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RESEARCH ARTICLE

EFFECT OF COMPOSTED COIRPITH, COMPOSTED PRESSMUD AND FARMYARD MANURE APPLICATION ON SOIL ENZYME ACTIVITIES AND LEGHAEMOGLOBIN CONTENT IN NODULES OF GREEN GRAM (*Vigna radiata* L.)

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ABSTRACT

An experiment was conducted at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu (India) for assessing the effect of composted coirpith, composted pressmud and FYM on leghaemoglobin content in nodules of green gram and enzymatic activity (dehydrogenase and urease) of the soil sowned green gram (*Vigna radiata* L.). There was an increase in leghaemoglobin content from 25 to 45 DAS and its goes down gradually upto 55 DAS .The treatmentT_{12} (composted coirpith + composted pressmud + farmyard manure) showed increased leghaemoglobin content followed by T_9 (composted coirpith + NPK) as compared to the control T_1. Soil enzymatic activity dehydrogenase and urease activity increase upto 45 DAS and then declined gradually in 55 and 75 DAS. T_{12} (composted coirpith + composted pressmud + farmyard manure) treatment shows more dehydrogenase and urease activity followed by T_9 (composted coirpith + NPK) against the control (T_1). Hence composted coirpith, composted pressmud and farmyard manure increased the leghaemoglobin content of the nodules of green gram and also the enzymatic activity of the treated soil.

INTRODUCTION

Green gram (*Vigna radiata* L.) commonly known as "mung bean" is one of the most important short duration pulse in India. Among the pulse green gram occupies 10.2 lakh hectares (4.3% total) in India. Treatment and recycling of the agrowastes is an useful way. The need of the hour is to improve soil health by providing the much needed organic matter. Leghaemoglobin also known as legoglobin 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 bacterium. Leghaemoglobin plays an essential role in the nitrogen fixation process by providing oxygen to the bacteria for the respiration and the enzymatic activity. Soil enzymes are one of the main components participating in and assuring the correct sequence of all the biochemical routes in soil biogeochemical cycles. In the present investigation the leghaemoglobin content in the nodules and enzymatic activity (dehydrogenase and urease) were studied.

MATERIALS AND METHODS

The agroindustrial waste such as pressmud was collected from Bannari Sugars Private limited Sathyamangalam and coirpith from Pollachi, Tamil Nadu (India). Seeds of green gram and FYM were collected from Tamil Nadu Agricultural University, Coimbatore. Using Pleurotus sajor – caju the compost was prepared. The pots were filled with 7kg of sandy clay loam soil. The composts was applied to the respective pots and mixed thoroughly. Vaible seeds were selected and about five seeds were sown in each pot with three replications. After germination three healthy plants were maintained per pot. 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}), 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}). On 25, 45 and 55 DAS (leghaemoglobin content) and 0day, 25, 45, 55 and 75 DAS (dehydrogenase and urease activity).

Statistical Analysis

The data obtained on 25, 45, 55 and 75 DAS were subjected to the statistical analysis (two way Anova) and based on the results inference were drawn.

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RESULTS AND DICUSSION

I – Effect of composted coirpith, composted pressmud and farmyard manure on leghaemoglobin content in nodules of green gram

There was an appreciable increase in leghaemoglobin content in all the treatments from 25 to 45 DAS and it decreased gradually upto 55 DAS (Table 1). The treatment T_{12} (composted coirpith + composted pressmud + farmyard manure) showed increased leghaemoglobin content from 0.047 mg/g to 0.056 mg/g followed by T_9 (composted coirpith + NPK) from 0.045 mg/g to 0.048 mg/g and again decreased gradually to 0.047 mg/g and 0.046 mg/g upto 55 DAS as compared to the control T_1. In control (T_1) it increased from 0.014 mg/g to 0.022 mg/g upto 45 DAS and decreased to 0.015 mg/g upto 55 DAS. The increase in laeghaemoglobin content from 25 to 45 DAS might be due to high nitro genase activity by the respiring bacteroids and declined gradually upto 55 DAS may 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. Similar results was given by Ott *et al*. (2005) who observed that plant hemoglobins are crucial for symbiotic nitrogen fixation.

Table 1. Effect of composted pressmud, composted coirpith and farmyard manure on Leghaemoglobin content in nodules of green gram

Treatment	Leghaemoglobin Content(mg/g)		
	25DAS	45DAS	55DAS
T1	0.0140	0.0220	0.0150
T2	0.0250	0.0283	0.0300
T3	0.0220	0.0250	0.0230
T4	0.0210	0.0230	0.0220
T5	0.0180	0.0210	0.0200
T6	0.0390	0.0470	0.0400
T7	0.0330	0.0420	0.0340
T8	0.0320	0.0370	0.0335
T9	0.0450	0.0480	0.0460
T10	0.0430	0.0450	0.0440
T11	0.0390	0.0420	0.0410
T12	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).

II – Effect of composted coirpith, composted pressmud and farmyard manure on the enzymatic activity (dehydrogenase and urease activity) of the soil.

The data obtained from Table 2 stated that there was an pronounced increase in soil dehydrogenase enzyme activity upto 45 DAS and it reduce gradually upto 75 DAS in all the treatments. The soil dehydrogenase enzyme activity increased maximally in T_{12} (composted coirpith + composted pressmud + farmyard manure) treatment from 0.64 to 0.75 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein followed by T_9 (composted coirpith + NPK) treatment from 0.63 to 0.75 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein upto 45 DAS and declined gradually to 0.62 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein and 0.53 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein at harvest compared to the control T_1. In control (T_1) it increased from 0.14 to 0.21 upto 45 DAS and decreased to 0.18 µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein at harvest. The increase in soil dehydrogenase enzyme activity upto 45 DAS may be due to the usage of composted coirpith, composted pressmud and FYM in the soil which enhance the microbial population, biological activity and the reduction might be due to cell lysis and inactivation of microbes. A similar result was observed by Tiquia *et al*. (2002) who reported that the dehydrogenase activity of yard trimming compost was maximal (1331 µg TPF g^{-1}24 h^{-1}) at the beginning of composting period and decreased (717 µg TPF g^{1}24 h^{-1}) after 63 days of decomposition. 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 percent). It is observed from Table 3 that there was increased urease enzyme activity in all the treatments upto 45 DAS and declined gradually upto harvest.

Table 2. Dehydogenase activity of the soil with different treatments used for the productivity of green gram

Treatment	Dehydrogenase Enzyme(µ mol of TTC formed g^{-1} soil mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T1	0.1400	0.1990	0.2100	0.2000	0.1800
T2	0.2800	0.3200	0.3700	0.2500	0.1500
T3	0.2500	0.3000	0.3600	0.2600	0.1600
T4	0.2300	0.3400	0.3900	0.3700	0.2700
T5	0.1500	0.2000	0.2800	0.2200	0.1800
T6	0.4800	0.5300	0.6400	0.4200	0.4400
T7	0.4600	0.5200	0.5800	0.5400	0.3200
T8	0.3500	0.5400	0.6600	0.6200	0.4400
T9	0.6300	0.6800	0.7500	0.6500	0.5300
T10	0.5700	0.6100	0.6827	0.6700	0.5500
T11	0.5650	0.6500	0.6700	0.6300	0.5700
T12	0.6480	0.7100	0.7500	0.7200	0.6200
SED			0.00309		
CD(0.05)			0.00613		
CD(0.01)			0.00812 **		

** - Significant at 1% (P<0.01).

Table 3. Urease activity of the soil with different treatments used for the productivity of green gram

Treatment	Urease enzyme(µ mol ammonia formed min^{-1} mg^{-1} enzyme protein)				
	0 Day	25DAS	45DAS	55DAS	75DAS
T1	0.1400	0.2100	0.2500	0.2300	0.1300
T2	0.4400	0.4800	0.5300	0.2600	0.1600
T3	0.3600	0.3900	0.3600	0.3200	0.2200
T4	0.1300	0.3400	0.3800	0.3400	0.2400
T5	0.1600	0.2300	0.2850	0.2500	0.1500
T6	0.3200	0.4000	0.4500	0.4200	0.3200
T7	0.2400	0.4500	0.4800	0.4300	0.3300
T8	0.2200	0.4600	0.4900	0.4600	0.3600
T9	0.4500	0.5300	0.5600	0.5400	0.4400
T10	0.4200	0.5500	0.5800	0.5650	0.4650
T11	0.3400	0.6600	0.6400	0.6290	0.5200
T12	0.5200	0.6500	0.6800	0.6450	0.5447
SED			0.00593		
CD(0.05)			0.01176		
CD(0.01)			0.01557 **		

** - Significant at 1% (P<0.01).

Soil urease enzyme activity was much pronounced in T_{12} (composted coirpith + composted pressmud + farmyard manure) treatment followed by T_9 (composted coirpith + NPK) treatment which showed an increase from 0.52 to 0.68 µ mol ammonia formed min^{-1} mg^{-1}enzyme protein and from 0.45 to 0.56 µ mol ammonia formed $min^{-1}mg^{-1}$enzyme protein upto

45 DAS and goes down to 0.54 µ mol ammonia formed min^{-1} mg^{-1}enzyme protein and 0.44 µ mol ammonia formed $min^{-1}mg^{-1}$enzyme protein at harvest against the control T_1. In control (T_1) it increased from 0.14 to 0.25 µ mol ammonia formed min^{-1} mg^{-1}enzyme protein and decreased to 0.13 µ mol ammonia formed min^{-1} mg^{-1}enzyme protein. The increase in urease enzyme activity upto 45 DAS could be due to the production of ammonia during mineralization of composted coirpith, composted pressmud and FYM by the microbes and declined at harvest may be due to its utilization by plants and micro organisms. The result coincided with the findings of Kulandaivelu *et al*. (2013). They observed during their study that high management practices found to significantly increase dehydrogenase activity (2.15 µg TPF^{-1}) compared to low management (1.78 µg TPF g^{-1}), while no significant difference were found in dehydrogenase activity between irrigated and rainfed system. A similar result was obtained by Nogales and Benitez (2007). They conducted an incubation experiment to ascertain the effects of organic amendments (fresh, composted and vermicompost) significantly increase humic acid contents in soil and it stimulated dehydrogenase and urease activities initially upto a certain period and showed decreased activity later on.

Conclusion

The present study indicate that the benefits of agroindustrial wastes can be best exploited if they are applied with right combination of soil amendments. Composted coirpith, composted pressmud and farmyard manure were suitable to achieve better leghaemoglobin content and enzymatic activity of the soil. Thus, it can be inferred from the present investigation that composted coirpith, composted pressmud along with farmyard manure can be effectively consider as a value added product, organic manure.

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