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# Bioconversion of Garbage: Garden Waste (GW); Kitchen Waste (KW) and Combination of Both Garbage: Garden Waste and Kitchen (GW +KW) into Vermicompost through the use of earthworm, Eisenia fetida (L).

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## ABSTRACT

The present attempt deals with analysis of conversion potential of earthworm, Eisenia fetida (L) through the use of Garbage (Garden waste) (GW), Kitchen Waste (KW) and combination of both (GW + KW ). The Garbage (Garden waste) (GW); Kitchen Waste (KW) and combination of both (GW + KW ) were subjected for recycling through vermicomposting through the using the epigeic earthworm, Eisenia fetida (L) under laboratory conditions. The parameters of analysis include: pH, moisture content, total organic carbon, humus, nitrogen, phosphorous and potassium in vermicompost. The moisture content, total organic carbon, humus, nitrogen, phosphorous and potassium of vwas high in the vermicompost derived from combination of both (GW + KW ) , followed by kitchen waste (KW) and garden waste (GW). This attempt is demonstrating, the potential of earthworm species and the type of wastes utilized. Role of soil microbes and earthworms are responsible for the recycling and biochemical degradation of organic matter. The earthworms are the important ecological drivers for the process by conditioning the substrate and altering the biological activity. However, the quality of the end product vary according to the composition of the initial mixture being processed.

**Keywords :** Garbage, Garden Waste (GW), Kitchen Waste (KW), Vermicomposting, Eisenia fetida (L).

## I. INTRODUCTION

The disposal of organic wastes is a serious problem all over the world. The efficient disposal and management of organic solid wastes has become more rigorous. This is due to rapidly increasing population, intensive agriculture and industrialization. It requires a sustainable approach in cost effective manner for the disposal problems caused by the production of large quantities of organic waste all over the world (Edwards and Bater, 1992). It is prime concern for maintaining healthy environment (Senapati and Julka, 1993).

Vermitechnology or vercomposting is considered as a potential option in the hierarchy of integrated solid waste management. It involves the stabilization of organic material by the joint action of earthworms and the soil microbials. Role of earthworms is serving a lot Although for the biochemical degradation of organic matter. The earthworms are the important drivers of the process by conditioning the substrate and altering the biological activity (Aira et al., 2007). According to Singh, et al (2010), the time of processing organic waste and quality of the end product in the form of vermicompost (or vermiwash) vary according to the composition of the initial mixture of the waste. That is to say, the quality of vermicompost is the result of the quality of the waste utilized. The paper waste have been already vermicomposted and turned into nutrient rich manure is well established concept in the disposal of industrial wastes (Elvira et al., 1998; Kaur et al., 2010). Same is true for textile mill sludge (Garg and Kaushik, 2005), guar gum industrial waste (Suthar, 2006), sugar industry wastes (Sen and Chandra, 2007), distillery sludge (Suthar and Singh, 2008), leather industry (Ravindran et al., 2008) and beverage industry sludge (Singh et al., 2010), agroindustrial sludge (Suthar, 2010), primary sewage sludge (Hait and Tare, 2011), and tannery industries (Ravindran and Sekaran, 2011). Vermicomposting deserve impressive effects with reference to the growth of various field crops (Mamta et al., 2012). There are many methods (physical, chemical and microbiological) for the disposal of organic solid wastes. Most of these methods are of high cost and time consuming. Hence, there is a need to find out alternative cost-effective paying shorter duration particularly suited to Indian conditions. In this reference, use of earthworms for vermicomposting has been reported to be a viable, cost-effective and rapid technique for the efficient management of the organic solid wastes (Hand et al., 1988; Raymond et al., 1988; Harris et al., 1990; Logsdson, 1994). Several other attempts of studies have demonstrated the ability of some earthworm species to consume a wide range of organic wastes such as sewage sludge, animal dung, crop residues and industrial refuse (Mitchell et al., 1980; Chan and Griffiths, 1988; Hartenstein and Bisesi, 1989; Edwards, 1998). Species of earthworms use to fragment the waste substrate and accelerate the rate of decomposition of the organic matter, leading to a composting effect through which unstabilized organic matter becomes stabilized. The vermicompost has more available nutrients per kg weight than the organic substrate from which it is produced (Buchanam et al., 1988). The biological activity of earthworms provides nutrient rich vermicompost for plant growth thus facilitating the transfer of nutrients to plants (Ismail, 2000).

Keeping in view the facts, the present attempt on vercomposting trial has been planned. The objectives of the attempt include: to assess the potential of Eisenia foetida in composting the different types of organic substrates in the form of garbage: Garden Waste (GW) and Kithhen Waste (KW).

## II. MATERIAL AND METHODS

The attempt was carried out through the steps like: Maintenance of earthworms; Preparations for vermin-bed; Inoculation of vermibeds with earthworms; Analysis of parameters and Statistical Analysis of the data through Statistical methods.

### (A). Maintenance of Earthworms:

Young and non-clitellted earthworms species, Eisenia fetida (L) were collected from the vermiculture unit at Malegaon Sheti Farm of Agricultural Development Trust, Baramati. in laboratory of department of Zoology, Shardabai Pawar Mahila Mahavidyalaya, Shardanagar, Baramati (India) through standard methods prescribed by Vitthalrao B. Khyade and Sharad G. Jagtap (2016). They were maintained in separate plastic tubs containing soil, cow dung and decayed leaf litters in the ratio of 1:4:2. The earthworms were kept in the laboratory made condition for a minimum of ten days in order to allow them to adapt to experimental conditions (28 ± 2°C) and to get acclimatization of the laboratory condition.

### (B). Vermibed Preparation:

The black soil was collected from the maize crop field just along side of the road to Malegaon Sheti Farm of Agricultural Development Trust, Baramati. The weight of soil was recorded. The garbage: garden waste (GW) and kitchen waste (KW) were collected from the waste bin (Just near the college garden) and Kitchen of Karmveer Hostel respectively. Both the wastes were subjected for air drying at room temperature. Air drying allow the waste to become free from unwanted gases and normalize the temperature. The weight of garbage: garden waste

(GW) and kitchen waste (KW) were recorded. Four trays of vermicomposting were taken. One kilograms of soil was taken in each tray. The air dried garden waste: Garbage (in the form of leaf litter) of one kilograms was well mixed with soil in one of the tray and labeled it as GW. The air dried kitchen waste of one kilograms was well mixed with soil in another tray and labeled it as KW. For the third tray, half kilograms of kitchen waste and half kilograms of garbage: garden waste were mixed and this tray was labeled as GW + KW. The fourth tray was for the control. In this fourth tray normal soil of on kilograms was mixed. Thus, totally four trays were prepared. Daily, on each day, early in morning, at 8.00 a.m. water of one liter was sprinkled. This water sprinkling was carried out for ten days continuously.

They were maintained in separate plastic tubs containing soil, cow dung and decayed leaf litters in the ratio of 1:4:2. The earthworms were kept in the laboratory made condition for a minimum of ten days in order to allow them to adapt to experimental conditions (28 ± 2°C) and to get acclimatization of the laboratory condition.

**(C). Inoculation of Vermibeds with earthworms:**

Two hundred eartworms of Eisenia fetida (L) species were selected randomly from the stock. They were divided into four groups, each with fifty individuals. Fifty earthworms were transferred into the tray labeled with GW. Another set of fifty earthworms was transferred into the tray labeled with KW. The tray labeled with GW + KW was received fifty earthworms. The control tray was also received fifty earthworms. All the four trays of experimentation were kept in laboratory. All the sets were maintained at 25 ± 1 °C . According to Reinecke et al. (1992), 25 ± 1 °C is the optimum temperature range for the growth of Eisena foetida (L). All the four sets (GW; KW; GW+KW and Control) were maintained for sixty days.

**(D). Analysis of parameters:**

After sixty days, five samples of vermicompost from each group were collected in a separate dry beaker. Beakers were labeled as GW; KW; GW+KW and Control. The pH of the vermicompost from each group was determined separately in double distilled water suspension of each concentration in the ratio of 1:10 (w/v) using digital meter-LNK-VI-8611 SYSTRONICS. Total Kjeldahl nitrogen (TKN) was measured through Micro-Kjeldhal method prescribed by Bremner and Mulvaney (1982) after digesting the sample in digestion mixture (H2SO4 + K2–So4:CuSo4:SeO2 in 10:4:1). For the purpose to measure total potassium TK), John method (1970) was employed. The same John method was used for measuring total available phosphorous (TAP) through the use of Systronics Flame photometer-128 and UV–Visible Spectrophotometer, respectively after digesting the samples in diacid mixture (HClO4:HNO3 in 4:1 ratio). Total organic carbon (TOC) was measured after igniting the sample in a Muffle furnace at 550 °C for 60 min by the method of Nelson and Sommers (1996).

**(E). Analysis of the data through Statistical methods:**

The whole experimentation was repeated for three times. This was for the purpose to obtain consistency in the results. The data obtained was subjected for analysis through employing the statistical methods. The maen; standard deviation and t – test were employed for analysis. Pearson's coefficient of correlation was used to correlate the relationship between different parameters. Results of all experiments were analyzed by one way analysis of variance (ANOVA) with Duncan's multiple range test for comparison of the significance level (P) between the means of different wastes. A $P \leqslant 0.05$ value was considered a significant difference between the values compared.

## III. RESULTS AND DISCUSSION

The results on bioconversion of garbage: garden waste (GW), kitchen waste (KW) and combination of both garbage: garden waste and Kitchen (GW +KW) into Vermicompost through the use of earthworm, Eisenia

fetida (L) are summarized in table – 1 ; Figure – 1 to 7
and explained parameter-wise.

**Table 1.** The physio-chemical parameters of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L).

| Parameter Group | pH | MC | TOC | Humus | Nitrogen | Phosporus | Potassium |
|---|---|---|---|---|---|---|---|
| Control | 6.9 (± 0.08) | 1.089 (± 0.786) | 8.653 (± 2.837) | 39.897 (± 7.786) | 1.027 (± 0.663) | 0.116 (± 0.048) | 0.571 (± 0.033) |
| Garbage (GW) | 6.3 (± 0.07) | 2.811 ( ± 0.21) | 21.831 (± 0.26) | 68.901 (± 0.92) | 1.041 (± 0.08) | 0.382 (± 0.051) | 0.661 (± 0.032) |
| Kitchen Waste (KW) | 7.3 (± 0.05) | 3.221 (± 0.09) | 23.411 (± 0 .32) | 64.011 (± 2.001) | 1.313 (± 0.02) | 0.512 (± 0.0321) | 1.021 (± 0. 191) |
| Combination (GW + KW ) | 8.2 (± 0.07) | 2.722 (± 0.042 ) | 38.401 ( ± 1.17) | 64.108 (± 0.941) | 1.971 ( ± 0.09) | 0.631 ( ± 0.032) | 0.882 ( ± 0.183) |

MC: Moisture Content; TOC: Total Organic Carbon;

All values are in mean ± 1 S.E. Values bearing different superscripted alphabets differ from each other at $P \leqslant 0.05$ (based on Duncan's multiple range test). Data are expressed as M ± 1 SEM; values with different superscripts differ from each other at $P \leqslant .05$, values with the same superscripts do not differ from each other at $P \leqslant .05$ (based on Duncan's multiple range test).

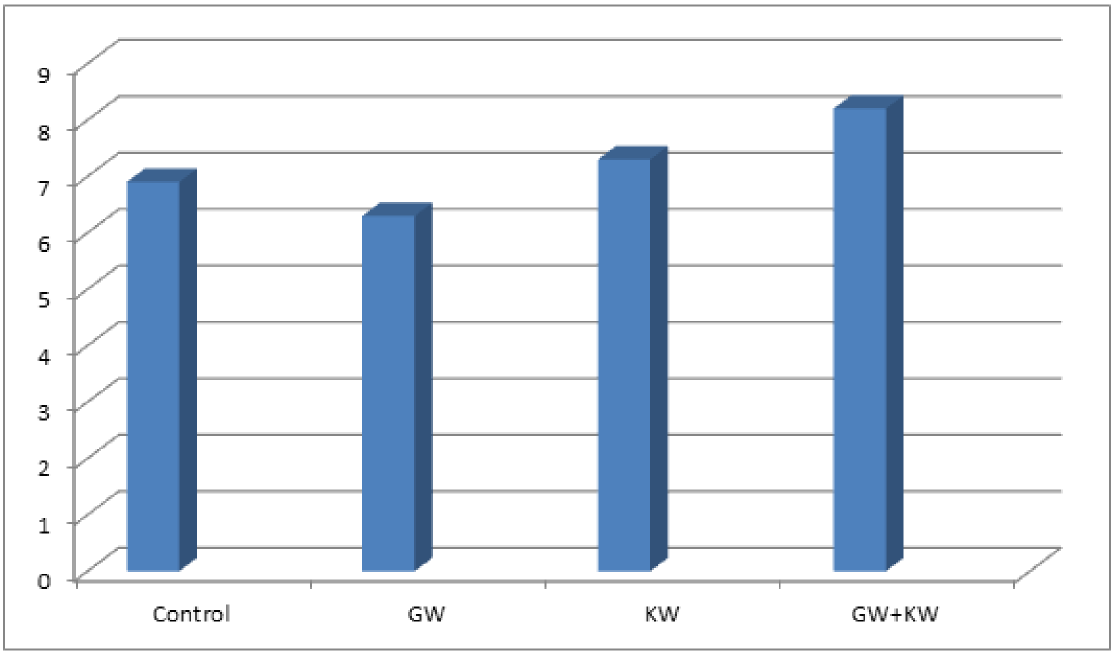


**Figure 1.** The pH of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage: Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L).

**(A). The pH of Vermicompost derived from from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L):**

The vermicompost from garbage: garden waste (GW); kitchen waste (KW) and combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L) in the present attempt exhibited similar pattern of change in pH. The pH of vermicompost of control; GW; KW and GW+KW trays was measured 6.9 (± 0.08); 6.7 (± 0.07); 7.3 (± 0.05) and 8.2 (± 0.07) respectively (Table – 1 and Figure 1). The pH readings of vermicompost from all the four trays seems to be within the optimal range. It shows a shift from the initial acidic condition towards the neutral condition. The range of pH for optimal growth of field crops is 7 – 8 (Goh and Haynes, 1977). There is a significant difference ($P > 0.05$) in the values of pH was found between the values of garbage: garden waste (GW) and kitchen waste (KW); garbage: garden waste (GW) and Combination of both Garden waste and Kitchen Waste (GW+KW). According to Ndegwa and Thompson (2000), the process of mineralization of nitrogen and phosphorus into nitrites/nitrates and orthophosphates and there by bioconversion of the organic material into intermediate species of organic acids may be responsible for decrease in the pH of the soil contents (Ndegwa and Thompson, 2000).

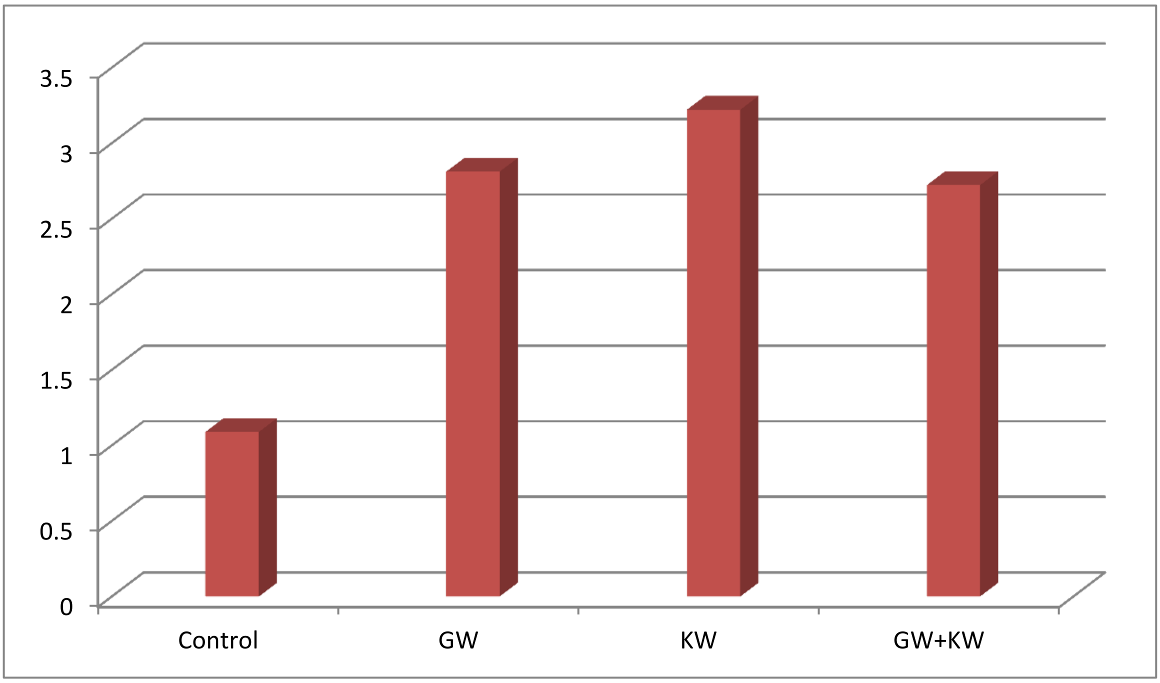


**Figure 2.** The Moisture Contents (MC) of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage: Garden waste and Kitchen Waste (GW + KW ) through the earthworm, *Eisenia fetida (L).*

**(B). The Moisture Contents of Vermicompost derived from from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage: Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L):**

The moisture content of soil is playing a crucial role in growth of soil organisms including earthworms. The growth rate of earthworm deserve definite pattern. It is assumed that moisture was appropriate for earthworm growth. The Moisture Contents of Vermicompost derived from from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage: Garden waste and Kitchen Waste (GW + KW ) through the earthworm, *Eisenia fetida (L), in the present attempt was found measured 1.089* (± 0.786)*; 2.811*( ± 0.21)*; 3.221*(± 0.09) *and 2.722* 722 (± 0.042) *respectively (Table-1 and Fig. 2).* A significant difference ($P > 0.05$) in the values of moisture content was found among the groups in the present attempt. The growth rate of earthworms has been related to moisture. The optimal humidity range for *E. fetida* has been reported to be between 60% and 90%, with the fastest growth rate at 80–90% humidity. Low moisture conditions may also delay sexual development; it was found that earthworms of the same age developed clitella at different times under different moisture conditions (Dominguez et al., 2001). The moisture content of vermicompost derived from garbage: garden waste (GW) exhibited a positive correlation with total organic carbon (0.3564), humus (0.4944), total nitrogen (0.0735), total phosphorus (0.2114). And it exhibited a negative correlation with potash (–0.0285). The moisture content of the kitchen compost showed a positive correlation with total organic carbon (0.2586), total phosphorus (0.552), potash (0.4865); whereas it exhibited a negative correlation with humus (–0.2417), total nitrogen (–6.954) and the moisture content of combination (GW+KW) compost showed a positive correlation with total organic carbon (0.2865), humus (0.0658), potash (0.8901).whereas it exhibited negative correlation with total nitrogen (–0.4815), and total phosphorus (–0.3819).

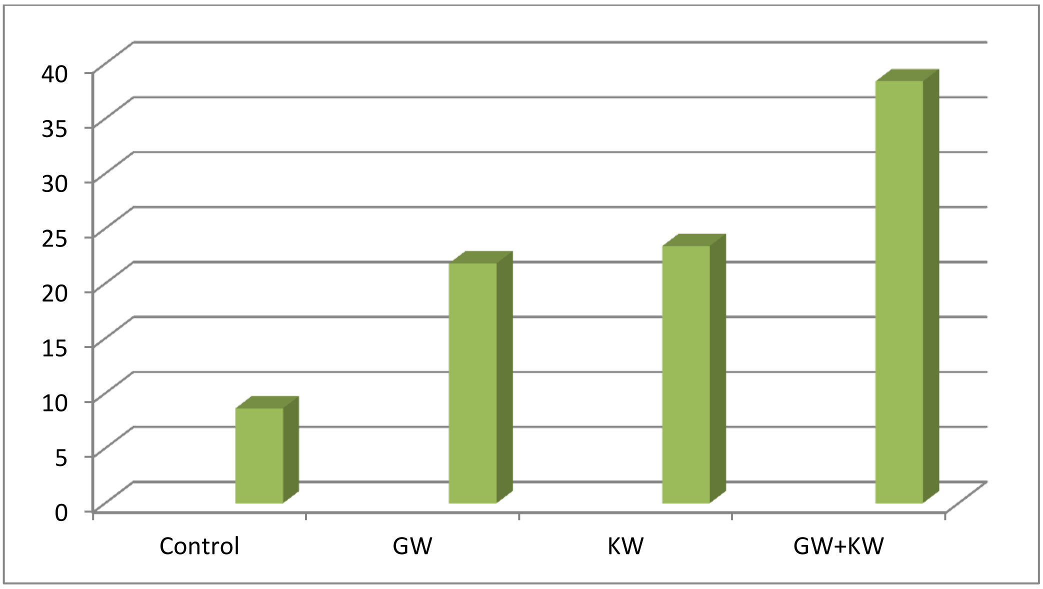


**Figure 3.** The Total Organic Carbon (TOC) content of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage: Garden waste and Kitchen Waste (GW + KW ) through the earthworm, *Eisenia fetida (L).*

**(C). The Total Organic Carbon Contents (TOC) of Vermicompost derived from from recycling Garbage - Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L):**

There is possibility of consumption of the available carbon as a source of energy by the earthworms and the microorganisms. It may have decreased the large fraction of TOC in the form of CO2. The Total Organic Carbon Contents (TOC) of Vermicompost derived from from recycling Garbage - Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L) in present attempt was found measured 8.653(± 2.837); 21.831(± 0.26); 23.411(± 0.32) and 38.401( ± 1.17) units respectively (Table-1 and Fig. 3). A significant difference ($P > 0.05$) in the values of TOC was found between the values of garden waste (GW) and kitchen waste (KW); garden waste and combination (GW+KW); kitchen waste (KW) and combination (GW+KW). Kaviraj and Sharma (2003) reported the reduction of Total Organic Carbon into CO2 during vermicomposting of the waste collected by municipal and industrial wastes. The total organic carbon of the composting the garden waste exhibited a significant negative correlation with humus (–0.1499), total nitrogen (–0.2454), and total phosphorus (–0.3732), whereas it exhibited a positive correlation with potash (0.7334). The total organic carbon of the kitchen compost showed a significant positive correlation with total phosphorus (0.7897), potash (0.3987), whereas it exhibited a negative correlation with humus (–0.3076), total nitrogen (0.0261) and the total organic carbon of cow dung compost showed a significant positive correlation with total nitrogen (0.2149), potash (0.3907), whereas it exhibited negative correlation with humus (–0.1867), total phosphorus (–0.2362).

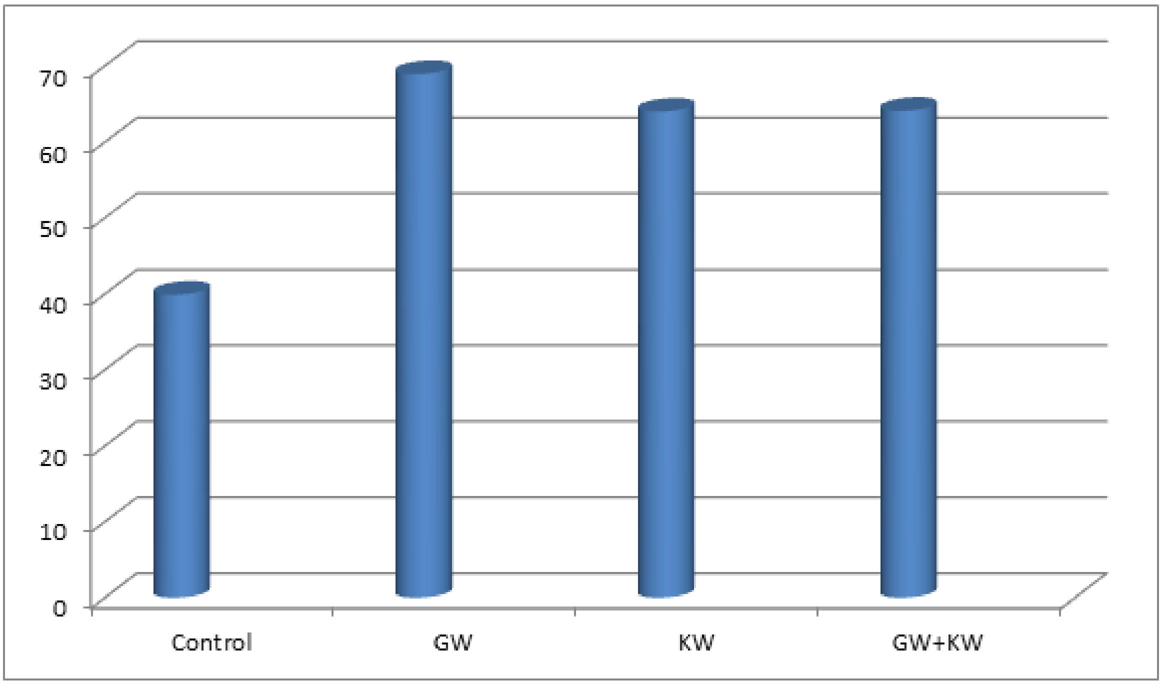


**Figure 4.** The Humus content of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L).

**(D). The Humus Contents of Vermicompost derived from from recycling Garbage - Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L):**

About one-fourth of the organic matter in the soil is converted into humus through soil microbials. The growth of plants is very influenced by the humic acid (Atiyeh et al., 2002). According to Tomati, et al (1983), Colloidal humus acts as 'slow release fertilizer' in the soil (Tomati et al., 1983). Humus Contents of Vermicompost derived from from recycling Garbage - Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L) in present study was found measured 39.897 (± 7.786); 68.901 (± 0.92); 64.011 (± 2.001) and 64.108 (± 0.941) units respectively (Table – 1 and Fig. 4). Humus content was highest in the kitchen waste (KW) (68.901 ± 0.92) followed by the combination of garden waste and Kitchen waste (GW+KW) (64.108 ± 0.941). There was significant difference ($P > 0.05$) in the values of humus was found between the values of garden waste (GW) and kitchen waste (KW); garden waste (GW) and combination of garden waste and Kitchen waste (GW+KW). No significant difference ($P > 0.05$) was observed between the values of kitchen waste (KW) and combination of garden waste and Kitchen waste (GW+KW).

According to (Bhawalkar and Bhawalkar, 1993), the prolific activity of earthworms ingested organic matter up to 12 tonnes/ha/year soil or is by this population, leading to the upturning of 18 tons of soil per year. The humus of the garden compost showed significant positive correlation with total nitrogen (0.4294), total phosphorus (0.8148), whereas it exhibited a negative correlation with potash (–0.2613). The humus of the kitchen compost showed a significant positive correlation with total nitrogen (0.3821), whereas it exhibited a negative correlation with total phosphorus (–0.3883), potash (–0.4358). The humus of combination of garden waste and kitchen waste (GW+KW) showed a significant positive correlation with potash (0.0551). It exhibited a negative correlation with total nitrogen (–0.3613), total phosphorus (–0.3012).

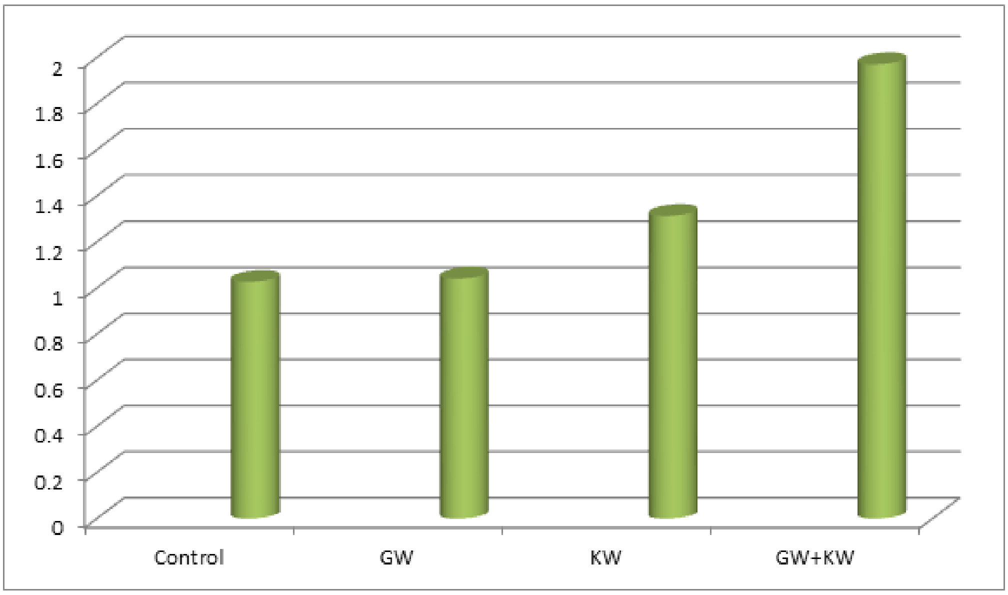


**Figure 5.** The Nitrogen content of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, *Eisenia fetida (L).*

(E). The Total Nitrogen Contents of Vermicompost derived from from recycling Garbage - Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L): Nitrogen is a key element in plant growth. It is found in all plant cells, in plant proteins and hormones, and in chlorophyll. Atmospheric nitrogen is a source of soil nitrogen. Some plants such as legumes fix atmospheric nitrogen in their roots; otherwise fertiliser factories use nitrogen from the air to make ammonium sulfate, ammonium nitrate and urea. When applied to soil, nitrogen is converted to mineral form, nitrate, so that plants can take it up. Soils high in organic matter such as chocolate soils are generally higher in nitrogen than podzolic soils. Nitrate is easily leached out of soil by heavy rain, resulting in soil acidification. It need to apply nitrogen in small amounts often so that plants use all of it, or in organic form such as composted manure, so that leaching is reduced. Total Nitrogenis an essential nutrient for plants and animals. However, an excess amount of nitrogen in a waterway may lead to low levels of dissolved oxygen and negatively alter various plant life and organisms. Sources of nitrogen include: wastewater treatment plants, runoff from fertilized lawns and croplands, failing septic systems, runoff from animal manure and storage areas, and industrial discharges that contain corrosion inhibitors.

Total Nitrogen (TN) consists of the inorganic forms of nitrogen $NH_4$–N and $NO_3$–N. Present attempt is reporting highest total nitrogen (TN) content (1.971 ± 0.09) in vermicompost derived from the combination of garden waste and kitchen waste (GW+KW). It was followed by kitchen waste (KW) vermicompost measuring 1.313 (± 0.02) and garden waste, measuring about 1.041 (± 0.08), respectively (Table 1 and Fig. 5). There was a significant difference ($P > 0.05$) in the values of nitrogen was found between the values of garden waste (GW) and kitchen waste (KW); garden waste (GW) and combination of garden waste and kitchen waste (GW+KW); kitchen waste (KW) and combination of garden waste and kitchen waste (GW+KW). Increase in nitrogen content in the final product in the form of mucus, nitrogenous excretory substances, growth stimulating hormones and enzymes from earthworms have also been reported (Tripathi and Bhardwaj, 2004). The loss in organic carbon might be responsible for nitrogen enhancement Viel et al. (1987). The mineral nitrogen may be retained in the nitrate form by nitrogen transformations by earthworms in manure, by enhancing nitrogen mineralization, Atiyeh et al. (2000). It has been found that the final N content of the compost is dependent on the initial N present in the waste and the extent of decomposition (Crawford, 1983; Gaur and Singh, 1995). The total nitrogen of garden compost showed significant positive correlation with total phosphorus (0.4433), whereas it exhibited negative correlation with potash (–0.4223). The total nitrogen of kitchen compost showed significant negative correlation with total phosphorus (–0.1917), potash (–0.1828) and the total nitrogen of cow dung showed a significant positive correlation with total phosphorus (0.7338), whereas it exhibited negative correlation with potash (–0.1829).

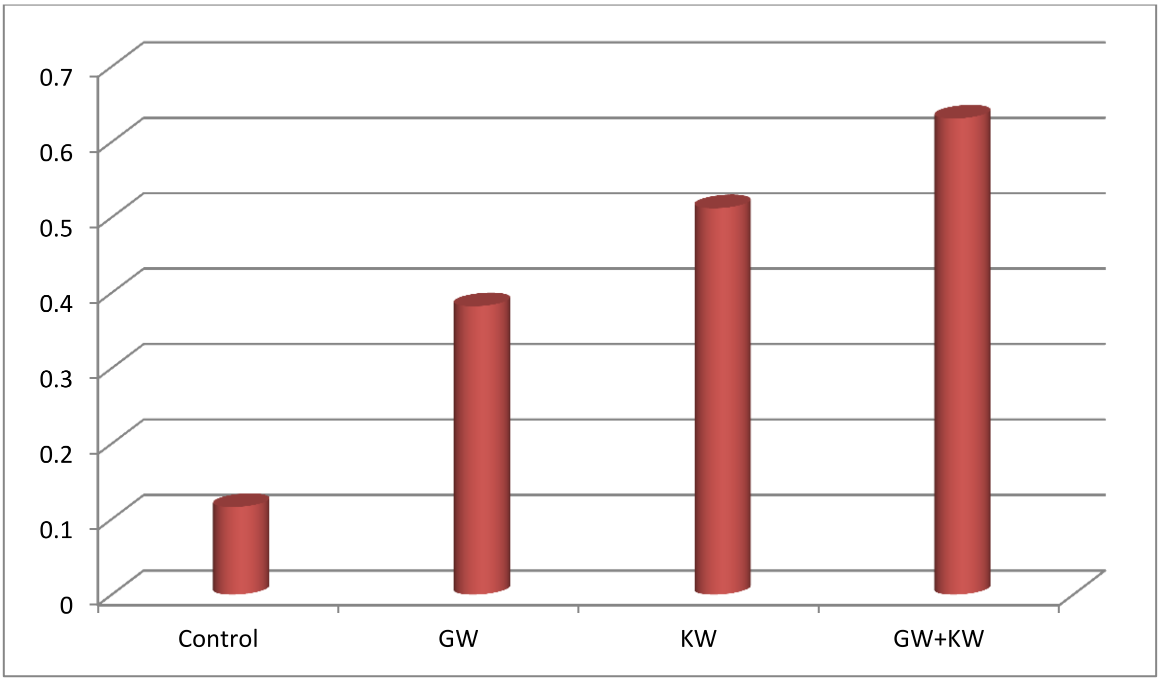


**Figure 6.** The Phosphorus content of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, *Eisenia fetida (L).*

**(F). The Total Phosphorus Contents of Vermicompost derived from from recycling Garbage - Garden waste (GW);** Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L): Phosphorus helps transfer energy from sunlight to plants, stimulates early root and plant growth, and hastens maturity. Very few Australian soils have enough phosphorus for sustained crop and pasture production and the North Coast is no exception. The most common phosphorus source on the North Coast is superphosphate, made from rock phosphate and sulfuric acid. All manures contain phosphorus; manure from grain-fed animals is a particularly rich source. The present attempt is reporting higher total phosphorus in vermicompost derived from combination of garden waste and kitchen waste (GW+KW) (0.631 ± 0.032) as compared to kitchen waste (KW) (0.512 ± 0.0321) and garden waste (GW) (0.382 ± 0.051) (Table- 1 and Fig. 6). Further, the study is reporting significant difference ($P > 0.05$) in the values of phosphorus between the values of garden waste (GW), kitchen waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ). Increase in total phosphorus (TP) during the process of vermicomposting is probably through mineralization and mobilization of phosphorus by bacterial and phosphatase activities of earthworms (Edwards and Lofty, 1972). Mansell et al. (1981) reported that plant litter was found to contain more available P after ingestion by earthworms, which may be due to the physical breakdown of the plant material by worms. Satchell and Martein (1984) also reported an increase of 25% in P of paper waste sludge, after worm activity. They attributed this increase in P to the direct action of worm gut enzymes and indirectly by stimulation of the microflora. Increase in TP during vermicomposting is probably due to mineralization and mobilization of phosphorus as a result of bacterial and fecal phosphatase activity of earthworms (Edwards and Lofty, 1972). The total phosphorus of garden compost showed negative correlation with potash (–0.6246) and the total phosphorus of the kitchen compost showed positive correlation with potash (0.7695) however, the total phosphorus of cow dung compost showed negative correlation with potash (–0.7203).

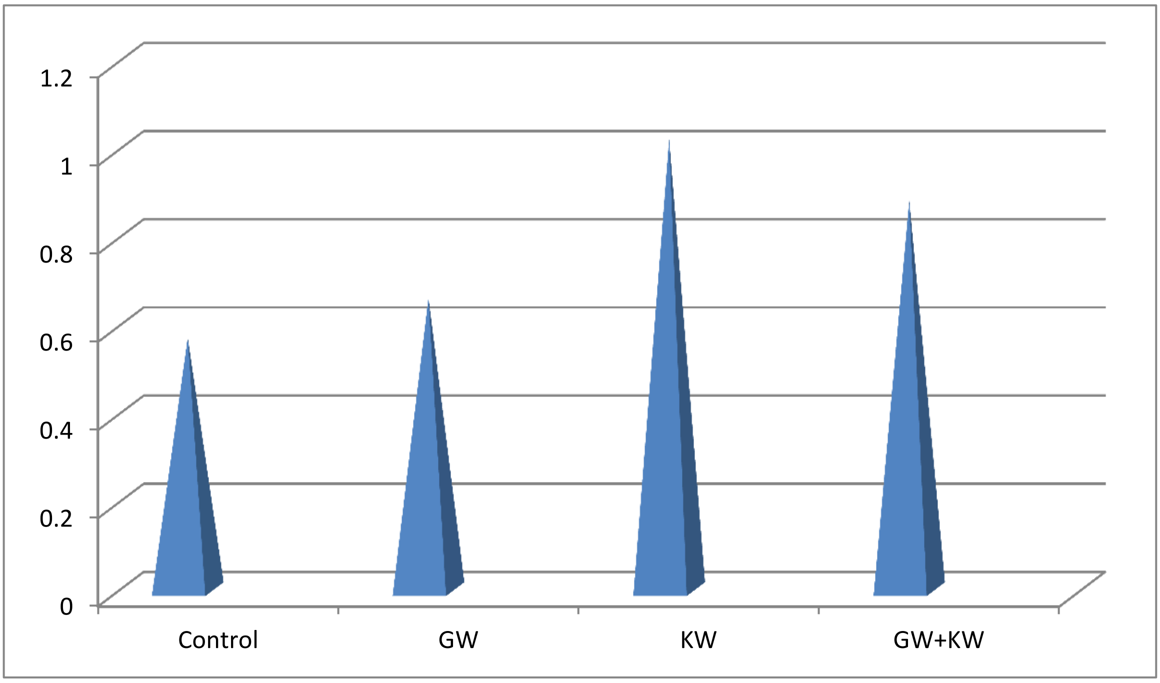


**Figure 7.** The Potassium content of Vermicompost derived from recycling Garbage: Garden waste (GW); Kitchen Waste (KW) and the combination of both Garbage:Garden waste and Kitchen Waste (GW + KW ) through the earthworm, *Eisenia fetida (L).*

**(G). The Total Potassium Contents of Vermicompost derived from from recycling Garbage - Garden waste (GW);** Kitchen Waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) through the earthworm, Eisenia fetida (L): Potassium increases vigour and disease resistance of plants, helps form and move starches, sugars and oils in plants, and can improve fruit quality. Potassium is low or deficient on many of the sandier soils of the North Coast. Also, heavy potassium removal can occur on soils used for intensive grazing and intensive horticultural crops (such as bananas and custard apples). Muriate of potash and sulfate of potash are the most common sources of potassium. Data of present attempt reveal that total potassium increase was significantly higher (1.021 ± 0.191) in kitchen waste (KW) as compared to the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ) (0.882± 0.183 ) and garden waste (GW) (0.661 ± 0.032) (Table – 1 and Fig. 7) during our study. There was significant difference ($P > 0.05$) in the values of potassium was found between the values of garden waste (GW) and kitchen waste (KW). No significant difference ($P > 0.05$) was found between the values of garden waste (GW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ), kitchen waste (KW) and the combination of both Garbage-Garden waste and Kitchen Waste (GW + KW ). The available Micro-nutrients like potassium (K) are required for assimilation by earthworms during the vermicomposting, although the quantity required is very low as compared to the initial content present in the parent feed material. The production of acids by the microorganisms and enhanced mineralization rate through increased microbial activity during the vermicomposting process play a key role in the solubilizing of insoluble potassium (Kaviraj and Sharma, 2003; Khwairakpam and Bhargava, 2009).

## IV. CONCLUSION

The utilization of earthworms for the conversion of different types of wastes into compost is going to orchestrate the progression of eco-friendly economic prosperity for the farmers. It deserve the environmental security. The use of Eisenia fetida (L), epigeic species of earthworm for vermicomposting of garden waste (GW); kitchen waste (KW); combination of both garden waste, kitchen waste (GW+KW) on the basis of nutrient content is significant indication of reducing the burden of synthetic fertilizers. The present attempt tried it's best to demonstrate the simple for of research to be carried out with minimum efforts.

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