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# COMBINED EFFECT OF PRESSMUD, FARMYARD MANURE, GYPSUM AND ZINC SULPHATE FOR ENHANCED CROP PRODUCTIVITY IN COWPEA (*VIGNA UNGUICULATA* L.)

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## Abstract

The agroindustrial waste pressmud was composted and along with farmyard manure, gypsum and zinc sulphate was used for the study of seedling, vegetative parameters and yield of cowpea. The composted pressmud significantly increased the seedling parameters namely length of epicotyls, hypocotyls, root length, number of lateral roots, plant fresh weight and plant dry weight. On the 30th Days After Sowing (DAS) the shoot length, plant fresh weight and dry weight in $T_3$ treatment (composted pressmud + farmyard manure) (14.10cm, 3.41g, 1.09g) were increased when compared to the control (8.41cm, 1.20g, 0.83g). On the 45th DAS shoot length was increased in $T_3$ (composted pressmud + farmyard manure). Root length (24.88 cm) number of leaves (10.66) and number of nodules were significantly increased in $T_2$ (composted pressmud) treatment. The yield parameters length of pod and weight of pod (5.58cm, 0.35g respectively) were increased in $T_3$ treatment (composted pressmud + farmyard manure) and number of seeds per pod (6.50) weight of seeds per pod (0.30g) were increased in $T_4$ (composted pressmud + farmyard manure+ gypsum) treatment respectively. Hence from the present investigation it is clear that pressmud can be recycled and along with farmyard manure, gypsum and zinc sulphate. It can be used as a cheaper source of organic nutrients for plant growth.

***Key words:*** composted pressmud, farmyard manure, gypsum.

## Introduction

India has a vast scope for re-utilization of renewable agricultural wastes like farmyard manure, industrial wastes like pressmud and industrial byproduct like gypsum and zinc sulphate. Cow pea (*Vigna unguiculata* L.) Walp is commonly referred to as southern pea, black eye pea and pea. Worldwide cow pea production has increased dramatically in the last 25 years. Cow peas are grown mostly for their edible beans, although the leaves, fresh peas and fresh pea pods can also be consumed. The protein in cow pea seed is rich in the amino acids, lysine and tryptophan compared to cereal grains. This will definitely lay the

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foundation for developing novel value added cowpea products. Therefore, this work was under taken to study the integrated effect of composted pressmud, farmyard manure, gypsum and zinc sulphate for sustainable production of cowpea.

## Materials and Methods

### Collection of Agro – Industrial Waste

The agro-industrial waste pressmud was collected in large amounts from Gomuki Sugar Factory, Kallakurichi and Villupuram District.

### Bioassay Estimation

The seeds of cow pea were soaked in beaker containing equal amount of different concentration of compost extracts for 12 hours. One set was kept as control by soaking the seed in water. The seeds were arranged in germination towels. The following concentration of composts were used $T_1$- control, $T_2$- 1 percent pressmud, $T_3$- 2 percent pressmud, $T_4$- 3 percent pressmud, $T_5$- 4 percent pressmud, and $T_6$- 5 percent pressmud. The parameters such as Root length, length of epicotyl, length of hypocotyl and number of lateral roots were recorded after seven days of growth. Thus the influence of pressmud on germination of seedlings was determined.

### Pot Culture Experiment

#### a. Treatment application and cultivation

The pots were filled with 7kg of sandy loam soil. The compost pressmud, farmyard manure, gypsum and zinc sulphate was above five seeds were sown in each pot with three replication. After germination three healthy plants were maintained per pot. Plant protection measures and other cultural practices were followed as recommended by Tamil Nadu Agricultural University, Coimbatore.

#### b. Treatment details

$T_1$ - Control

$T_2$ - Composted pressmud 12.5 t $ha^{-1}$

$T_3$ - Composted pressmud 12.5 t $ha^{-1}$ + farmyard manure 12.5 t $ha^{-1}$

$T_4$ - Composted pressmud 12.5 t $ha^{-1}$+ farmyard manure 12.5 t $ha^{-1}$+ gypsum 12.5 t $ha^{-1}$

$T_5$ - Composted pressmud 12.5 t $ha^{-1}$+ farmyard manure 12.5 t $ha^{-1}$+ zinc sulphate 12.5 t $ha^{-1}$

#### Vegetative Parameters

On the 30 DAS (Days After Sowing) and 45$^{th}$ DAS (cow pea) the plants were uprooted from the pot and the vegetative characters were noted like the number of leaves, number of nodules, shoot length, root length, plant fresh weight and plant dry weight.

#### Yield Parameters

On the 70$^{th}$ DAS (cow pea) the plants were uprooted from the pot and the yield parameters like length of the pod, weight of the pod, number of seed per pod and weight of the seed per pod were observed.

#### Statistical Analysis

The data obtained from various biometrical observations and yield parameters were subjected to the statistical

## Results and Discussion

The experimental result pertaining to the composted pressmud, farmyard manure, gypsum, zinc sulphate, biometric parameters of cow pea during seedling, vegetative growth and yield parameters during the pot culture experiment on legume *Vigna unguiculata* (L.) walp var. co (cp) 7 were analyzed and the details of which are presented in Table 1, 2 and 3.

**Table 1. Effect of Composted Pressmud Extract on Cowpea Seedling Growth**

| Treatment | Epicotyl length (cm) | Hypocotyl length (cm) | Root length (cm) | Number of lateral root |
|---|---|---|---|---|
| $T_1$ - Control | 9.77 | 9.70 | 12.32 | 25.17 |
| $T_2$ – 1% | 10.73 | 11.73 | 13.83 | 29.86 |
| $T_3$ – 2% | 12.47 | 10.05 | 18.25 | 35.83 |
| $T_4$ – 3% | 13.52 | 13.05 | 15.12 | 35.33 |
| $T_5$ – 4% | 17.18 | 10.73 | 16.87 | 32.17 |
| $T_6$ – 5% | 14.50 | 14.17 | 14.98 | 25.50 |
| SEd | 0.7414 | 0.7538 | 1.5618 | 1.7092 |
| CD (0.05) | 1.5270 | 1.5524 | 3.2165 | 3.5202 |
| CD (0.01) | 2.0668 | 2.1012 | 4.3546 | 4.7647 |

**Table 2. Effect of Composted Pressmud, Farmyard Manure, Gypsum and Zinc Sulphate on Vegetative Stage of Cowpea**

| Treatment | Shoot length (cm) | | Root length (cm) | | Number of leaves | | Number of nodules | | Plant fresh weight (g) | | Plant dry weight (g) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Days | | | | | | | | | | | |
| | 30 | 45 | 30 | 45 | 30 | 45 | 30 | 45 | 30 | 45 | 30 | 45 |
| $T_1$ | 8.41 | 12.90 | 10.66 | 21.68 | 4.16 | 8.50 | 0.50 | 6.83 | 1.20 | 3.54 | 0.39 | 0.83 |
| $T_2$ | 12.26 | 13.18 | 12.53 | 24.88 | 5.50 | 10.66 | 0.83 | 11.83 | 2.62 | 4.31 | 1.09 | 0.96 |
| $T_3$ | 14.10 | 15.50 | 13.16 | 22.00 | 6.16 | 9.83 | 0.66 | 3.66 | 3.41 | 3.96 | 0.94 | 0.85 |
| $T_4$ | 8.01 | 12.33 | 12.98 | 16.58 | 4.16 | 10.33 | 2.66 | 1.66 | 1.59 | 2.81 | 0.60 | 0.65 |
| $T_5$ | 7.63 | 10.38 | 7.80 | 14.65 | 5.50 | 10.66 | 0.33 | 9.33 | 2.00 | 3.02 | 0.48 | 0.59 |
| SEd | 1.18221 | | 1.81727 | | 0.81506 | | 0.53241 | | 0.48283 | | 0.16559 | |
| CD (0.05) | 2.38116 | | 3.66028 | | 1.64166 | | 1.07235 | | 0.97251 | | 0.33352 | |

**Table 3. Effect of Composted Pressmud, Farmyard Manure, Gypsum and Zinc Sulphate on Yield Parameters of Cowpea**

| Treatment | Length of pods (cm) | Weight of pods (g) | Number of seeds per pod | Weight of seeds per pod (g) |
|---|---|---|---|---|
| $T_1$ | 4.67 | 0.20 | 5.67 | 0.12 |
| $T_2$ | 5.11 | 0.30 | 5.57 | 0.09 |
| $T_3$ | 5.58 | 0.35 | 6.33 | 0.25 |
| $T_4$ | 5.18 | 0.32 | 6.50 | 0.30 |
| $T_5$ | 4.72 | 0.25 | 5.03 | 0.08 |
| SEd | 0.2272 | 0.0352 | 0.3202 | 0.0300 |
| CD (0.05) | 0.4718 | 0.0718 | 0.6672 | 0.0625 |
| CD (0.01) | 0.6435 | 0.0980 | 0.9099 | 0.0853 |

### i. Seedling growth experiment

#### a. Effect of composted pressmud extract on seedling growth (Table 1).

The composted pressmud extract was more significant in all the treatments regarding seedling growth. In 12 hours soaking experiment of cow pea, the epicotyls length was significantly increased with $T_5$ (17.18 cm) when compared to the control $T_1$ (9.77 cm) and other treatments $T_2$ (10.73 cm) and $T_3$ (12.47 cm). The hypocotyl length was significantly increased in $T_4$ (13.05 cm) and $T_6$ (14.17 cm) when compared to control $T_1$ (9.70 cm). The root length was highest in $T_3$ (18.25 cm) and $T_5$ (16.87 cm) when compared to control $T_1$ (12.32 cm). The number of lateral root was highest when compared to the control $T_1$ (25.17 cm). The similar results were supported by Mekki *et al.*, (2013) on composting of agro industrial waste and the

### ii. Pot culture experiment

Effect of composted pressmud, farmyard manure, gypsum and zinc sulphate on vegetative characters of cow pea (Table 2).

#### a. Shoot length and root length

On the 30th DAS the treatment $T_3$ (14.1 cm), $T_2$ (12.2 cm) showed the highest value in shoot length when compared to control $T_1$ (8.4 cm). On 45th DAS a significant value was obtained in $T_3$ (15.5 cm), $T_2$ (13.1 cm) when compared with control $T_1$ (12.9 cm). On the 30th DAS root length of cow pea was significantly increased in the treatments $T_3$ (13.1 cm), $T_4$ (12.9 cm) over the control $T_1$ (10.6 cm). On the 45th DAS the treatments composted pressmud $T_2$ (24.8 cm), $T_3$ (22.0 cm) treatment such as FYM had a greater influence than control $T_1$ (21.6 cm)

noted in Bengal gram due to the addition of pressmud compost (Deshmukh, 2004). Pressmud supplies nitrogen, macro and micro nutrients. Nitrogen is an active constituent of protoplasm, enzyme and chlorophyll. They act as a catalytic agent in accelerating cell division and photo assimilation which, boosts plant growth and also improved the plant building structures.

**b. Number of leaves**

The treatments influenced the number of leaves of cow pea over the control $T_1$ (4.1). On the 30th DAS a significant increase was observed in $T_3$ (6.1), $T_2$ (5.5), $T_5$ (5.5). On the 45th DAS the increased value was observed in $T_2$ (10.6) and $T_4$ (10.3) over the control $T_1$ (8.5). The result is in agreement with the Babcznska *et al.,* (2008) and Prabakaran, (2003). The presence of available nitrogen and organic matter improved the physico-chemical and biological properties of the soil, thus resulting in better vegetative growth and photosynthesis.

**c. Number of nodules**

On the 30th DAS the number of nodules was significantly increased with $T_4$ (2.6), $T_2$ (0.8), $T_3$ (0.6) when compared to control $T_1$ (0.5). On the 45th DAS the number of nodules were highly increased with treatment $T_2$ (11.8), $T_5$ (9.3) when compared to the control $T_1$ (6.8). The similar work was supported by Kumar and Rao, (2012) and Eusufzai *et al.,* (1999). Nitrogen fixing microorganisms enhance the nutrient

**d. Plant fresh weight and Plant dry weight**

The treatment such as composted pressmud + farmyard manure $T_3$ (3.41 g), $T_2$ (2.62 g) significantly increased the fresh weight over the control $T_1$ (1.20 g) on the 30th DAS of growth. On the 45th DAS a favourable increase was noted with composted pressmud $T_2$ (4.31 g), farmyard manure $T_3$ (3.96 g) over control $T_1$ (3.54 g). The application of composted pressmud significantly increased the plant fresh weight.

On the 30th DAS plant dry weight increased in $T_2$ (1.09 g), $T_3$ (0.94 g), $T_4$ (0.60 g) when compared to the control $T_1$ (0.39 g). On the 45th DAS when compared with control $T_1$ (0.83 g) the dry weight of $T_2$ (0.96 g) and $T_3$ (0.85 g) increased. This is in agreement with the work of Makoi and Nadkidemi (2007) and Anburani *et al.,* (2003). The increase may be due to the availability of nitrogen and phosphorus through the mechanism of reduction, chelation and favorable changes in soil.

**iii. Effect of composted pressmud, farmyard manure, gypsum and zinc sulphate on yield parameters of cow pea (Table 3)**

**a. Length and weight of pods**

The increased length of pod was observed in the treatments $T_3$ (5.58 cm). The other treatments increased slightly over control $T_1$ (4.67 cm). The weight of pod was increased in the treatment $T_3$ (0.35 g) when compared to the control $T_1$ (0.20 g). The similar findings were reported by Mathers

due to the application of different types of organic manures which contributed to more nutrients supply available for the crops in the soil.

**b. Number and weight of the seeds per pod**

The number of seeds in $T_3$ and $T_4$ (6.33 and 6.50) are greater when compared with control $T_1$ (5.67). Increase in number of seeds per pod was reported by Yadegari *et al.* (2008) in bean. The weight of the seeds per pod is observed higher in $T_4$ (0.30 g) and other treatment (0.12g) which is in agreement with findings of Akilandeswari (2003) in green gram. In these results $T_3$ composted pressmud and $T_4$ composted pressmud+ farmyard manure + gypsum enhanced the humus content and improved soil conditions which resulted in healthier and more nutrition status of plants. Hence, a maximum number of seeds were obtained in above treatments.

## Conclusion

Agro industrial wastes can be recycled and used as a cheaper source of organic nutrients. Integrated nutrient management alleviates the effect of inorganic elements responsible for toxicity hazards and prevents the physical, chemical degradation of soil thereby contributes to the restoration of soil health.

It is evident from the present investigation that the composted pressmud, farmyard manure, gypsum and zinc sulphate treatment increases the biometrical and yield parameters of cow pea. Hence it was concluded that the pressmud on composting can be effectively used as organic manure.

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