THE COMBINED APPLICATION OF COW DUNG AND SAW DUST ON THE GROWTH AND BIOCHEMICAL CHARACTERISTICS OF Vigna radiata (L.) Wilczek

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Abstract
The combined application of Cow dung and Saw dust on growth and biochemical characteristics of Vigna radiata (L.) Wilczek were investigated at the main campus of Government Arts College, Ariyalur, Ariyalur District. 10kg capacity of pots was taken in the present study and it comprises six treatments and each treatment was replicate three times. The treatments consists of A= (Saw dust + 1 kg of Cow dung), B= (Saw dust +2 kg of Cow dung), C= (Saw dust + 3kg of Cow dung), D= (Saw dust + 4kg of Cow dung), E = (Saw dust + 5kg of Cow dung) and F= (Saw dust only). The present study reveals that the growth parameters (Seed germination, Shoot length, Root length, Fresh weight, Dry weight and Vigour Index) Biochemical parameters (Chlorophyll - a, Chlorophyll - b, Total Chlorophyll, Carotenoids, Carbohydrates, Proteins and Nucleic acids) were increased significantly (p<0.05) as manure rate of quantity was increased. The combined effect of E = (Saw dust + 5kg of Cow dung) has significant increase in both growth and biochemical characters of Vigna radiata. Based on the findings of the experiments the combined application of cow dung and sawdust have showed increased the growth and biochemical parameters whereas the Saw dust shows the slight effect on plant growth.

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Keywords: - Cow dung, Sawdust, growth & biochemical characters, Vigna radiata.

INTRODUCTION
Biocomposting is a process involving biochemical conversion of organic matter into humus by mesophilic and thermophilic organisms. Thus the biocomposting seeks to harness the natural forces of decomposition to secure conversion of organic waste into organic manure. There are two groups of microorganism which decompose the organic matter. (Singh and Dwivedi, (2004). Sawdust is a material produced from cutting wood with a saw and has a high percentage of cellulose. It is main byproduct of wood processing in saw mills and can be processed into particles board, bunt in saw dust burner, used poultry floors or used to make heat for other milling operations (Eze et al., 2011). If burnt, they produce very thick smoke with high environmental consequences (Lennox et al., 2010). Sawdust is a wood waste containing a very rich carbonaceous component that can be used as soil amendment. However, it is also important to understand the adverse impact that sawdust might have on soil and crops. Sawdust may be beneficial due to its rich carbonaceous nature and to study the effect of sawdust on crop yield (Dunmitraescu, et al., 2009). So the Utilization of sawdust and cowdung on growth of plant are totally wanting. Hence it is programmed the combined application of saw dust and cowdung on growth of crop plants.

2. MATERIALS AND METHODS
2.1. Source of Materials: The Saw dust was collected from Natarajan saw Mills, Salem, Salem district. Cow dung was mainly served as the booster. Cow dung was obtained from the local Animal farm, Salem, Salem district. Based on the compost preparation the different quantities of cow dung were weighed into seven pots labelled (A,B,C,D, E and F). The treatment as follows
A= (Saw dust + 1 kg of cow dung)  
B= (Saw dust +2kg of cow dung)  
C= (Saw dust + 3kg of cow dung)  
D= (Saw dust + 4kg of cow dung)  
E= (Saw dust + 5kg of cow dung)  
F= (Saw dust only) – Control.

The content of the compost pots were mixed properly and they were left opened for proper aeration and allowed to decompose for the period of 3 months. The decomposing materials were frequently watered and turned.

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2.2 Composting analysis. Temperature, pH, microbial load and identification of the isolates were carried out on each decomposing materials on the first day of composting materials on the day on composting (Zero day). The temperature of the compost was measured using mercury thermometer graduated in degree centigrade. The temperature measurement was determined daily for two weeks and subsequently a week interval until compost matured. The pH of the compost was determined on the zero day of composting and subsequently determine weekly until full compost matured. The pH was determined using glass electrode pH meter. The moisture content of the compost was determined weekly by using METTLER LJ16 moisture analyser. The microbial load of the compost was determined on the zero day of composting and subsequently weekly until full compost maturation. The production of microbes mainly bacteria and fungi were determined by Nutrient agar for bacteria and Potato dextrose agar for fungi enumeration. Other microbiological analyses were further carried out to aid in the characterisation and identification of the isolates. Samples were collected form decomposing material A, B, C, D, E and F respectively using spatula sterilized with 70% ethanol. The spatula was used to transfer the decomposing sample into a sterile container and sealed tightly before been taken for microbial analysis using conventional techniques. Bacterial were isolated and identified according to Cowan and Steel (1997) and Holt et al., (1994) and fungi identification was carried out according to Barnett and Hunter (1980).

2.3 Seed Collection and Treatment

Seeds of green gram (Vigna radiata (L.)) were procured from a Seed Vendor, Certified by Tamilnadu Seed Certification Department, Madurai, Madurai District. The seeds were surface sterilized with 0.1% Mercuric Chloride for two minutes and then rinsed thoroughly with distilled water the seeds were placed in petri dishes layered with filter papers at the bottom by using different inocolums of A – F. The filter papers were kept moist with respective experimental treatment and control treated with ground water. Triplicates were maintained for each concentration along with control.

2.4. Seedling Treatment

Surface sterilized seeds of allowed to grow in each pot containing a mixture of saw dust and cow dung (A- F) for 10 days and kept moist with ground water. Triplicates were maintained for each composition and also for Control. Throughout the treatment period all the pots were irrigated with ground water.

After 30th day growth parameters like Germination percentage (Carley Watson, 1968), Root length (Buris et al., 1969), Shoot length (Arts and Marks, 1971), Leaf area (Daughtry and Hollinger, 1984), Fresh weight (Buris et al., 1969), Dry weight (Buris et al., 1996) and Vigour index (Abdul Baki and Anderson, 1973) were analyzed. Further the pigments content such as Chlorophyll-a, Chlorophyll-b, Total Chlorophyll, Carotenoids (Arnon, 1949), Carbohydrates (Jeyaraman, 1981), Proteins (lowry et al., 1951) and Nucleic acids (Katoch and Cox, 1986) were quantitatively estimated. The results obtained treatments were tested through the method of Analysis of variance (ANOVA) by Steel and Toorie, (1960).

RESULT AND DISCUSSION.

The physico-chemical characteristics of saw dust is revealed in Table –1. In the present study the pH in the range was 4.8 – 5.7 supports good microbial during composting. Bertoldi et al., (1983) reported that the optimum values are between 5.5 and 8.0, which were observed during composting period. The moisture content was decreased (9.0%) in the saw dust. The moisture content was decreased can be justified by the hydrophobic nature of the fat, which might reduce the water retention capacity of the organic matrix. This is indicative that fat addition can reduce the need of bulking agents, since sawdust was added in the beginning of the experiment in order to set the humidity in the optimal range (Neves et al., 2009). The organic carbon was higher in saw dust (52.7%). The organic carbon was higher in during composting piles that was subsequently degraded to organic acids by the acid forming bacteria that exist in compost files (FAO. 1987). In addition, the pH decreased may also be caused by the mineralization of organic acids and the large quantity of carbon di-oxide released during the composting period (Hunag et al., 2004 and Meunchang et al., 2005). The C/N ratio content of saw dust contains 80.3%. The initial C/N ratio was the main factor that affected the time required for compost maturity (Tiquia et al., 1997). Based on the nutritional requirement of the microbes that are active in composting, the C/N ratio of the organic matter should be on the order of 20- 25 parts carbon to 1 part nitrogen, a departure from this ratio leading to slow composting. On the other hand the 20/1 ratio is critical in terms of crop production. If the C/N ratio is higher than 20/1, there is a strong possibility of nitrogen shortage for the crop plants (Washington, 1990 and Diaz et al., 1993). Composts with a C/N ratio of 20, but not higher, are required for proper maturation. Levi-minzi et al., (1986) and Guerra et al.,(2001) have concluded that a C/N ratio of 20-25% indicated the maturity of the final compost product. However, although the C/N ratio is a factor used for indicating compost maturation, it cannot be used in this study as an absolute indicator of compost maturation since the initial C/N ratio was below 20. For instance the C/N ratio of compost at maturity was 13-27 for the co-composting of chestnut burr and leaves with solid poultry manure (Guerra et al., 2001) and 11 – 17 for the composting bagasse with sewage sludge (Negro et al., 1999). The Phosphorus (0.29%) and Potassium (0.35%) content in the saw dust. The cellulose content was 39.5%, Hemicellulose (29.2 %) and lignin content was 42 % in the substrate of saw dust. In general, cellulose decomposition limits the rapid production of compost more than any other substrate (Goyal et al., 2005).Cellulase activity, involved in the degradation of cellulose, depends on the type of cellulolytic microorganisms that develop in organic waste (Poincelot, 1974). For the most part, fungi are involved in the decomposition of cellulose, hemicelluloses and lignin that are present in the organic matter (Nonglak et al., 2009). The force – aerated system can provide aerobic conditions for microorganisms and this is favorable for
Table 1: The physico–chemical characteristics of saw dust.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Parameters</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>4.8-5.7</td>
</tr>
<tr>
<td>2</td>
<td>EC (dS/m)</td>
<td>1.62±0.023</td>
</tr>
<tr>
<td>3</td>
<td>Moisture content (%)</td>
<td>9.0±0.043</td>
</tr>
<tr>
<td>4</td>
<td>Organic carbon (%)</td>
<td>52.7±0.056</td>
</tr>
<tr>
<td>5</td>
<td>Nitrogen (%)</td>
<td>0.62±0.023</td>
</tr>
<tr>
<td>6</td>
<td>C:N ratio</td>
<td>80.3±0.032</td>
</tr>
<tr>
<td>7</td>
<td>Phosphorous (%)</td>
<td>0.29±0.098</td>
</tr>
<tr>
<td>8</td>
<td>Potassium (%)</td>
<td>0.36±0.021</td>
</tr>
<tr>
<td>9</td>
<td>Cellulose (%)</td>
<td>39.5±0.034</td>
</tr>
<tr>
<td>10</td>
<td>Hemicellulose (%)</td>
<td>29.2±0.034</td>
</tr>
<tr>
<td>11</td>
<td>Lignin (%)</td>
<td>42.0±0.090</td>
</tr>
</tbody>
</table>

All the values are averages of 3 months observation.

Table 2. Isolation of microorganisms from saw dust.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Microorganisms</th>
<th>Bacteria (CFU X 10^5/ gm)</th>
<th>Fungi (CFU X 10^4/ gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bacillus subtilis</td>
<td>34.33</td>
<td>56.33</td>
</tr>
<tr>
<td>2</td>
<td>Bacillus laterosporus</td>
<td>45.66</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Proteus sp.</td>
<td>52.33</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pseudomonas sp.</td>
<td>51.66</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>E.coli</td>
<td>66.33</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. The combined application of cow dung and saw dust on the growth characteristics of Vigna radiata (L.) Wilczek

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameters</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Germination %</td>
<td>25</td>
<td>55</td>
<td>76</td>
<td>84</td>
<td>100</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Shoot Length (cm)</td>
<td>12±0.045</td>
<td>34±0.045*</td>
<td>43±0.078*</td>
<td>54±0.098*</td>
<td>62±0.034*</td>
<td>08±0.021*</td>
</tr>
<tr>
<td>3</td>
<td>Root Length (cm)</td>
<td>05±0.034</td>
<td>08±0.023*</td>
<td>12±0.034*</td>
<td>15±0.090*</td>
<td>25±0.056*</td>
<td>04.2±0.065*</td>
</tr>
<tr>
<td>4</td>
<td>Fresh Weight (gm)</td>
<td>5.0±0.034</td>
<td>5.6±0.023*</td>
<td>6.7±0.056*</td>
<td>8.2±0.045*</td>
<td>10.2±0.056*</td>
<td>3.2±0.090*</td>
</tr>
<tr>
<td>5</td>
<td>Dry Weight (gm)</td>
<td>0.9±0.023</td>
<td>1.1±0.054*</td>
<td>1.5±0.012*</td>
<td>2.5±0.023*</td>
<td>3.6±0.034*</td>
<td>0.4±0.011*</td>
</tr>
<tr>
<td>6</td>
<td>Leaf Area (cm²)</td>
<td>52.2±0.034</td>
<td>72.4±0.05*</td>
<td>84.5±0.065*</td>
<td>125±0.065*</td>
<td>167±0.090*</td>
<td>15.0±0.054*</td>
</tr>
<tr>
<td>7</td>
<td>Vigour Index</td>
<td>92±0.045</td>
<td>231±0.078*</td>
<td>418±0.078*</td>
<td>579±0.091*</td>
<td>870±0.056*</td>
<td>144±0.034*</td>
</tr>
</tbody>
</table>

All the values are an average of 10 observations. *p<0.05 significant
Table: 4 THE COMBINED APPLICATION OF COW DUNG AND SAW DUST ON THE BIOCHEMICAL CHARACTERISTICS OF Vigna radiata (L.) Wilczek

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameters</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chlorophyll –a</td>
<td>0.912±0.034</td>
<td>0.998±0.078*</td>
<td>1.23±0.023*</td>
<td>1.45±0.012*</td>
<td>2.54±0.090*</td>
<td>0.850±0.023*</td>
</tr>
<tr>
<td>2</td>
<td>Chlorophyll –b</td>
<td>0.230±0.045</td>
<td>0.530±0.056*</td>
<td>0.670±0.090*</td>
<td>0.850±0.045*</td>
<td>0.990±0.012*</td>
<td>0.201±0.034*</td>
</tr>
<tr>
<td>3</td>
<td>Total Chlorophyll</td>
<td>1.141±0.041</td>
<td>1.52±0.045*</td>
<td>1.90±0.078*</td>
<td>2.30±0.076*</td>
<td>3.53±0.095*</td>
<td>1.050±0.056*</td>
</tr>
<tr>
<td>4</td>
<td>Carotenoid</td>
<td>0.101±0.023</td>
<td>0.115±0.034*</td>
<td>0.120±0.089*</td>
<td>0.125±0.034*</td>
<td>0.250±0.012*</td>
<td>0.098±0.067*</td>
</tr>
<tr>
<td>5</td>
<td>Carbohydrates</td>
<td>42.0±0.065</td>
<td>48.0±0.045*</td>
<td>52.0±0.078*</td>
<td>65.0±0.078*</td>
<td>78.0±0.056*</td>
<td>38.0±0.034*</td>
</tr>
<tr>
<td>6</td>
<td>Protein</td>
<td>23.0±0.034</td>
<td>27.0±0.045*</td>
<td>34.0±0.067*</td>
<td>45.0±0.078*</td>
<td>56.0±0.034*</td>
<td>13.0±0.078*</td>
</tr>
<tr>
<td>7</td>
<td>D.N.A</td>
<td>2.3±0.045</td>
<td>2.5±0.067*</td>
<td>3.6±0.065*</td>
<td>4.5±0.097*</td>
<td>5.9±0.067*</td>
<td>2.2±0.045*</td>
</tr>
<tr>
<td>8</td>
<td>R.N.A</td>
<td>2.5±0.023</td>
<td>2.6±0.067*</td>
<td>2.9±0.076*</td>
<td>3.4±0.023*</td>
<td>5.5±0.067*</td>
<td>1.2±0.023*</td>
</tr>
</tbody>
</table>

*All the values are an average of 10 observations. *p<0.05 significant

The growth of microorganisms (bacteria and fungi) on the saw dust was revealed in Table -2. The biological population (E. coli - CFU X 10^9 gm) was more in the saw dust. The fungal population was observed in more in saw dust (Aspergillus fumigatus (CFU X 10^9 gm)). The growth rate of mesophilic and thermophilic fungi in the tuned pile were mostly parallel to those in the force aerated pile but resulted in overall lower cell counts. These results indicate that composting through force-aerated pile allowed the mesophilic and thermophilic bacteria and fungi to grow better in comparison with the turned pile composting. During decomposition the temperature of the material was raised, which favors the growth of bacteria and fungi during that particular stage of composting. The proliferation of the mesophilic and thermophilic microorganisms during composting is related to the mesophilic and thermophilic stages of the composting system(Diaz-Ravina et al., 1989). Microbial succession plays a key role in the composting process and in the appearance of certain microorganisms that reflect the quality of maturing compost(Ishii et al., 2000).

The combined application of cowdung and saw dust on the growth characteristics of Vigna radiata revealed in table - 3. Amendments with different composition of saw dust and cowdung as constituents influences almost all the growth characters was increased.

The germination percentage effectively of seeds 100 percent in the treatment was E. The shoot length and root length, fresh weight and dry weight, leaf area and vigour Index increased in all the treatment plants. In all the treatment at the end of the different stages of treatment, E was found to be more effective that the others. The combined application of cowdung and saw dust on the biochemical characteristics of Vigna radiata revealed in table - 4. Amendments with different composition of saw dust and cowdung as constituents influences almost all the growth characters was increased.

The chlorophyll-a, chlorophyll – b and total chlorophyll, carotenoids, carbohydrates, protein and nucleic acid content was increased in Treatment – E. Organic materials have always been recognised of physical condition of alkaline soil. Organic materials (FYM, green manure, crop residues, weeds, grasses tree leaves, and low cost agriculture wastes) provide food and energy for microorganism, which help in the formation of stable aggregated by a complex series of polysaccharides synthesised by bacteria. Due to the addition of organic amendments, the bulk density improves the porosity of soil. There are several organic products secreted by microorganisms, which act as a binding material for the soil particles. During the process of decomposition, a lot of carbon- di-oxide and organic acid are produced (Agarwal et al., 1982). CO_2 also forms carbonic acids. The acids solubilise the active CaCO_3 and thereby calcium becomes available for the displacement of exchangeable sodium resulting in reduction of ESP. Besides increasing the solubility of the incorporation of organic acids also improves the fertility of the soil by providing several nutrients to the soil (Agarwal et al., 1982). Ogundiran and Adekunle (2013) reported that the combine application of manure and saw dust at different level does not has significant effect in yield and fruit number of Okra because saw dust is not easily decomposed in the soil but vary figures due to the variation in the quantity of manure and saw dust applied to each ridges. There was no significant difference in the treatment but there is a slight effect on the plant height. According to combine application of manure and saw dust at 10ton/ha has the highest effect on plant height of Okra follow by application of manure and sawdust at 5ton/ha while application of manure and

sawdust at 0 ton/ha has the least effect of plant height of Okra. (Ogundiran and Adekunle, 2013). Based on the finding of the present study, it may be recommended that applying dried cowdung manure was adequate for maximum growth and biochemical parameters studied of crop plants. For the optimum performance of crop plants, under a low input system, an early application of compost manure 5kg on crop planted on heap or bed, depending on the quality of compost will be appropriate for suitable production. More so, these organic materials presently being wasted can be converted to wealth by using them as organic fertilizers.

REFERENCES


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