e- ISSN: 2394-5532
p- ISSN: 2394-823X

Scientific Journal Impact Factor: 3.762

International Journal of Applied And Pure Science and Agriculture

www.ijapsa.com

Utilization and effect of composted coirpith, composted pressmud, farmyard manure and NPK on leghaemoglobin content in nodules of black gram (*Vigna mungo* L.) and cluster bean (*Cyamopsis tetragonoloba* (L.) Taub)

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ABSTRACT

An experiment was conducted at Avinashilingam Institute for Home Science and Higher Education for Women, Tamil Nadu (India) to analyse the conjugative effect of composted coirpith, composted pressmud, farmyard manure and NPK on leghaemoglobin content in the nodules of black gram and cluster bean. The experiment consisting of twelve treatments (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}) was laid in a pot having 7kg soil (per pot) with three replications. There was a significant increase in leghaemoglobin content in nodules of both the crops 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) when compared to the control. From the present investigation it was concluded that composted coirpith, composted pressmud, farmyard manure and NPK promote the leghaemoglobin content in the nodules of black gram and cluster bean.

Keywords: Composted coirpith, Composted pressmud, Farmyard manure, Leghaemoglobin, NPK.

I. INTRODUCTION

India has a vast utilization of agroindustrial wastes. There are eco-friendly techniques which utilize the benefits of agroindustrial waste disposal and recycling these wastes for increasing crop productivity. Pressmud and coirpith can be biocomposted into nutrient rich organic products, which can serve as one of the components in Integrated Nutrient Management (INM). Farmyard manure is bulky organic manure resulting from the decomposed mixture of dung and urine of farm animals along with the litter (bedding material). Maintaining and improving the soil in the long run is an essential part of sustaining the ecosystem.

Black gram (*Vigna mungo* L.) is the third important pulse in India, where beans are eaten whole or split, boiled or roasted, ground into flour and used to make cakes, breads and porridge. Integrated nutrient management approach is flexible, minimizes the use of chemicals, but maximizes its own efficiency. Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub) commonly known as guar is a cash crop of the family Leguminosae . It is an annual legume and the source of guar gum. It is also known as Gavar, Guwar or Guvar bean. It is widely cultivated in countries like India, Pakistan, USA, Italy, Morocco, Germany, Greece and Spain. Cluster bean is a drought tolerant warm season crop grown for its tender fruits for use as vegetable. Leghaemoglobin is an oxygen carrier and a hemoprotein found in the nitrogen fixing root nodules of leguminous plants. It is produced in response to the roots being infected by nitrogen fixing bacteria called *Rhizobia* as part of the

symbiotic interaction between plants and bacteria. Legumes can only "fix" nitrogen if they have abundant and active nitrogen – fixing nodules. The nodules are the house of the microscopic *Rhizobium* that convert atmospheric nitrogen to nitrate and ammonium that can be used by plants (Oldroyd *et al*., 2011). In the present investigation the leghaemoglobin content in the nodules of black gram and cluster bean was studied.

II. MATERIALS AND METHODS

The agroindustrial waste such as coirpith was collected from eastern slopes of western ghats area which includes Pollachi, in and around Coimbatore district (Tamil Nadu) and pressmud from Bannari Sugars Private Limited Sathyamangalam. The coirpith and pressmud were collected and heaped according to the standard procedure prescribed by Tamil Nadu Agricultural University (TNAU). Farmyard manure was collected from Tamil Nadu Agricultural University, Coimbatore.

A Pot culture experiment was conducted with black gram (*Vigna mungo* L. Var. ADT 5) and cluster bean (*Cyamopsis tetragonoloba* L. (taub) Var. Pusa Navbahar) to evaluate the efficacy of composted coirpith, composted pressmud and farmyard manure on leghaemoglobin content in the nodules of both crops. Using *Pleurotus sajor-caju* the compost was prepared. Sandy clay loam soil was used for pot culture experiment. In this experiment composted coirpith, composted pressmud and FYM were incorporated in different concentration-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), T5-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). Leghaemoglobin content was analyzed on 25, 45 and 55 Days After Sowing .

STATISTICAL ANALYSIS

The data obtained on leghaemoglobin content on 25, 45 and 55 DAS were subjected to the statistical analysis (two way ANOVA) and based on the results inference were drawn.

III. RESULTS AND DISCUSSIONS

3.1. Leghaemoglobin content in nodules of black gram and cluster bean by the effect of composted coirpith, composted pressmud , farmyard manure and NPK.

3.1.1. Effect on biocompost on 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 - 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).

3.1.2. Effect of biocompost on cluster bean

The data from table- 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).

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.

IV. 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 leghaemoglobin content (blackgram and cluster bean) 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.

V. ACKNOWLEDGEMENTS

The authors express their sincere thanks to Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore to carry out this work.

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TABLE - I

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})

TABLE - 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)

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})

