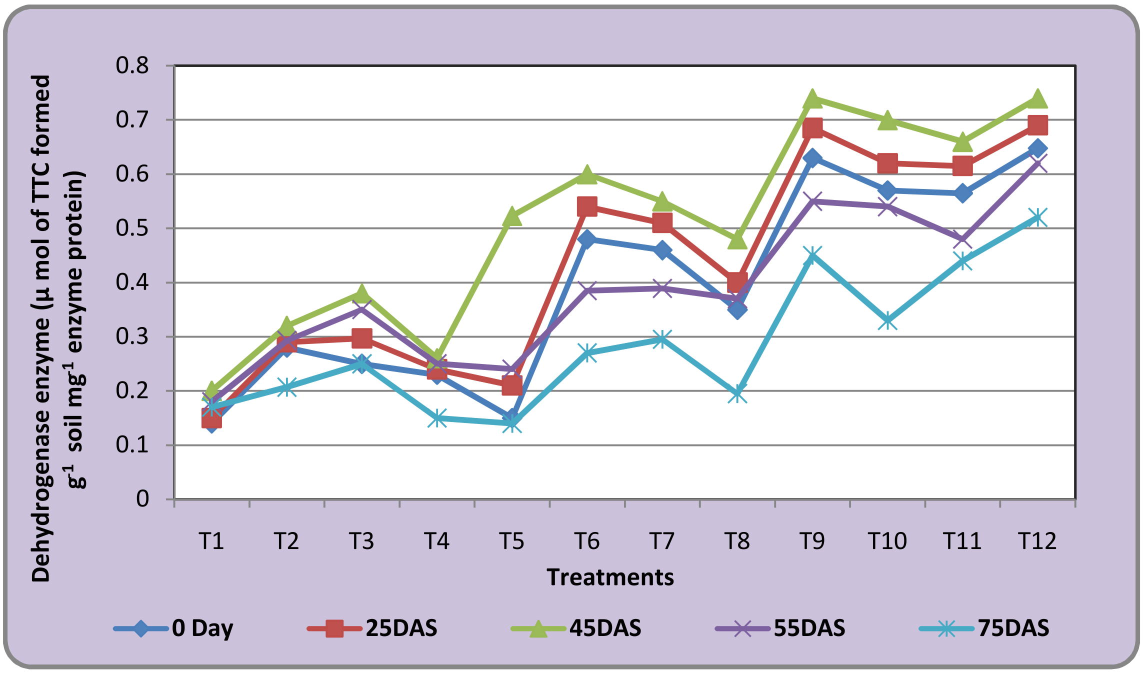
Treatment	Dehydrogenase enzyme (µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T_1	0.140	0.150	0.200	0.180	0.170
T_2	0.280	0.290	0.320	0.293	0.207
T_3	0.250	0.297	0.380	0.350	0.250
T_4	0.230	0.240	0.260	0.250	0.150
T_5	0.150	0.210	0.523	0.240	0.140
T_6	0.480	0.540	0.600	0.385	0.270
T_7	0.460	0.510	0.550	0.389	0.295
T_8	0.350	0.400	0.480	0.370	0.195
T_9	0.630	0.685	0.740	0.550	0.450
T_{10}	0.570	0.620	0.700	0.540	0.330
T_{11}	0.565	0.615	0.660	0.480	0.440
T_{12}	0.648	0.690	0.740	0.620	0.520
SED	0.00105				
CD(0.05)	0.00207				
CD(0.01)	0.00274**				

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE-XI

DEHYDOGENASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

4.6.1c Green gram

The data from table- XXIX and figure -XII stated that there was a increase in soil dehydrogenase enzyme activity up to 45 DAS and after that, it declined gradually in all the treatments.

TABLE – XXIX

DEHYDOGENASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF GREEN GRAM
(*Vigna radiata* L. Var. (Co (Gg) 7))

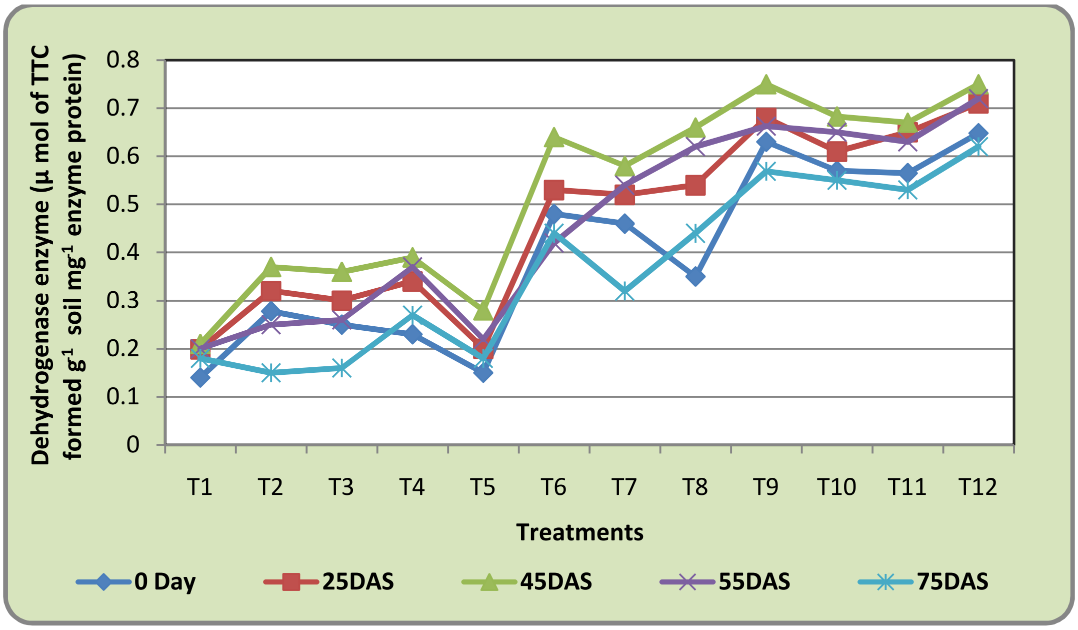
Treatment	Dehydrogenase Enzyme (µ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T_1	0.140	0.199	0.210	0.200	0.180
T_2	0.278	0.320	0.370	0.250	0.150
T_3	0.250	0.300	0.360	0.260	0.160
T_4	0.230	0.340	0.390	0.370	0.270
T_5	0.150	0.200	0.280	0.220	0.180
T_6	0.480	0.530	0.640	0.420	0.440
T_7	0.460	0.520	0.580	0.540	0.320
T_8	0.350	0.540	0.660	0.620	0.440
T_9	0.630	0.680	0.750	0.663	0.569
T_{10}	0.570	0.610	0.683	0.650	0.550
T_{11}	0.565	0.650	0.670	0.630	0.530
T_{12}	0.648	0.710	0.750	0.720	0.620
SED	0.00170				
CD(0.05)	0.00337				
CD(0.01)	0.00446**				

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

FIGURE - XII

DEHYDOGENASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF GREEN GRAM
(*Vigna radiata* L. Var. (Co (Gg) 7))



T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

The soil dehydrogenase activity increased maximally in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.648 to 0.750 μ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein followed by T_9 (composted coirpith (12.5t ha^{-1}) + 25% NPK) treatment from 0.630 to 0.750 μ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein and decreased gradually to 0.620 μ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein and 0.569 μ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein at harvest as compared to control T_1 (increased from 0.140 to 0.210 up to 45 DAS and decreased to 0.180μ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein at harvest).

The present finding is in accordance with the result of Gil *et al*. (2000). They found that solid waste compost applied at 80 t ha^{-1} showed a higher dehydrogenase activity (200%).

The present finding is in accordance with the result of Sajjad *et al.* (2002). They found that the incubation of soil with sesbania at 0, 2, 4 and 8 weeks showed a higher dehydrogenase activity (1.70.12, 146.60, 294.02, 252.01).

Similar result was reported by Jothimani (2002) on solid waste compost application in maize. Highest dehydrogenase activity obtained was 12.3μ TTC formed gm^{-1} of soil and the lowest activity was 73.7 μg TTC formed gm^{-1} of soil in NPK applied soil.

The result is on par with the result of Sangeeth Adlene (2008) who obtained a significant increase in soil dehydrogenase enzyme activity incorporated with EM- SW compost (80t ha^{-1}) from 19.7 to 57.5 μ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein in lady's finger compared to control up to 60 DAS and it decreased gradually to 47.1 μ mol of TTC formed gm^{-1} soil mg^{-1} enzyme protein at harvest.

Similar result was reported by Saidi (2008) who observed an increase in dehydrogenase activity from 0.8, 4.5 and 6 TPES/TPF/g of DM to 5.9, 6.2 and 12 TPES/TPF/g of DM up to 85 days and decreased to 0.3, 0.8 and 0.4 TPES/TPF/gm of DM respectively over 200 days of decomposition in three types of compost (green waste, green waste mixed with *Posidonia* and municipal solid waste).

The result is on par with Vajantha *et al*. (2010) who observed a maximum increase in dehydrogenase activity of 35.23 μg TPF/ nitrophenol/gm soil/ h with the application of 100% nitrogen through poultry manure to maize crop. The present finding coincides with the findings of Chaitanya *et al*. (2011) who reported highest dehydrogenase activity of 161.0 to 177.1 μg TPF gm^{-1} 24 h^{-1} with the application of 50% vermicompost and 50% poultry manure in soil at different growth stages of tomato crop and decreased to 133.4 μg TPF gm^{-1} 24 h^{-1} at harvest.

The result is on par with the result of Nath *et al*. (2012) who observed a maximum increase in dehydrogenase activity of 209.0 µg TPF gm^{-1} soil 24 h^{-1} with the application of 50% NP + Recommended dose of potassium (RDK) + biofertilizers + compost at 1t ha^{-1} when compared to absolute control of 136.6 µg TPF gm^{-1} soil 24 h^{-1} under integrated nutrient management (INM) in rice- toria sequence.

The enhancement of dehydrogenase enzyme activity in soil upto 45 DAS might be due to the greater availability of organic carbon, nutrients and stimulated microbial activity in the soil. The increase in soil dehydrogenase enzyme activity up to 45 DAS might be due to the increased population of microorganism like bacteria etc., due to the increased availability of substrate (organic carbon) through composted coirpith, composted pressmud and farmyard manure which in turn release this enzyme of extra-cellular origin and declined after that which might be due to the lack of sufficient substrate (organic carbon) which act as energy source for proliferating the microbial population.

4.6.2 Effect of composted coirpith, composted pressmud and farmyard manure on the urease activity of the soil used for the productivity of black gram.

4.6.2a Black gram

Urease enzyme is an important extracellular enzyme which influences the availability of plant utilizable forms of nitrogen in soil.

The data from table- XXX and figure- XIII revealed that there was a substantial increase in soil urease enzyme activity up to 45 DAS and after that, it declined gradually in all the treatments.

Among the treatments a significant increase in urease activity up to 45 DAS was recorded in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.520 to 0.650 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein followed by T_9 (composted coirpith(12.5t ha^{-1}) + 25% NPK) from 0.450 to 0.560 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein and the enzyme activity gradually declined to 0.590 and 0.520 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein over 75 DAS of degradation when compared to control T_1 (increased from 0.140 to 0.180 up to 45 DAS and decreased to 0.155 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein at harvest).

TABLE - XXX

UREASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	Urease Enzyme (µ mol ammonia formed min^{-1} mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T_1	0.140	0.150	0.180	0.165	0.155
T_2	0.440	0.520	0.580	0.540	0.530
T_3	0.360	0.430	0.478	0.460	0.420
T_4	0.130	0.227	0.250	0.197	0.210
T_5	0.160	0.200	0.260	0.220	0.190
T_6	0.320	0.400	0.460	0.420	0.390
T_7	0.240	0.320	0.365	0.340	0.310
T_8	0.220	0.300	0.350	0.320	0.290
T_9	0.450	0.530	0.560	0.550	0.520
T_{10}	0.420	0.490	0.548	0.500	0.440
T_{11}	0.340	0.420	0.480	0.440	0.410
T_{12}	0.520	0.600	0.650	0.620	0.590
SED	0.00623				
CD(0.05)	0.01233				
CD(0.01)	0.01630**				

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control

T_2 - Composted coirpith (12.5t ha $^{-1}$)

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

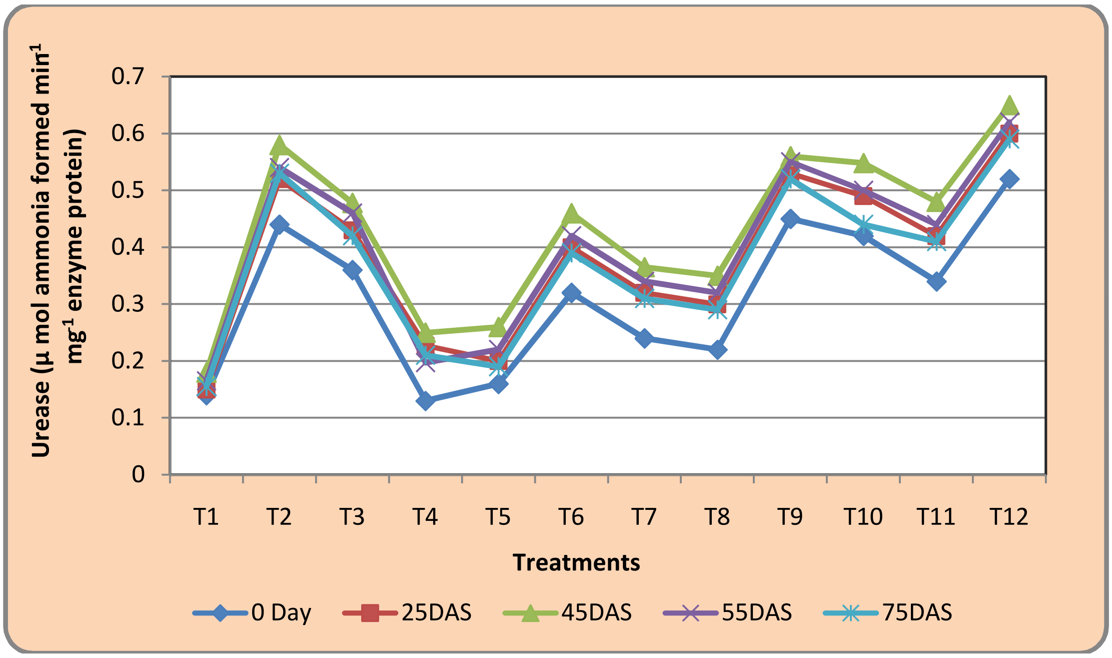
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

FIGURE – XIII

UREASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)



T_1 - Control

T_2 - Composted coirpith (12.5t ha^{-1})

T_3 - Composted pressmud (12.5t ha^{-1})

T_4 - Farmyard manure (12.5t ha^{-1})

T_5 - NPK (100%)

T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK

T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK

T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK

T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK

T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK

T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK

T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

4.6.2b Cluster bean

Urease enzyme is an important extracellular enzyme which influences the availability of plant utilizable forms of nitrogen in soil.

The data from table – XXXI and figure - XIV revealed that there was a substantial increase in soil urease enzyme activity up to 45 DAS and after that, it declined gradually in all the treatments.

Among the treatments a significant increase in urease activity up to 45 DAS was recorded in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.520 to 0.600 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein followed by T_9 (composted coirpith(12.5t ha^{-1}) + 25% NPK) from 0.450 to 0.580 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein and the enzyme activity gradually declined to 0.457 and 0.420 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein over 75 DAS of degradation when compared to control T_1 (increased from 0.140 to 0.290 up to 45 DAS and decreased to 0.150 µ mol ammonia formed min^{-1} mg^{-1} enzyme protein at harvest).

4.6.2c Green gram

Urease are important enzymes produced by the microorganisms that promote the transformation of organic compounds, which are unavailable to plants in mineral form.The primary physiological role of urease is to allow the organism to use externally supplied and internally generated urea as a nitrogen source . Urease converts urea to products at a rate of at least 10^{14} times faster than the urea spontaneous decomposition rate. It catalyses the hydrolysis of urea to CO_2 and NH_3 which is of specific interest because urea is an important nitrogen fertilizer which plays an important role in enhancing the crop productivity and soil fertility.

The data from table -XXXII and figure -XV revealed that there was a substantial increase in soil urease enzyme activity up to 45 DAS and after that, it declined gradually in all the treatments.

TABLE - XXXI

UREASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF CLUSTER BEAN

(*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

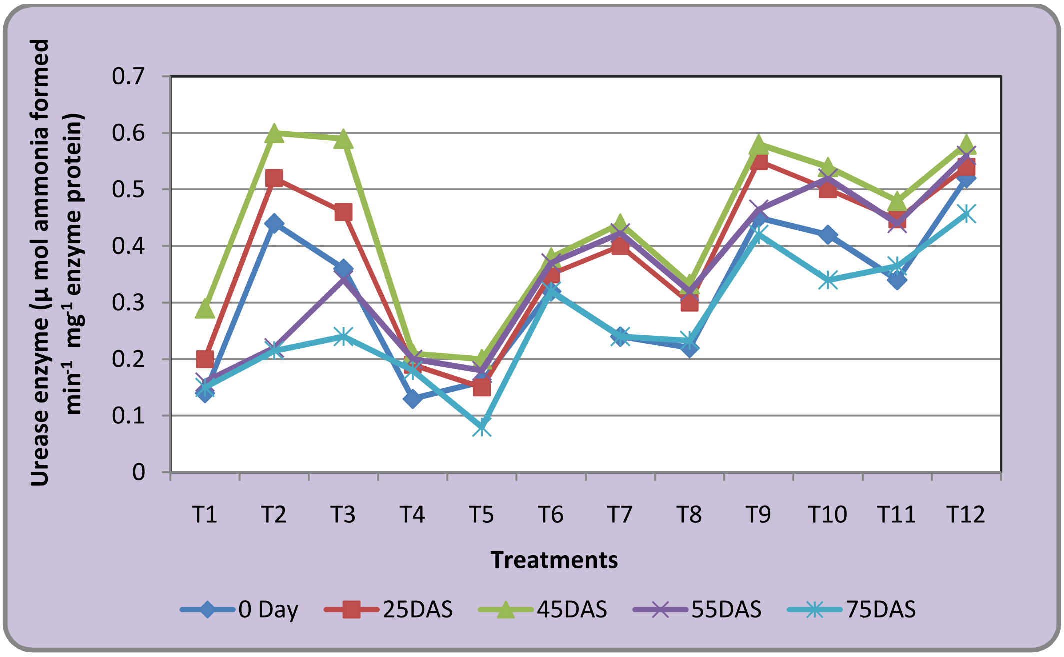
Treatment	Urease enzyme (µ mol ammonia formed min^{-1} mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T_1	0.140	0.200	0.290	0.160	0.150
T_2	0.440	0.520	0.580	0.220	0.215
T_3	0.360	0.460	0.590	0.340	0.240
T_4	0.130	0.190	0.210	0.200	0.180
T_5	0.160	0.150	0.200	0.180	0.080
T_6	0.320	0.350	0.380	0.370	0.320
T_7	0.240	0.400	0.440	0.423	0.240
T_8	0.220	0.300	0.333	0.320	0.233
T_9	0.450	0.550	0.580	0.465	0.420
T_{10}	0.420	0.500	0.540	0.520	0.340
T_{11}	0.340	0.447	0.480	0.440	0.365
T_{12}	0.520	0.540	0.600	0.560	0.457
SED	0.00179				
CD(0.05)	0.00355				
CD(0.01)	0.00469**				

** - Significant at 1% ($P<0.01$); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE - XIV

UREASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)



** - Significant at 1% (P<0.01); DAS – Day after sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

TABLE - XXXII

UREASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))

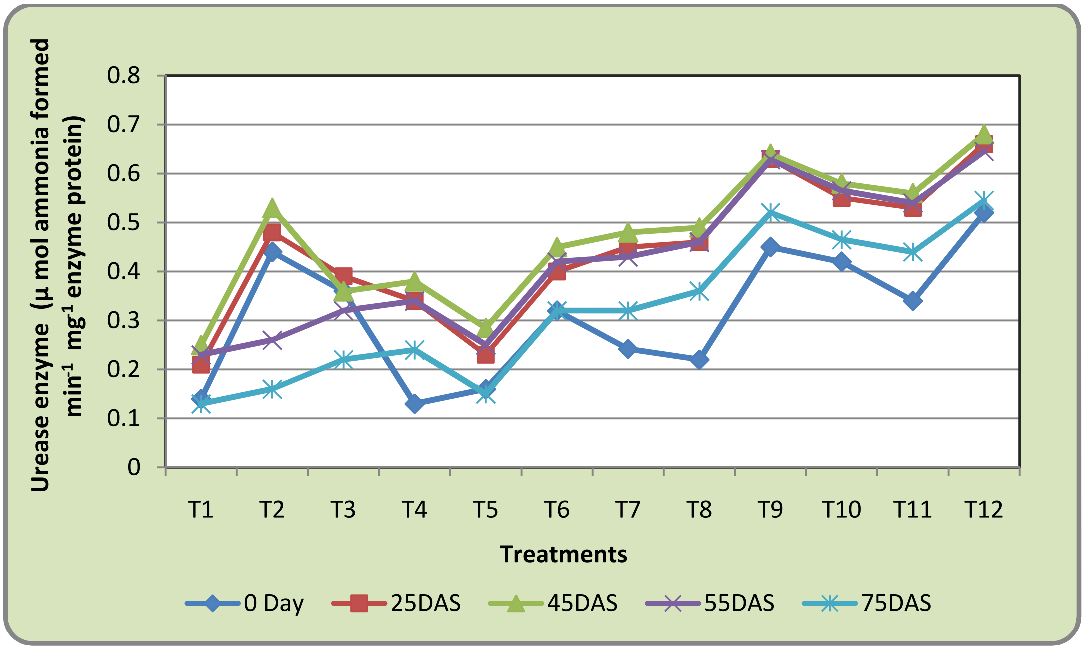
Treatment	Urease enzyme (µ mol ammonia formed min^{-1} mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T_1	0.140	0.210	0.250	0.230	0.130
T_2	0.440	0.480	0.530	0.260	0.160
T_3	0.360	0.390	0.360	0.320	0.220
T_4	0.130	0.340	0.380	0.340	0.240
T_5	0.160	0.230	0.285	0.250	0.150
T_6	0.320	0.400	0.450	0.420	0.320
T_7	0.242	0.450	0.480	0.430	0.320
T_8	0.220	0.460	0.490	0.460	0.360
T_9	0.450	0.630	0.640	0.628	0.520
T_{10}	0.420	0.550	0.580	0.565	0.465
T_{11}	0.340	0.530	0.560	0.540	0.440
T_{12}	0.520	0.660	0.680	0.645	0.545
SED	0.00186				
CD(0.05)	0.00369				
CD(0.01)	0.00488**				

** - Significant at 1% (P<0.01); DAS – Day After Sowing

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

FIGURE -XV

UREASE ACTIVITY OF THE SOIL WITH DIFFERENT TREATMENTS USED FOR THE PRODUCTIVITY OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))



T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1})

Among the treatments a significant increase in urease activity up to 45 DAS was recorded in T_{12} (composted coirpith (6.5t ha^{-1}) + composted pressmud (6.5t ha^{-1}) + farmyard manure (6.5t ha^{-1})) from 0.520 to 0.680 μ mol ammonia formed min^{-1} mg^{-1} enzyme protein followed by T_9 (composted coirpith(12.5t ha^{-1}) + 25% NPK) from 0.450 to 0.640 μ mol ammonia formed min^{-1} mg^{-1} enzyme protein and the enzyme activity gradually declined to 0.545 and 0.520 μ mol ammonia formed min^{-1} mg^{-1} enzyme protein over 75 DAS of degradation when compared to control T_1 (increased from 0.140 to 0.250 up to 45 DAS and decreased to 0.130 μ mol ammonia formed min^{-1} mg^{-1} enzyme protein at harvest).

The present result coincides with the findings of Krishnakumar *et al*. (2005). They observed maximum urease activity of 0.65 mg NH_4^+ formed gm^{-1} of soil h^{-1} with the application of farmyard manure and neem cake in kharif rice as compared to absolute control of 0.25 mg NH_4^+ formed gm^{-1} of soil h^{-1}.

Similar result was observed by Chang *et al*. (2007) who observed an increase in the urease and phosphatase activity as well as the population of bacteria, fungi and actinomycetes during their study on different application rates of compost treated soil when compared with the chemical fertilizer treated soil.

A similar result was reported by Nogales and Benitez (2007). They conducted an experiment to study the effect of soil enzymatic activity on fresh, composted and vermicomposted olive cake. They concluded from the study that the application of compost and vermicompost significantly increased humic acid content in soil and it induced dehydrogenase and urease activities initially up to a certain period and showed decreased activity later on.

The result coincides with the result of Perotti *et al*. (2008) who observed higher urease activity in argricultural and grassland soil of 1.38 and 4.94 μ mol $N\text{-}NH4^+$ /g d.w./h amended with 12% biosolids when compared to control. Sangeeth Adlene (2008) obtained a significant higher soil urease enzyme activity in lady's finger up to 60 DAS (from 10.2 to 34.5 μ mol of ammonia formed min^{-1} mg^{-1} enzyme protein) and decline at harvest (24.6 μ mol of ammonia formed min^{-1} mg^{-1} enzyme protein) in EM-SW compost.

The result coincides with the result of Yang *et al*. (2008) who observed significantly higher urease enzyme activity of 2.28 mg gm^{-1} up to 56 DAT and decreased significantly to 2.01 at harvest in soil amended with horse manure + NPK treatments during growing season of cucumber. Mohammadi (2011) obtained a significant increase in urease enzyme activity in wheat of 49.8 µg of NH_4 gm^{-1} soil h^{-1} in soil amended with farmyard manure (10t ha^{-1})+ compost of crop residues (5t ha^{-1}) when compared to control of 27.9 µg of NH_4 gm^{-1} soil h^{-1}.

This is an agreement with works of Vandana *et al*. (2012) who reported higher urease activity of 9.3 µg of NH_4 gm^{-1} soil h^{-1} up to 60 DAT and decreases significantly to 3.2 µg of NH_4 gm^{-1} soil h^{-1} at 105 DAT in soil amended with organic (hand weeding) and mineral fertilizer (recommended dose fertilizer of NPK) when compared to control (increased from to 7.5 µg of NH_4 gm^{-1} soil h^{-1} up to 45 DAS and decreased to 2.7 µg of NH_4 gm^{-1} soil h^{-1} at 105 DAT).

The present observation is on par with the result of Usha Rani *et al*. (2013) who also observed an increase in urease activity with the application of 100% vermicompost at different growth stage of maize (30.82 mg NH_4^+ formed gm^{-1} of soil h^{-1}) and at final cutting of spinach (17.66 mg NH_4^+ formed g^{-1} of soil h^{-1}) in maize- spinach cropping system when compared to control (20.34 mg NH_4^+ formed gm^{-1} of soil h^{-1} and 10.05 mg NH_4^+ formed gm^{-1} of soil h^{-1}).

The present finding is in accordance with the result Uz and Tavali (2014) .They found that the incubation of soil with *sesbania* at 0, 2, 4 and 8 weeks showed a higher dehydrogenase activity (1.70.12, 146.60, 294.02, 252.01). It was indicated that the urease activity increases till 4 weeks and decrease gradually after that.

The increase in the soil enzymatic activity may be ascribed to the easily biodegradable organic matter imposed in the soil, which stimulated the growth of soil microorganisms. The urease activity increased significantly with increase in nitrogen level. This was evidently due to higher availability of substrate nitrogen (composted coirpith, composted pressmud and farmyard manure) which promoted urease enzyme. Decrease in urease activity in harvest stage might be due to its utilization by the plants or microorganisms.

4.7 SOIL ANALYSIS

4.7.1 Initial nutrient status in soil

The initial and experimental soil samples of all the treatments were assessed for their characteristics. The results of the soil analysis are shown in table - XXXIII.

The changes in soil pH, electrical conductivity, organic carbon, available nitrogen, available phosphorus, available potassium, available sulphur, and available micronutrients (copper, zinc, iron and manganese) status of the initial soils due to different treatment combinations are presented in table. The results in the present study revealed that soil pH, electrical conductivity, organic carbon, available nitrogen, available phosphorus, available potassium, available sulphur, and available micronutrients (copper, zinc, iron and manganese) were built up in T_{12} (composted coirpith (6.5t ha^{-1})+ composted pressmud (6.5t ha^{-1})+ farmyard manure (6.5t ha^{-1})) followed by T_9 (composted coirpith (12.5t ha^{-1})+ 25% NPK) over the control.

4.7.2 Post harvest nutrient status in soil

4.7.2a pH

Black gram

The data from the table from the present study stated that pH was maximum in T_8 (7.49) treatment followed by T_{12} (7.46) treatment as compared to control T_1 (6.02) (Table -XXXIV)

Cluster bean

pH was found to be highest in T_8 (7.49) treatment followed by T_{12} (7.46) treatment when compared to control T_1 (6.05). (Table -XXXV)

Green gram

pH was estimated maximum in T_{12} (7.49) followed by T_9 (7.46) as compared to control T_1(6.03). (Table -XXXVI)

TABLE – XXXIII

INITIAL ANALYSIS OF EXPERIMENTAL SOIL

Treatment	pH	EC (Millimhos cm^{-1})	Organic carbon (%)	Available Nitrogen (Kg/ha)	Available Phosphorus (Kg/ha)	Available Potassium (Kg/ha)	Sulphur (ppm)	Copper (ppm)	Zinc (ppm)	Iron (ppm)	Manganese (ppm)
T_1	5.00	0.28	0.05	40	4.45	240	18.00	0.65	0.84	2.00	2.23
T_2	7.22	1.12	0.10	54	5.89	286	18.80	0.79	1.97	2.93	3.20
T_3	6.33	1.15	0.11	55	5.55	243	40.00	0.73	1.78	2.53	3.25
T_4	7.48	1.13	0.14	56	5.78	255	28.40	0.78	1.97	3.11	4.00
T_5	6.48	1.10	0.09	45	4.65	300	18.50	0.71	1.28	2.10	3.10
T_6	6.66	2.10	0.17	53	5.67	310	39.20	0.99	2.02	3.41	3.35
T_7	7.01	2.18	0.12	55	5.89	305	39.00	1.00	2.01	3.62	6.24
T_8	7.48	1.30	0.15	49	4.89	250	31.20	0.98	1.62	3.00	6.43
T_9	7.53	2.40	0.17	60	6.66	319	50.40	1.09	2.08	4.54	7.92
T_{10}	7.38	2.33	0.09	59	5.78	299	25.60	0.85	1.79	3.83	6.00
T_{11}	7.10	2.22	0.12	57	5.77	286	28.00	0.77	1.60	3.42	7.90
T_{12}	7.76	2.55	0.20	65	6.90	325	62.04	1.25	2.14	5.00	8.00

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE – XXXIV

POST HARVEST SOIL ANALYSIS OF BLACK GRAM (*Vigna mungo* L. Var. ADT 5)

Treatment	pH	EC (millimhos cm^{-1})	Organic carbon (%)	Available Nitrogen (kg/ha)	Available Phosphorus (kg/ha)	Available Potassium (kg/ha)	Sulphur (ppm)	Copper (ppm)	Zinc (ppm)	Iron (ppm)	Manganese (ppm)
T_1	6.02	1.50	0.11	56	5.50	303	18.5	0.96	0.87	4.34	4.18
T_2	6.49	2.86	0.16	72	9.00	441	29.6	1,15	2.67	4.76	4.49
T_3	6.35	2.50	0.19	79	8.00	373	42.9	1.18	2.54	5.62	5.30
T_4	6.77	2.60	0.15	72	10.5	315	35.2	1.78	2.77	5.74	5.79
T_5	6.24	2.00	0.13	59	5.55	310	19.2	1.10	1.45	4.41	5.42
T_6	6.68	3.99	0.18	86	6.00	369	40.8	1.76	1.56	4.72	4.45
T_7	7.04	4.93	0.16	81	9.00	306	35.6	1.55	1.69	5.78	6.51
T_8	7.49	3.93	0.17	60	9.50	324	34.0	1.60	1.60	6.59	6.84
T_9	7.42	5.90	0.23	86	12.5	441	64.6	1.96	1.86	7.56	7.97
T_{10}	7.13	3.00	0.16	70	8.00	370	35.0	1.18	1.70	6.29	6.42
T_{11}	7.32	4.83	0.18	67	8.50	364	32.6	1.24	1.68	6.69	7.93
T_{12}	7.46	5.95	0.25	99	13.5	427	68.8	1.99	2.89	7.76	8.35

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE – XXXV

POST HARVEST SOIL ANALYSIS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar)

Treatment	pH	EC (millimhos cm^{-1})	Organic carbon (%)	Available Nitrogen (kg/ha)	Available Phosphorus (kg/ha)	Available Potassium (kg/ha)	Sulphur (ppm)	Copper (ppm)	Zinc (ppm)	Iron (ppm)	Manganese (ppm)
T_1	6.05	1.54	0.15	60	5.54	307	18.09	2.00	0.91	4.38	4.22
T_2	6.27	2.90	0.20	76	9.04	377	30.00	1.19	2.71	4.80	4.53
T_3	6.38	2.54	0.23	83	12.09	418	43.03	1.22	1.90	5.66	5.34
T_4	6.78	2.64	0.19	76	8.04	319	35.06	1.82	2.81	5.78	5.46
T_5	6.50	2.04	0.17	63	5.59	310	19.06	1.14	1.49	4.45	4.49
T_6	6.68	3.03	0.23	82	6.04	373	40.12	1.80	1.60	4.76	5.83
T_7	6.02	5.00	1.59	85	9.06	314	35.10	1.59	1.73	5.82	6.55
T_8	7.49	3.97	1.64	74	9.54	328	34.04	1.64	1.64	6.63	6.88
T_9	7.12	5.94	2.00	90	13.00	431	64.10	2.02	2.90	7.60	8.01
T_{10}	7.43	3.04	1.22	74	8.04	370	35.04	1.22	1.74	6.33	6.46
T_{11}	7.33	4.87	1.28	71	8.59	368	32.10	1.28	1.73	6.73	7.97
T_{12}	7.46	5.99	2.03	95	13.09	445	68.12	2.05	2.93	7.80	8.39

T_1 - Control
T_2 - Composted coirpith (12.5t ha^{-1})
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

TABLE – XXXVI

POST HARVEST SOIL ANALYSIS OF GREEN GRAM (*Vigna radiata* L. Var. (Co (Gg) 7))

Treatment	pH	EC (millimhos cm^{-1})	Organic carbon (%)	Available Nitrogen (kg/ha)	Available Phosphorus (kg/ha)	Available Potassium (kg/ha)	Sulphur (ppm)	Copper (ppm)	Zinc (ppm)	Iron (ppm)	Manganese (ppm)
T_1	6.03	1.52	0.13	58	5.52	305	18.07	1.12	0.89	4.36	4.20
T_2	6.25	2.82	0.18	74	9.02	443	28.00	1.58	2.69	4.78	4.51
T_3	6.34	2.52	0.21	81	13.07	416	43.01	1.21	2.56	5.64	5.32
T_4	6.77	2.62	0.17	74	8.02	317	35.04	1.80	2.79	5.76	5.44
T_5	6.11	2.02	0.15	61	5.57	312	19.04	1.17	1.47	4.43	4.47
T_6	6.67	4.01	0.21	80	6.02	371	40.10	1.78	1.58	4.74	5.81
T_7	6.49	4.58	1.57	83	9.04	308	35.08	1.57	1.71	5.80	6.53
T_8	7.14	3.95	1.62	72	9.52	326	34.02	1.62	1.62	6.61	6.86
T_9	7.46	5.92	1.98	88	12.07	375	64.08	1.98	1.88	7.58	7.99
T_{10}	7.42	3.02	1.20	72	8.02	368	35.02	1.20	1.72	6.31	6.44
T_{11}	7.33	4.85	1.26	69	8.57	366	32.08	1.26	1.71	6.71	7.95
T_{12}	7.49	5.97	2.01	93	13.07	429	68.10	2.00	2.91	7.78	8.37

T_1 - Control
T_2 - Composted coirpith (12.5t ha $^{-1}$)
T_3 - Composted pressmud (12.5t ha^{-1})
T_4 - Farmyard manure (12.5t ha^{-1})
T_5 - NPK (100%)
T_6 - Composted coirpith (12.5t ha^{-1}) + 50% NPK
T_7 - Composted pressmud (12.5t ha^{-1}) + 50% NPK
T_8 - Farmyard manure (12.5t ha^{-1}) + 50% NPK
T_9 - Composted coirpith (12.5t ha^{-1}) + 25% NPK
T_{10} - Composted pressmud (12.5t ha^{-1}) + 25% NPK
T_{11} - Farmyard manure (12.5t ha^{-1}) + 25 % NPK
T_{12} - Composted coirpith (6.5t ha^{-1}) + Composted pressmud (6.5t ha^{-1}) + Farmyard manure (6.5t ha^{-1}).

Similar result was also observed by Sangeeth Adlene (2008) with the increased pH (7.5 to 8.7) in lady's finger as a result of incorporation of EW – SW compost in the soil. The result is on par with the result of Mohammadi *et al*. (2011) who observed a maximum increase in pH of 7.45 in the farmyard applied soil as compared to the compost applied soil of 7.2 in the winter oilseed rape cultivated harvest soil. The present finding is in accordance with the result of Vimera *et al*. (2012) who recorded significantly higher pH (4.9) in the soil supplemented with 50% NPK+ 50% FYM+ biofertilizers as compared to the control T_1(4.7) after harvest of king chilli.

This result coincides with the result of Ahmad *et al*. (2012) who also reported increase in pH of 8.00 with the addition of pressmud in conventional media (garden soil+ silt+ leaf mould [1:1:1:, v/v/v]) when compared to conventional media alone (control) of 7.8. The increase in pH when applied with organic materials can be attributed to ligand exchange reaction releasing OH ions causing an increase in pH.

4.7.2b EC and organic carbon

Black gram

EC and organic carbon was increased in T_{12} (5.95 millimhos/cm and 0.25%) followed by T_9 (5.90 millimhos/cm and 0.23%) as compared to control T_1 (1.50 millimhos/cm and 0.11%).

Cluster bean

The maximum EC and organic carbon was estimated in T_{12} (5.99 millimhos/cm and 2.03%) followed by T_9 (5.94 millimhos/cm and 2.00%) when compared to control T_1 (1.54 millimhos/cm and 0.15%).

Green gram

EC and organic carbon was found to be increased in T_{12} (5.97 millimhos/cm and 2.01%) followed by T_9 (5.92 millimhos/cm and 1.98%) when compared to control T_1 (1.52 millimhos/cm and 0.13%).

The result is on par with the result of Singh and Aggarwal (2000) who reported increase in soil organic carbon under farmyard manure (0.52%) than organic carbon under cowpea green manure (0.46%) at a depth of 7.5-15cm. Similar result was reported by Annadurai *et al*. (2005) who observed enhanced EC (0.64 millimhos) when 100% pressmud was mixed with *Theri*- soil over *Theri*- soil alone.

This result coincides with the result of Kumar *et al*. (2007) who recorded maximum organic carbon content in the rice crop harvested soil of 0.47 with the application of recommended dose of fertilizer (100kg N+ 50kg P_2O_5+ 40kg K_2O ha^{-1}) + pressmud (20t ha^{-1}) when compared to the control (0.40).

The present finding is in accordance with the result of Ghulam *et al*. (2010). They found maximum EC (0.55millimhos) with the application of pressmud (10t ha^{-1}). This result coincides with the result of Sarwar *et al*. (2010) who recorded maximum EC content in the sugarcane crop harvested soil of 0.67 millimhos with the application of 100% nitrogen though pressmud over the control (0.51 millimhos).

The present finding is in conformity with the finding of Laxshminarayana (2011) who recorded an increased in organic carbon content of 0.96 g/kg in the combined application of lime+ FYM+ neem cake+ green manure in the sweet potato harvested soil when compared to the control (3.2gm kg^{-1}).

Increase in organic carbon might be due to the application of organic manure which promote the growth and activity of microorganism, better root biomass and the reduction in bulk density of soil and the increase in EC might be due to the presence of higher salts and metal concentrations as compared to other treatments.

4.7.2c Available NPK

Black gram

Available nitrogen and phosphorus content was found to be maximum in T_{12} (99 and 13.5 Kg ha^{-1}) followed by T_9 (86 and 12.5 Kg ha^{-1}). Whereas, available potassium content was maximum in T_9 (441 Kg ha^{-1}) and T_2 (441 Kg ha^{-1}) followed by T_{12} (427 Kg ha^{-1}) as compared to control T_1 (56, 5.50 and 303 Kg ha^{-1}).

Cluster bean

The maximum available NPK was found in T_{12} (95, 13.09 and 445 kg/ha) followed by T_9 (90, 13.00 and 431 Kg ha^{-1}) when compared to control T_1 (60, 5.54 and 307 Kg ha^{-1}).

Green gram

The maximum available nitrogen and potassium was found in T_{12} (93 and 429 Kg ha^{-1}) and available phosphorus in T_{12} (13.07) and T_3 (13.07) followed by T_9 (88, and 375 and 12.07 Kg ha^{-1}) when compared to control T_1 (58, 5.52 and 305 Kg ha^{-1}).

According to Zamanov *et al*. (2002) only the organic fertilizers could raise the humus maintenance in soil. They were a source of carbon for replenishing humus loses, improving the physical properties of soil and enhancing the mineralization of organic matter.

The result coincides with the result of Sarwar *et al*. (2010) who observed higher nitrogen (%), phosphorus (ppm) and potassium (ppm) in the soil after sugarcane harvest of 0.058 ,6.1ppm and 120ppm in the soil amended with 100% nitrogen through pressmud and 25% nitrogen through inorganic fertilizer when compared to control. Deivasigami and Thanunathan (2011) obtained a highest available soil nitrogen, phosphorus and potassium of 221.2, 17.50 and 286.26 kg/ha among the organic nutrient sources with the application of farmyard manure (12.5t ha^{-1}).

Sunil *et al*. (2012) observed maximum available nitrogen (145.35 Kg ha^{-1}) phosphorus (33.56 Kg ha^{-1}) and potassium (142.50 Kg ha^{-1}) with the integrated incorporation of nitrogen through recommended dose of fertilizer NPK+ pressmud compost in the soil after harvest of rice.

The increase in available nitrogen status due to the application of organic manure might be due to the multiplication of soil microorganisms leading to enhanced conversion of organically bound nitrogen into inorganic forms, rapid mineralization and thus made available to the crops. Increase of available phosphorus might be due to the production of the organic acids during decomposition of the organic manure which solubilize phosphate and other phosphate bearing minerals thereby increasing phosphorus availability in the soil. The increase availability of potassium might be due to the solubilization action of certain organic acids produced during decomposition of organic manures and its greater capacity to hold potassium in available form in soil and also due to the interaction of organic matter with clay and direct addition of potassium to available pool of soil.

4.7.2d Available sulphur

Black gram

Available sulphur was found to be maximum in T_{12} (68.8 ppm) followed by T9 (64.6 ppm) as compared to control T_1 (18.5 ppm).

Cluster bean

The maximum available sulphur was estimated in T_{12} (68.12 ppm) followed by T_9 (64.10 ppm) when compared to control T_1 (18.09 ppm).

Green gram

Increased available sulphur was observed in T_{12} (68.10 ppm) followed by T_9 (64.08 ppm) as compared to control T_1 (18.07 ppm).

Sushma *et al*. (2007) obtained a highest available sulphur content of 67.0mg ha^{-1} in coirpith based compost (CPBC) + pressmud (45t ha^{-1}) and 100% recommended dose of fertilizer in the soil after harvest of ragi crop.

Upadhyay *et al*. (2011) obtained highest available sulphur (18.3 mg kg^{-1}) in the soil supplemented with 50% recommended dose of fertilizer through fertilizers and 50% nitrogen through farmyard manure in rice and 100% recommended dose of fertilizer through fertilizers in wheat under rice-wheat cropping system over the control of 12.1 mg kg^{-1}.

The present finding is in accordance with the result of Yadav *et al*. (2013). They found maximum available sulphur (16.0 Kg ha^{-1}) with the combined application of 50% NPK ha^{-1} (50:30:30 Kg ha^{-1})+ 5t FYM+ PSB+ *Azotobacter*+ 5kg Zn ha^{-1} as compared to the initial soil contained (12.1 to 12.9 Kg ha^{-1}) on the physico- chemical characteristics of the Aswagandha harvested soil.

Increase in the available sulphur might be due to the chelating action of organic compounds released during decomposition of organic manures increased the availability of sulphur cations and also prevented their fixation, precipitation, oxidation and leaching.

4.7.2e Available copper, zinc, iron and manganese

Black gram

Copper, zinc iron and manganese was maximum in T_{12} (1.99, 2.89, 7.76 and 8.35 ppm) followed by T_9 (copper 1.96, iron 7.56 and manganese 7.97 ppm) and zinc 2.77 ppm in T_4 as compared to control T_1 (0.96, 0.87, 4.34 and 4.18 ppm).

Cluster bean

The maximum copper, zinc, iron and manganese was found in T_{12} (2.05, 2.93, 7.80 and 8.39 ppm) followed by T_9 (2.02, 2.90, 7.60 and 8.01ppm) as compared to control T_1 (2.00, 0.91, 4.38 and 4.22 ppm).

Green gram

The maximum copper, zinc, iron and manganese was observed in T_{12} (2.00, 2.91, 7.78 and 8.37 ppm) followed by T_9 (1.98, 1.88, 7.58 and 7.99 ppm) as compared to control T_1 (1.12, 0.89, 4.36 and 4.20 ppm).

According to Rangaraj *et al*. (2007), Zn (2.84, 2.95ppm), Fe (13.2, 13.5 ppm), Cu (0.75, 0.75ppm) and Mn (3.57, 3.59ppm) were found to be higher in the soil supplemented with pressmud (12.5t ha^{-1}) during the post monsoon in 2003 and 2004.

The result is on par with the result of Omotayo and Chukwuka (2009) who also reported increase in available zinc (3.01 ppm), iron (115.69 ppm) and manganese (271.54 ppm) in the top soil with the application of water hyacinth (1 kg) where as copper (3.36 ppm) was increased with the application of Tithonia green manure (0.5 kg) + water hyacinth (0.5 kg) in sub-Saharan Africa.

The present finding is in accordance with the result of Ghulam *et al*. (2010) who found maximum copper, zinc, iron and manganese (6.0ppm, 6.0ppm, 5.0ppm, 8.0ppm) with the application of pressmud (10, 15, 20t ha^{-1}).

The present finding is in accordance with the result of Sridevi and Venkata Ramana (2012). They found maximum copper, zinc, iron and manganese (2.25ppm, 55.14ppm, 5.81ppm, 1.48ppm) with the application of FYM + vermicompost + neem cake (1/3rd recommended nitrogen) + biofertilizer containing nitrogen and phosphorus carrier in the post harvest soil of maize -cropping system under organic farming.

The results were well supported by Rama Lakshmi *et al*. (2014) who found that the cumulative effect of 75% of recommended dose of fertilizer + 2.5t ha^{-1}vegetable market waste compost promotes copper (1.45 to 1.47 mg kg^{-1}). zinc (0.90 to 0.93mg kg^{-1}), iron (8.94 to 8.88 mg kg^{-1}) and manganese (13.33 to 14.76mg kg^{-1}) when compared to the residual effect (copper- 1.30 to 1.34 mg kg^{-1}, zinc - 0.85 to 0.86 mg kg^{-1}, iron- 8.82 to 8.83mg kg^{-1}, manganese- 12.81 to 13.05mg kg^{-1}) and control in post harvest soil of rabi green gram under rice-pulse cropping system during 2009 to 2010.

Increment of micronutrient in the post harvest soil might be due to the production of variety of biochemical substances during the decomposition of organic manures which stimulated the solubility, transport and availability of the micronutrients in the soil or might be due to release of chelating agent from the organic manures which prevented the micronutrients from precipitation, oxidation and leaching.