

## SUMMARY AND CONCLUSION

The present investigation entitled “**Integrated Application of Agroindustrial compost - An Environmental Friendly Technology for Enhancing Crop productivity of Legumes**” was undertaken to study the effect of composted coirpith, composted pressmud and farmyard manure as a growth promoter for legumes and to find out means and solution for the profitable utilization and to reduce its environmental hazards. The ultimate goal of sustainable agriculture is to develop farming system that are productive and profitable, conserve the natural resources base, protect the environment and enhance health and safety measures. So, recycling of coirpith and pressmud would be a good substitute of organic manures along with farmyard manure and NPK to promote the productivity and nutrient uptake besides, ensuring hygienic disposal of the organic waste.

The changes in coirpith and pressmud after composting, biometric, biochemical, yield parameters, leghaemoglobin content in the nodules, enzymatic activities of the soil of different treatments, initial and post harvest soil sample analysis under the influence of composted coirpith, composted pressmud and farmyard manure along with NPK on 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)) were analysed. The conclusion drawn from all the above phases of the investigation are summarized in this chapter.

### 5.1 Composting

#### 5.1.1 Composition of raw and composted coirpith and pressmud

Lignin and cellulose content was reduced after composting in composted coirpith by using *Pleurotus sajor-caju*. pH was reduced in composted coirpith while it was increased in composted pressmud.

Electrical conductivity of the composted coirpith and composted pressmud was increased. After composting coirpith and pressmud, the total NPK content along with calcium and magnesium content was increased.

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Organic carbon and C:N ratio of both the composted coirpith and pressmud was reduced. So, composting can be a useful way of transforming organic waste into valuable organic manure for use as an organic amendment for soils. If it is recycled properly by adopting suitable agriculture waste management, it could serve as a good source of plant nutrients for sustainable crop productivity and soil fertility. It shows drastic reduction in the lignin, because of the action of lignolytic enzymes of the fungi *Pleurotus sajor-caju*.

C:N ratio is one of the most important parameters that determine the extent of composting and degree of compost maturity. 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.

## **5.2 POT CULTURE EXPERIMENT**

### **5.2.1 Biometrical characters**

There was a significant increase in root length of black gram, cluster bean and green gram. In black gram root length was maximum in T<sub>2</sub> on 25 DAS, T<sub>11</sub> on 45 DAS and T<sub>2</sub> on 55 DAS. Root length of the cluster bean was maximum in T<sub>11</sub> on 25 DAS, T<sub>12</sub> on 45 DAS and T<sub>5</sub> on 55 DAS. Root length of the green gram was maximum in T<sub>2</sub> on 25 DAS, T<sub>9</sub> on 45 DAS and T<sub>10</sub> on 55 DAS.

Shoot length of the black gram was maximum in T<sub>9</sub> on 25 DAS, T<sub>10</sub> on 45 DAS and 55 DAS. Maximum shoot length of cluster bean was noted in T<sub>5</sub> on 25 DAS, T<sub>3</sub> on 45 DAS and T<sub>9</sub> on 55 DAS. Shoot length of green gram was maximum in T<sub>5</sub> on 25 DAS, T<sub>6</sub> on 45 DAS and T<sub>10</sub> on 55 DAS. It was seen that the number of leaves in black gram was maximum in T<sub>6</sub> on 25 DAS, T<sub>8</sub> on 45 and 55 DAS when compared to the control. Maximum number of leaves in cluster bean was found in T<sub>6</sub> on 25 DAS, T<sub>11</sub> on 45 DAS and T<sub>10</sub> on 55 DAS. Number of leaves in green gram was maximum in T<sub>7</sub> on 25 DAS, T<sub>3</sub> on 45 and 55 DAS.

Maximum number of root nodules in black gram was found in T<sub>2</sub> on 25, 45 and 55 DAS. In cluster bean maximum number of root nodules was recorded in T<sub>8</sub> on 25 DAS, T<sub>11</sub> on 45 and 55 DAS. Maximum number of root nodules in green gram was found in T<sub>4</sub>

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on 25 DAS, T<sub>3</sub> on 45 DAS and T<sub>4</sub> on 55 DAS. An appreciable increase in the number of flower/plant was observed in T<sub>5</sub> and T<sub>6</sub> in black gram, T<sub>12</sub> in cluster bean and T<sub>8</sub> in green gram on 45 DAS. Number of pods/plant was high in T<sub>11</sub> in black gram, T<sub>5</sub> and T<sub>12</sub> in cluster bean and T<sub>6</sub> in green gram on 55 DAS. In black gram maximum fresh weight was noted in T<sub>11</sub> on 25 DAS, T<sub>7</sub> on 45 and T<sub>10</sub> on 55 DAS. Maximum fresh weight in cluster bean was recorded in T<sub>6</sub> on 25 DAS, T<sub>10</sub> on 45 DAS and T<sub>11</sub> on 55 DAS. Maximum fresh weight in green gram was recorded in T<sub>10</sub> on 25 DAS, T<sub>11</sub> on 45 DAS and T<sub>12</sub> on 55 DAS.

In black gram maximum dry weight was noted in T<sub>10</sub> on 25 DAS, T<sub>5</sub> on 45 DAS and T<sub>3</sub> on 55 DAS. Maximum dry weight in cluster bean was recorded in T<sub>12</sub> on 25 DAS, T<sub>2</sub> on 45 DAS and T<sub>11</sub> on 55 DAS, Maximum dry weight in green gram was recorded in T<sub>11</sub> on 25 DAS and T<sub>8</sub> on 45 and 55 DAS. 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.

### **5.3 BIOCHEMICAL CHARACTERS**

Maximum protein, carbohydrate, chlorophyll a, b and total chlorophyll content in the leaves, leghaemoglobin content in the nodules, protein and carbohydrate content in the pods of black gram, cluster bean and green gram was noted in T<sub>12</sub> followed by T<sub>9</sub> on 25, 45 and 55 DAS as compared to the control. The increase in the biochemical content might be due to the application of organic manure which makes available all the nutrients with the help of the soil microorganism and its further assimilation of biosynthesis of protein and carbon.

### **5.4 YIELD CHARACTERS**

It was observed from the present study that the number of pods per plant, length of pod (cm), weight of pod (gm), number of seeds per pod, weight of seeds per pod (gm), pod fresh weight (gm) and pod dry weight (gm) were maximum in T<sub>11</sub> on 75 DAS in black gram. In cluster bean the number of pods per plant, length of pod (cm), weight of pod (gm), pod fresh weight (gm) and pod dry weight (gm) were maximum in T<sub>11</sub>, number of seeds per pod in T<sub>6</sub> and weight of seeds per pod (gm) in T<sub>7</sub>. In green gram the number of pods per

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plant were maximum in T<sub>11</sub>, length of pod, weight of pod and pod fresh weight in T<sub>10</sub>, number of seeds per pod in T<sub>5</sub>, weight of seeds per pod in T<sub>8</sub> and pod dry weight in T<sub>2</sub> on 75 DAS.

## **5.5 ENZYME STUDIES**

It was examined from this study that maximum dehydrogenase and urease activity of the soil for the productivity of black gram, cluster bean and green gram were observed in T<sub>12</sub> followed by T<sub>9</sub> as compared to the control. 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 increased organic matter in the surface soil enhanced the soil dehydrogenase activity by an increase in the number of the microbial groups and improvement in other living conditions such as aeration and moisture and declined after that which might be due to the immature manure which harboured high numbers of active bacteria and as the digestion proceeded, the bacterial number decreased. Reduction in dehydrogenase enzyme after flowering could be due to reductive state of ferric oxide.

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.

## **5.6 SOIL PROPERTIES**

### **5.6.1 Initial nutrient status in soil.**

The results revealed that soil pH, electrical conductivity (millimhos cm<sup>-1</sup>), organic carbon (%), available nitrogen (Kg ha<sup>-1</sup>), available phosphorus (Kg ha<sup>-1</sup>), available potassium (Kg ha<sup>-1</sup>), sulphur (ppm) and available micronutrients (copper (ppm), zinc (ppm), iron (ppm) and manganese (ppm)) were build up in T<sub>12</sub> followed by T<sub>9</sub> over the control.

### **5.6.2 POST HARVEST NUTRIENT STATUS IN SOIL.**

Maximum pH was observed in T<sub>8</sub> followed by T<sub>12</sub> over the control in the soil after harvesting black gram and cluster bean. In green gram pH was maximum in T<sub>12</sub> followed by T<sub>9</sub> as compared to control.

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Electrical conductivity (millimhos  $\text{cm}^{-1}$ ), organic carbon (%), available nitrogen ( $\text{Kg ha}^{-1}$ ), available phosphorus ( $\text{Kg ha}^{-1}$ ), sulphur (ppm) and available micronutrients (copper (ppm), zinc (ppm), iron (ppm) and manganese (ppm)) was maximum in  $T_{12}$  and available potassium in  $T_9$  treatment in black gram. Available NPK was maximum in  $T_{12}$  followed by  $T_9$  when compared to the control  $T_1$  in the cluster bean and green gram harvested soil.

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.

## CONCLUSION

The present research is to brighten the possibilities of using the agroindustrial wastes like coirpith, pressmud and farmyard manure in enhancing the crop productivity. Composted coirpith and pressmud produced by the degradation of ligno-cellulolytic fungi (*Pleurotus sajor-caju*) and farmyard manure was found to be an efficient organic manure as it enhanced the biometric, biochemical, leghaemoglobin content, yield parameters (blackgram, cluster bean and green gram) and enzymatic activity of the soil, incorporated with different concentration of composted coirpith, composted pressmud, farmyard manure and NPK. The enhancement in growth and yield parameters of the test crops might be due to the synergistic interaction of the constituent present in the composted coirpith and pressmud along with farmyard manure.

To be sustainable, organic farming needs to be self sufficient in nitrogen (N) through the fixation of atmospheric nitrogen ( $\text{N}_2$ ) by legumes, recycling of agrowastes and the application of farmyard manure compost. Thus, it can be inferred from the present investigation that coirpith, pressmud and farmyard, a menace can be effectively harnessed as a value added product, organic manure. The treatment of the coirpith and pressmud with the *Pleurotus sajor-caju* promote the cycling of nutrients in the environment and reduce the quantity of the waste accumulation in the disposal site. This technology provides an alternate solution for the disposal of coirpith and pressmud.

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The overall goal of waste management is to collect, treat and dispose the waste using the most economical means available. The success of the study will provide not only an alternate solution for the disposal of coirpith and pressmud but also minimizes the application of chemical fertilizers to crops and encourage organic farming. Good compost with all the micronutrients is the key to increase productivity and sustainability. Well decomposed organic matter and farmyard manure, applied under the right soil moisture condition, would not only improve soil texture and structure but also provide the crop necessary resistance against pest and disease.

A fairly good concentration of nitrogen, phosphorus, potassium and micronutrients makes coirpith and pressmud, a potential role player in enhancing the soil fertility and crop productivity. To conclude the integrated management of coirpith, pressmud and farmyard manure in various concentrations improved the vegetative and yield parameters of the test crops (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)).

#### **RECOMMENDATIONS FOR FUTURE STUDY**

- Composted coirpith, composted pressmud along with the farmyard manure may be applied to maximize yield of different crops and soil health.
- The hygroscopic nature of coirpith, its ability to exchange stored moisture with the atmosphere can be exploited for the cooling effect and it can be used as a roofing material.
- Pressmud, a byproduct of sugar manufacture and a cheap alternative to chemicals may offers opportunities to farmers to efficiently use poor quality ground water and improve crop productivity and soil fertility.
- Effect of coirpith, pressmud along with farmyard manure application to different soils and cropping system in the long run can be studied.
- Amount of application of coirpith and pressmud, either for crop production or for soil reclamation has to be precisely quantified. The amount of farmyard manure it can substitute is also to be quantified for different crops.

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- Application of farmyard manure along with the composted coirpith and pressmud can result in the improvement of soil quality and long term sustainability of degraded soils.
  - Before recommending above findings further studies are needed in different agro-ecological zones (AEZ) for regional adaptability and other performances in legume crop production.
  - For smallholder farmers, farmyard manure will be a favourable source of nutrients as it is cost effective, locally available and also effective in reducing aluminium toxicity in acid soils.