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Research Article

EFFECT OF COCOA SHELL BIOCOMPOST TO IMPROVE THE GROWTH PARAMETERS OF COWPEA (VIGNA UNGUICULATA (L.) WALP)

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A B S T R A C T

Every year huge amount of cocoa (*Theobroma cacao*) shell is discarded as waste in chocolate industry. The present study is to investigate the efficiency of biocomposted cocoa shell waste and its impact on the vegetative and yield characters of cowpea [*Vignaunguiculata* (L.) Walp]. Different treatments were used C - control, T_1- (cocoa shell waste + *Eudrilus eugeniae*), T_2- (cocoa shell waste + *Pleurotus eous* + *Eudrilus eugeniae*), T_3- (cocoa shell waste + *Pleurotus florida* +*Eudrilus eugeniae*), T_4-(cocoa shell waste + *Pleurotus eous* + *Pleurotus florida* + *Eudrilus eugeniae*). The present study concluded that T_4 treatment is significantly increased the vegetative and yield characters of the test crop. Biocomposted cocoa shell waste increase the vegetative and yield characters of cowpea and availability of soil nutrients.

INTRODUCTION

Biocomposting is a method of the decomposition of agroindustrial wastesthat converts organic matter into a stable humus. Applications of compost help in controlling soil erosion, increase the water holding capacity and provide safe food.Recycling of biowaste will also help to reduce environmental pollution arising out of accumulated biowastes (Kumar, 2005). Organic manures (biocompost) enhance the availability of macro and micronutrients. Recently, cultivation of organic vegetable gets many special attentions due to its bio-efficacy, eco-friendly and sustainability in nature (Senthilkumar *et al*., 2014).

Bio composting maintains the biodiversity on the farm and creates a healthy balance in soil, plants and animals, and protect soil microorganisms. It also, produces healthy food rapidly throughout the world and create the best possible relationship between the earth and human beings. Agro-industrial wastes are recycled to produce biomanure which is also a rich source of macro and microelements. Composting can be done by using microbial consortium, vermicomposting methods, biofertilizer treatments etc.

The accumulation of agroindustrial wastes cause environmental pollution such as, foul odours, mosquitoes breeding and propagate viral diseases. Improper dumping of cocoa shell waste is also responsible for these problems. This wastes contain rich source of liginin, cellulose and pectin hence does not decompose easily.

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Cocoa shells can be used in manure combined with other organic materials to produce substrates for plants cultivation. This waste can be used to produce material for soil amendment. since its addition to the soil as biofertilizers increases soil fertility and crop productivity (Sadasivuni *et al* 2015).

The present study deals withcocoa shell waste composting and its impact on the vegetative and yield characters of cowpea (*Vignaunguiculata* (L.) Walp). In India, legumes constitute indispensable part of the regular human diet. *Vigna unguiculata* (L.) Walp is one of most commonly used vegetables of leguminosae family and grown in most of the tropical and sub-tropical areas. Cowpea contains rich nutrients source such as vitamin B9, protein, potassium, iron, copper, phosphorus and tryptophan. It is used to prevent cancer, anaemia, repair muscle tissue, maintain bowel health and supports healthy cardiovascular system. The objective of the research work is to study the effect of cocoa shell waste biomanure on the growth characteristics of cowpea.

MATERIALS AND METHODS

Collection of agro-industrial waste

The agro-industrial waste of cocoa shell waste was collected in large amount in Calicut district of Kerala. Seeds of *Vigna unguiculata* (L.)Walp**.** were collected from Tamil Nadu Agricultural University, Coimbatore.

Composting Process

The process of composting consists of four pits of 1.6 feet long and 5 square feet width. They were named as compost 1 (C_1), compost 2 (C_2), compost 3 (C_3), compost 4 (C_4). The Cocoa shell waste were subjected to decomposition by various treatments to achieve good quality of biomanure.

The Sundried Cocoa shell waste was transferred to C_1 pit. The process was repeated until the heap reaches a height of above 1.5 meters and after 30 days vermicomposting process adopted. C_2 pit was filled with Cocoa shell waste and add 20 g of *Pleurotus eous*. It was allowed for decompost for 30 days and vermicomposting process adopted.C_3 pit was filled with Cocoa shell. It was predigested by using 20 g of *Pleurotusflorida* spawn and then the vermicomposting process adopted.C_4 pitwas filled with cocoa shell and then added 10 g of*Pleurotus eous+10 g of Pleurotus florida* spawn. After 30 days the pre-digested compost is transferred into vermicomposting tray.

After pre-decomposition pre-digested samples (CSW) was transferred to the plastic trays (40×20×20). To this around fifteen exotic earthworms *Eudrilus eugeniae* were introduced into each tray C_1, C_2, C_3 and C_4. Water was sprinkled regularly twice a day to maintained moisture content of the heap. These experimental trays were kept in the shady place undisturbed for 60 days. On the 90th day of composting the samples were taken and sieved.

Pot Culture Experiments

About 7 kg of sandy clay loam soil were filled in the pots. Different biocompost treatment was applied to the respective pots, mixed thoroughly and kept undisturbed for a week. A control was maintained. Viable *cowpea*seeds were selected and five healthy plants were maintained in each pot with three replications.

1. C – Control, (No manure)
2. T_1- compost 1(Raw cocoa shell + *Eudrilus eugeniae*),
3. T_2- compost 2 (Raw cocoa shell + *Pleurotus eous* + *Eudrilus eugeniae*),
4. T_3- compost 3 (Raw cocoa shell+ *Pleurotus florida* + *Eudrilus eugeniae*),
5. T_4- compost 4 (Raw cocoa shell+*Pleurotus eous* + *Pleurotus florida*+ *Eudrilus eugeniae*)

Statistical analysis

The experimentswere performed on different days (25 DAS, 35 DAS and 45 DAS) for vegetative growth and yield parameters (65DAS) for cowpea. The result were subjected to statistical analysis (one way and two-way ANOVA).

RESULTS AND DISCUSSION

Biometric Characters

Effect of biocomposted Cocoa Shell Waste on Vegetative Parameters of Cowpea

The experimental result of the effect of CSW on vegetative and yield parameters of *Vigna unguiculata* (L.)was given in Figure I to X.

Shoot Length and Root Length (Figure-I)

In shoot length a significant increase was recorded in T_4 (67.933 cm, 112.133 cm and 119.300 cm) on 25, 35 and 45 DAS when compared with the control (13.933 cm,35.233cm and 50.233 cm).

The result was positively correlated with the findings of Vijayalakshmi, (2011) who reported increase in shoot length (16.70 cm) with the application of press mud 5 mg and 1% IAA in *Lablab purpureus*. Hameeda *et al.,* (2007) also reported significant improvement in shoot length (1-12%) due to the application of rice straw vermicompost in Sorghum. The result was coinciding with the finding of Pavithra and Lakshmi Prabha, (2014) who obtained an increase in the shoot length of *Cyamopsis tetragonoloba* due to the application of vermicompost. Similar results were observed by Bharat and Divya, (2015) who also recorded significant increase in the shoot length (19.61 cm) in *Andrographis paniculata* due to the application of vermicompost. The present study was in agreement with the results of Omidi *et al.,* (2017) who observed an increase in plant height (16.83) with the application of soil + 100% compost peanut shells."

Effect of Cocoa Shell biocompost on Vegetative Parameters of Vigna unguiculata (L.)Walp (25, 35 and 45 DAS)

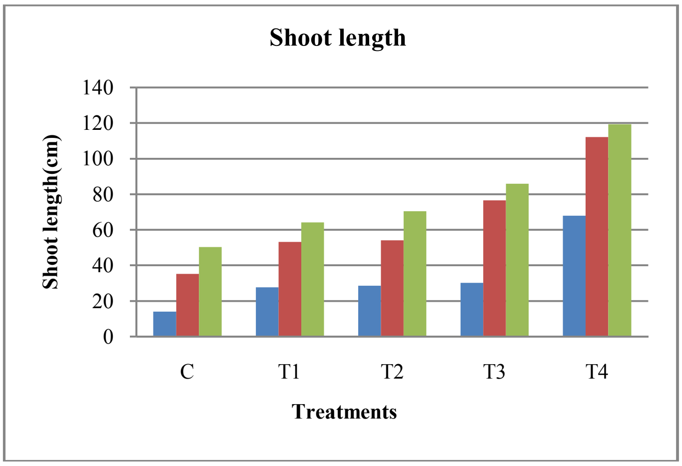

Figure I

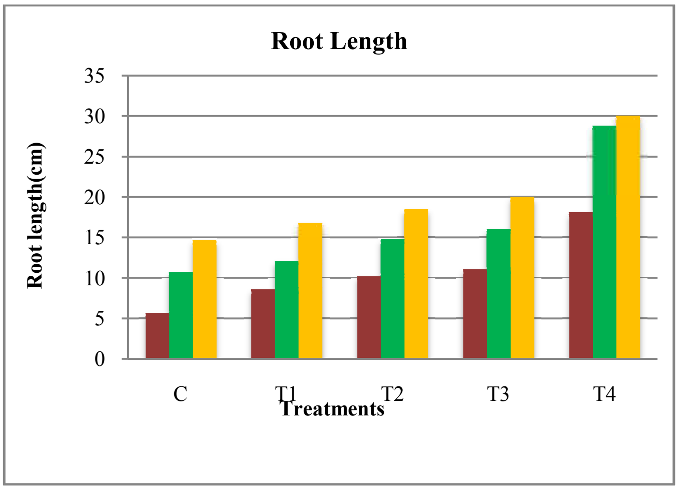

Figure II

There was a gradual increase in root length from 25 to 45 DAS in all treatments as revealed in the figure – II. A maximum increase in root length is noted in T_4 (18.133cm, 28.867 cm and 30.100 cm) on, 25, 35 and 45 days after sowing when compared with the control (5.7 cm,10.767 cm and 14.733 cm). The present findings is in confirmation with the results of Pradeepa *et al.,* (2011) who reported that application of 50% vermicomposted food waste significantly increased the root length (4.4 cm) of *Vigna unguiculata*.

Number of Leaves

Significant increase in number of leaves were shown in T_4 (20.50, 28.83 and 34.52) treatment and the minimum number of leaves were noted in control (10.500, 12.400 and 14.467) on all the three days examined as shown in figure III.

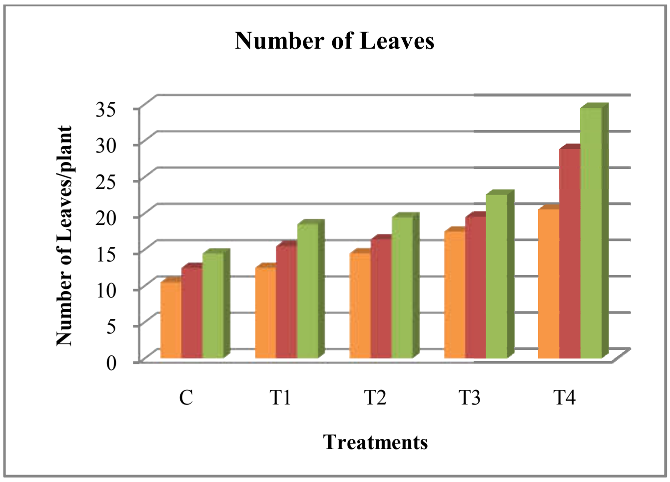

Figure III

Gayathri and Malathi (2018) reported that use of different biofertilizers increases the number of leaves in *Amaranthus viridis* L.Singh *et al.,* (2018) observed more number of leaves/plant 97.80, 94.00 and 93.20 on T_8 (75% RDF + 12.55 FYM + 12.5% VC) followed by T_3 (RDF + 10 tones VC) and T_9 (50% RDF + 25% FYM + 25% VC) respectively are in par with our results."

Similar result was obtained by Prakash and Hemalatha (2013) who reported that the combined application of vermicompost and plant growth-promoting *Rhizobacteria* isolated from vermin stabilized 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).

Number of Flowers

The combined application of cocoa shells with fungal consortium (T_4- Raw cocoa Shell+ *Pleurotus eous* + *Pleurotus florida* + *Eudrilus eugeniae)* showed a significant result in increasing the number of flowers (T_4-10**)** per plant of cowpea (Figure IV)when compared to the control (5) on the 45 DAS. The present study was in agreement with the results of Sakthivigneswari and Vijayalakshmi(2016)who observed increase in the number of flowers/ plant (28.67**)** of black nightshade when compared to the control (6.33).

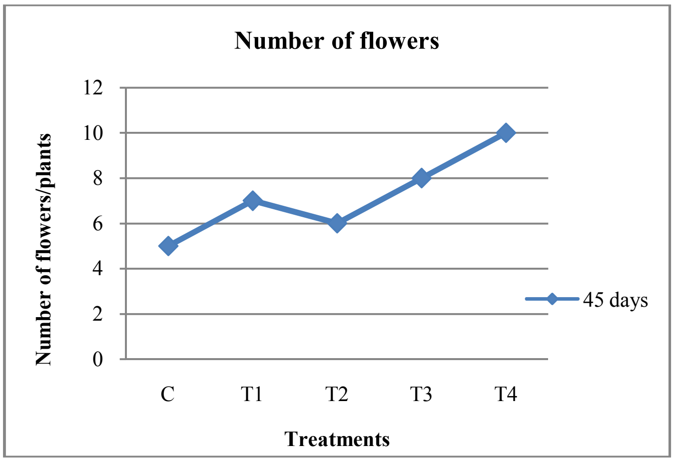

Figure IV

Fresh Weight and Dry Weight of Test Crop

An appreciable increase in plant fresh and dry weight content from 25 to 45 DAS in all treatments. A significant increase in fresh weight content was observed in T_4 (7.195 g, 8.186g and 12.555 g) on 25 DAS, 35 DAS and 45 DAS as compared to the control (1.053 g, 1.077 g and 1.856 g) respectively. The highest dry weight content was registered in the treatment in T_4 (1.277g,1.465 g, and 2.254 g) as compared to the control (0.494 g, 0.604 g, and 0.819 g) on 25, 35 and 45 days after sowing (Figure V & VI).

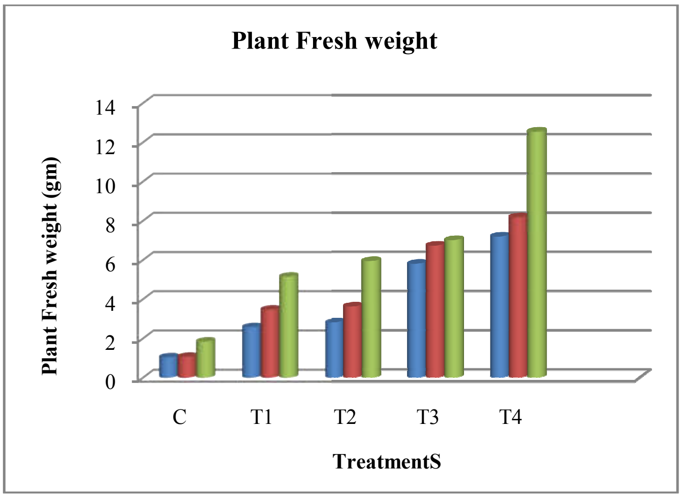

Figure V

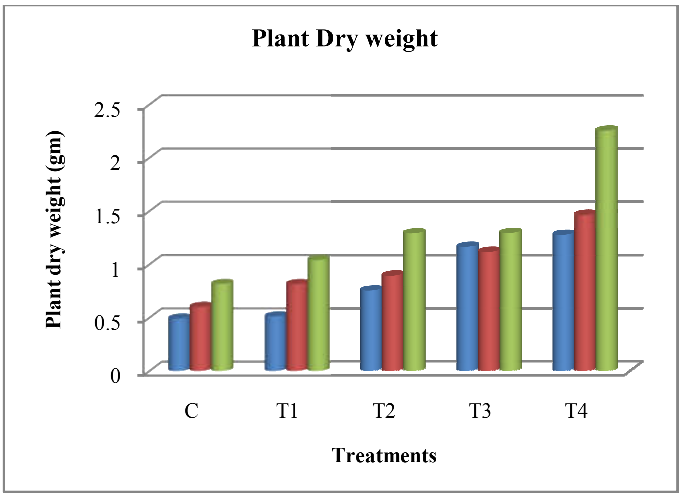

Figure VI

Similar findings showed by Biswas, (2014) that application of vermicompost combination with bio inoculants influenced the fresh weight (903.7 g) and dry weight (43.5 g) content in *Rumex acetosella.*Sivakumar and Karthikeyan, (2016) also concluded that the increase in fresh weight content (6.6 g) and dry weight content (2.2 g) of brinjal plant was due to the application of vermicomposted weed plants waste using *Eudrilus eugeniae*."

Yield Parameters (Figure VII to X)

In the number of pod/plants, a maximum increase was observed in T_4 (17.000) on 65th DAS as compared to the control (7.000). The pod length was increased in T_4 (13.867 cm) when compared to the control (8.700 cm). The maximum number of seeds/pods was seen in T_4 (18.000) over the control (8.000). An appreciable weight of seed/pod was recorded in T_4 (1.436 g) compared to the control (0.715 g). The pod fresh weight was highest in T_4 (4.243 g) over the control (1.140 g). A similar result was followed by the pod dry weight highest in T_4 (1.969g) over the control (0.784 g).

Alam *et al.,* (2007) recorded a similar finding that the application of vermicompost (10t/ha) + NPK (100%) enhanced the dry weight content which ranged from 337.38 to 1609.70 kg/ha in red amaranth. The present results also coincide with the result of Vijayalakshmi, (2011) who reported that plant fresh weight and dry weight (12.17 g and 6.80 g) with the application of press mud 5 mg + 1% IAA showed maximum increase in *Lablab purpureus*." "Sakthivigneswari and Vijayalakshmi (2016) reported that coir pith waste treated with *Pleurotus sajor-caju* and *Eudrilus eugeniae* used to improve vegetative growth and yield of *solanum nigrum.*"

Yield parameters of Vigna unguiculata (L.)Walp influenced by Cocoa shell waste Biocompost (65 DAS)

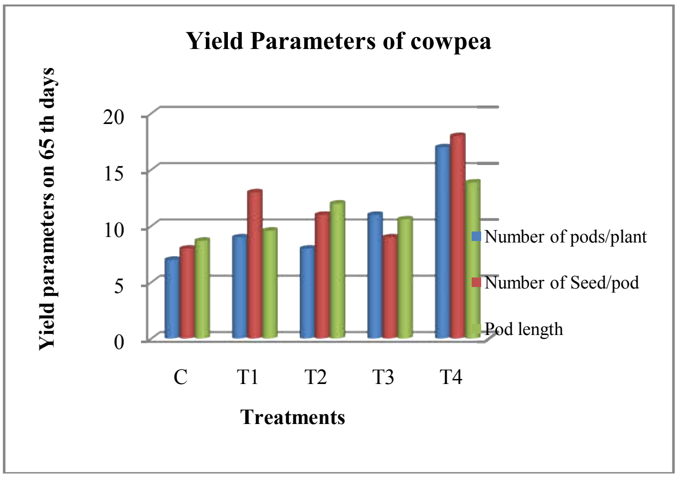

Figure VII

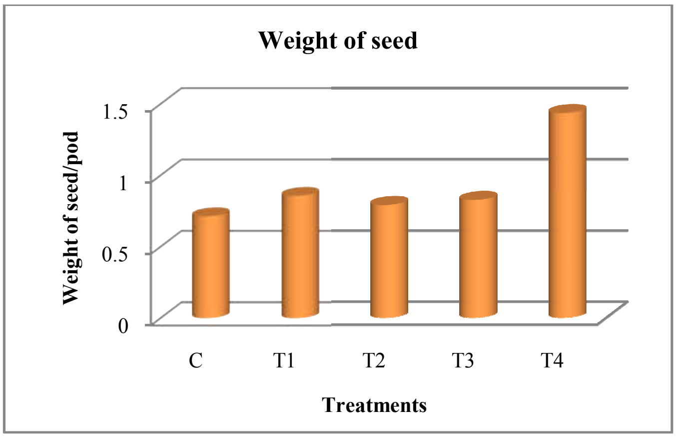

Figure VIII

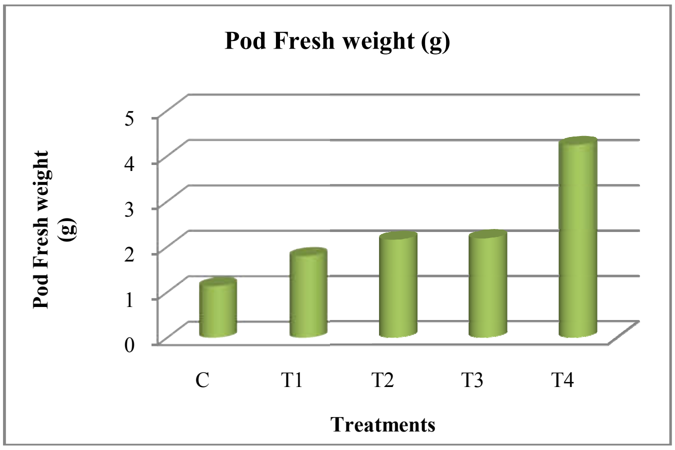

Figure IX

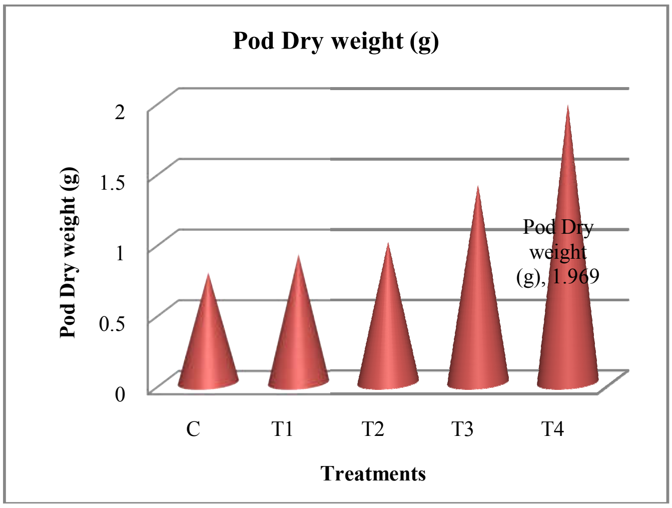

Figure X

CONCLUSION

Recycling of cocoa shell waste biocompost led to improvements in plant growth. All growth indices showed T_4 (Raw Cocoa shell waste + *Pleurotus eous* + *Pleurotus florida* + *Eudrilus eugeniae)* treatment showed significant increase on the growth and yield parameters of test crop (cowpea). The present study will encourage small scale producers to produce biomanure in large scales from less expansive materials.

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