International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

ISSN 2347-2677
IJFBS 2020; 7(1): 96-104
Received: 16-11-2019
Accepted: 18-12-2019

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Management of sugarcane trash and coal fly ash through vermi biotechnology

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Abstract
In India, coal fly ash and sugarcane trash are produced in large quantities and the storage or spreading of this waste on land causes contamination of the atmosphere, soil and water. The aim of this study was to convert (CFA) and sugarcane trash (ST) mixed with cow dung (CD) into vermicompost using an epigeous earthworm *Eisenia fetida* (red worm). Five treatments containing CD, CFA and ST in different ratios namely CFA: ST: CD in 1:1:8 ratio (T_1), CFA: ST: CD in 2:2:6 ratio (T_2), CFA: ST: CD in 3:3:4 ratio (T_3), CFA: ST: CD in 4:3:3 ratio (T_4) and CFA: ST: CD in 3:4:3 ratio (T_5) were run under laboratory conditions. The physicochemical changes of substrate materials in different treatments were measured at the end of vermicomposting (90 days). The vermicompost material showed decrease in Total Organic Carbon (TOC) (10.8-28.3g kg^1), pH (9.2-11.6) and Total Potassium (TK) (9.0-22.5g kg^1) and increase in Electrical Conductivity (EC) (12.6-14.1mS cm^{-1})), Total Kjeldhal Nitrogen (TKN) (33.3-95.2g kg^1) as well as Total Phosphorus (TP) (56.5-87.8g kg^1) contents. *Eisenia fetida* showed better growth performance in T1 treatment also worms grew favourably in T_2 and T_3 treatment. Greater proportion of CFA and ST in T_4 and T_5 treatment significantly reduces (p<0.05) the growth and reproduction rate of *Eisenia fetida* during experimentation. This study clearly indicates that CFA and ST could be potentially used as raw substrate in vermicomposting if mixed with CD in 1:1:8, 2:2:6 and 3:3:4 ratios, respectively. It was further found that vermicompost obtained by below method was rich in Sodium, Calcium, Magnesium content i.e. 33.5, 23.3 and 19.9 (g kg^1) respectively, while it was also rich in some micronutrients i.e. Iron, Zinc, Manganese (Mn), Copper (Cu), and content i.e. 1064, 169, 402and 165 ppm respectively. Thus, vermicomposting of coal fly ash and sugarcane trash is a cheap, excellent and ecofriendly method of sugarcane waste management.

Keywords: Sugarcane trash, coal fly ash, earthworm, nutrient changes growth, micronutrients

Introduction

The protected transfer and natural well-disposed administration of natural strong squanders have become a worldwide need. In India, around 80 million metric huge amounts of coal fly debris is created yearly from warm-power stations with just a minor part utilized now for getting ready blocks, pottery and concretes. Unclaimed coal fly debris involves an extra 100 ha of land every year. Through wastes of time in each blustery season adjoining regions, including rice fields, unavoidably become defiled, and in this manner potentiating grave issues (Mishra *et.al.* 2007) [1]. Coal fly debris, contains silica, aluminum, oxides of iron, magnesium, calcium, chromium, arsenic, lead, zinc, nickel and other dangerous metals (Gupta *et al.* 2005; Pandey *et al.*2010) [2, 3]. Some conceivable agronomic employments of coal fly debris as, a compost (Giedrojc *et al*.1980; Pandey et.al. 2009) [4, 5], a liming material (Hoodgsen *et.al.* 1982) [6] and as a physical correction (Campbell *et.al.* 1983) [7] have been demonstrated. Lower revision levels of coal fly debris caused improvements of both development and yield while antagonistic impacts at elevated levels were watched (Mill operator *et al.* 2000). As indicated by Division of Agribusiness and co-activity, sugarcane generation in India was assessed at 232.3MT during 2004-2005. During the generation procedure significant measures of items, for example, sugarcane junk, bagasse and pressmud are delivered. Sugarcane processes principally utilize actuated ooze process for squander water treatment, which creates colossal amount of slime regularly known as pressmud, (Sangwan *et.al.* 2008) [9]. (Parthasarathi *et al* 2006) [10] has detailed roughly 12 million tons sugarcane refuse is delivered in India yearly. Pressmud, produces extraordinary warmth (65 °C), foul scent and sets aside long effort for normal deterioration (Sen, *et.al* 2007) [11] and its high pace of utilization to soil prompts soil disorder and water contamination (Bhawalkar *et.al.* 1993) [13].

Pressmud has huge compost an incentive as it is a rich wellspring of natural issue, natural carbon, sugar, protein, compounds, micronutrients (Zn, Fe, Cu, Mn, and so forth.) and macronutrients (N, P and K) and higher microbial (Prakash *et.al.* 2010) [10].

In this way, proper coal fly debris and pressmud, the board innovation is wanted which ensures and moderates nature as well as to recoup the supplements present in it. In such manner, vermicomposting has been accounted for to be a reasonable, financially savvy and fast procedure for the productive administration of transfer of agrarian just as modern squanders (Yadav et.al. 2008; Joshi *et.al.* 2010; Rupani *et.al.* 2010; Nath, *et.al.* 2011; Chauhan *et.al.* 2012) [14, 15-18].

Vermicompost is the supplement rich natural excrement came about because of exercises of night crawlers and organisms on biodegradable squanders. The advantageous job of night crawlers was referenced by Darwin (1881) and Aristotle called them as "the digestive system of earth". Vermitechnology is an old idea which began in twentieth century and first vermicompost plant was set up at Holland in 1970.

Goals of the Investigation

The present investigation was done with the accompanying destinations-

i) Disconnection and choice of appropriate worms for generation of vermicompost.
ii) Investigation of bio-squanders for reasonableness as crude material for vermicomposting.
iii) Job of certain environmental factors on the generation of vermicompost.
iv) To think about the development and advancement of certain agrarian yields through utilization of vermicompost.
v) To think about the effect of vermicompost for manageable advancement of soil wellbeing.

Anticipated Outcomes

The advantages are presently being all around acknowledged as night crawlers can add to the administration of various pedoeco systems. Other than this current night crawler's assume following more jobs in sound soils:

- Churn the dirt and make it permeable.
- Improve water invasion rates
- Neutralize soil pH
- Bring up minerals and make accessible a greater amount of plant supplements
- >Buildup nitrogen fixing action
- Compost plant buildups
- Reduce hurtful nematode checks
- Stimulate useful microbial populaces
- Assist epic temperature managing components
- The worm castings (biofertilizers) are all around utilized in economical sericulture,
- Agriculture and waste land recovery.

Vermicomposting in India

Vermitechnology have a tremendous degree in India as there are ceaseless ages of provincial and urban waste biomass other than having immense labor to deal with it. Nonetheless, in India Vermitechnology is still in creating stage. Since over 10 years, formers, agro based enterprises and urban families are refined night crawlers as the natural material for natural waste administration in India (Kale *et al.* 2002) [20]. However, many research labs are engaged with doing research on this angle, lacuna still exists in legitimate advancement of procedures for refined of night crawlers (Kale *et.al.* 2002) [20].

In India, vermiculture is rehearsed primarily for reusing of natural squanders. The mindfulness made among the shaping network, with respect to the lopsidedness made in the supplement status of soil, has driven them to receive innovations to enlarge the breakdown of natural deposits and return them to soil (Kale *et.al.* 1994) [21].

Reasonable conditions for vermicomposting

Movement of worms relies on different natural variables like temperature, light, dampness, pH, natural carbon, precipitation, mugginess and so on. The physical conditions like temperature, dampness and light impact the development and fertility of worm (Evans and Society 1948; Mba CC *et.al.* 1978) [22, 23].

Despite the fact that worms have a wide scope of resilience to different environmental variables they stow ideal action under some perfect conditions. A great part of the writing states that ideal dampness content (MC) in vermicomposting lies somewhere in the range of 80 and 90% (Neuhauser *et al.* 1988; Beetz *et.al.* 1999; Edwards *et.al.* 1998) [14, 25, 26], yet physical and compound contrasts in feed stocks may causes light varieties.

(Reineeke and Venter 1985) [27] noticed that a 5% contrast in dampness content fundamentally influenced clitelhim (sexual organ) improvement in E. fetida. In another investigation, similar creators announced contrasts in dampness inclinations among adolescent and clitellated worms and cover statement (Reineeke and Venter 1987) [28].

Along a moisture slope, 80% of adolescent worms stayed between MC levels of 65%and 70%, though clitellated worms were all the more equally appropriated over MC levels of 60 to 75%. 80% of all cases were stored between 60%and 70% MC. essentially, night crawlers additionally display a mind boggling reaction to changed temperature condition. (Edward and Elevated 1977) depicted a temperature scope of 26 °C to 35 °C as the most reasonable for vermicomposting.

The Greek logician, Aristotle named them the \'Intestine of Earth\'. There are about 3920named types of night crawler so far detailed around the world. In India, up until this point, 509 species, referable to 67 genera and 10 families, have been accounted for (Kale et.al. 1991) [30].

Ecology of worms

Worms are tunneling creatures and structure burrows by truly eating their way through the dirt. The appropriation of night crawlers in soil relies upon factors like soil dampness, accessibility of natural issue and pH of the dirt. They happen in different natural surroundings exceptionally those that are dim and damp. Natural materials like humus, steers fertilizer and kitchen squanders are exceptionally alluring destinations for certain species. Night crawlers are commonly missing or uncommon in soil with an exceptionally coarse surface in soil and high earth substance or soil with pH <4m (Gunathilagraj *et.al.* 1996) [31].

Biology of worms

Worms are long, limited, round and hollow, reciprocally balanced, portioned creatures without bones. The body is dull dark colored, sparkling and secured with sensitive fingernail skin. They weigh around 700-1400mg following 10 weeks. They have a solid gizzard which finely crushes the nourishment (new and rotting plant garbage, living or dead hatchlings and little creatures, and microorganisms and protozoa blended in with earth) to a size of 2-4 microns. They are promiscuous creatures and cross-preparation happens when in doubt. Later the clitella of each worm launch cover where sperms enter to treat the eggs. Up to 3 covers for every worm every week are created. From each case around 10-12 small worms rise.

Material & Methodology

This chapter deals with the detail description of the materials and experimental procedures undertaken for the present investigation.

Collection and preparation of raw materials

Sugarcane trash

This wonder waste is sugarcane trash-the dry leaves of sugarcane crop-which is left in the farms itself after sugarcane harvesting as it has no utility as fodder and generally burnt by farmers, which harms the surrounding air quality substantially.

The sugarcane trashes (ST) especially were collected from the Simbhaoli Sugar Mill, Simbhaoli, Ghaziabad, and Uttar Pradesh, India. Sugarcane trash (ST) were chopped in to small pieces (3-4cm) & kept in shade for 15 days on 30 °C for the removal of noxious gases and extra moisture content before using for the vermicomposting (Sangwan *et al.* 2008) [9].

Cow dung: The cow dung was collected from the local farmer house Ghaziabad, Uttar Pradesh, India.

Coal Fly Ash: Coal fly ash (CFA) was procured from the dumping site of local restaurant Ghaziabad, India.

Collection and identification of earthworm

Earthworms: In the present studies the well-known species of earthworm *Eisenia fetida* (Fig. 1) was obtained from a vermiculture & vermicomposting unit of Bareilly University, Bareilly, and Uttar Pradesh, India. The species were identified at Department of Zoology, Bareilly University. The worms were cultured in mass culture tanks containing cow dung medium in the laboratory and were randomly picked for experimentation.

Earthworm classification

Earthworms are broadly belongs to the invertebrates, its distribution is all over the world. Only a few types are of commercial importance.

Scientific classification	
Kingdom:	Animalia
Phylum:	Annelida
Class:	Clitellata
Order:	Haplotaxida
Family:	Lumbricidae
Genus:	*Eisenia*
Species:	*E. fetida*

Treatment Design: The ST and CD were dried in air at room temperature. CFA was mixed with ST and CD in different ratios in order to produce different treatments (dry weight proportion). The stock culture of the earthworm was maintained in plastic containers using cow dung as growth medium in laboratory condition. This was further used in the vermicomposting experiment. The main physicochemical characteristics of all the three amended materials, i.e., CD, CFA and ST are given in Table 1. The compositions of CFA, ST and CD in different treatments are described in Table. 1




Fig 1: *Eisenia fetida* Fig. 2. Sugarcane trash Fig.3. Coal fly ash Fig. 4 Treatment Design

Table 1: Composition of different treatments used for experiments
Subtrate composition

Treatment	CFA	ST	CD	Ratio
T_1	100g	+ 100g	+ 800g	1:1:8
T_2	200g	+ 200g	+ 600g	2:2:6
T_3	300g	+ 300g	+ 400g	3:3:4
T_4	400g	+ 300g	+ 300g	4:3:3
T_5	300g	+ 400g	+ 300g	3:4:3

Coal Fly ash; sugarcane trash; Cow dung

One kg of substrate material was added to every vertical plastic compartment (Vol. 10L, measurement 38cm, profundity 14cm) for test preliminary. Every one of the medicines were kept for 14 days preceding experimentation for warm adjustment, commencement of microbial debasement and mellowing of substrate material (pre-treating the soil). Twenty clitellated worms, *Eisenia fetida* were immunized into every treatment (after the finish of pre-fertilizing the soil). During the vermicomposting time frame (90 days), the dampness substance of the substrate in every treatment was kept at 70 – 75% by intermittent sprinkling of satisfactory amount of water. The test medicines were kept in triplicate. Every one of the holders were set in a muggy and dim room at a temperature of 28.5±3 °C. 100g of homogenized examples (liberated from night crawlers, cases and hatchlings) of the substrate material were drawn at 0 (introductory) and at 90 days (last item) from every treatment. Day 0 demonstrates the day of immunization of worms. Beginning substrate and vermicompost (last item) were air dried at room temperature and stuffed in sealed shut containers for additional physico-synthetic examination. The adjustments in singular biomass of *Eisenia fetida* in various medicines were dictated by following technique depicted by (Suthar *et al.* 2007b) [32].

Physico-Chemical Analysis

The pH and electrical conductivity (EC) were broke down in a 1:5 (v/v) water separate utilizing a glass cathode. Complete natural carbon (TOC) was estimated utilizing the technique (halfway oxidation) of (Nelson and Sommers 1982) [23]. All out Kjeldhal nitrogen (TKN) was dictated by processing the examples with concentrated H2SO4 and HClO4 (9:1, v/v) by (Bremner and Mulvaney 1982) method. All out phosphorus (TP) was dissected utilizing the technique for (Bansal and Kapoor 2000) [35]. All out potassium (TK) was dictated by fire photometer in the wake of processing the example in diacid blend (Conc. HNO and Conc. HClO (4:1, v/v) (Bansal and Kapoor 2000) [35] and dehydrogenase movement (Casida *et al.* 1964) [36]. Information were oppressed for examination of change (ANOVA) trailed by Tukey's test to separate the huge contrast between various medications for compound parameters, night crawler development. The likelihood levels utilized for measurable hugeness were $p<0.05$ for the tests.

1. The all out populace of night crawlers by aloof strategy (Edwards and Bohlen 1996): physically isolating the worms from the vermicompost.
2. The aggregate sum of the vermicompost delivered (weight in kg).
3. Synthetic investigations utilizing the techniques applied in the dirt research facility of the Mewar Organization of the executives Ghaziabad U.P: pH-H2O utilizing a pH meter; electrical conductivity (EC in mS cm^{-1}) utilizing a conductivity meter; all out natural carbon (TOC in g kg^{-1}) by Titrimetry utilizing the Walkley-Dark strategy; absolute nitrogen (N in g kg^{-1}) utilizing the Kjeldahl strategy; C:N proportion; all out phosphorus (P in g kg^{-1}) dictated by the colorimetric technique utilizing a spectrophotometer; complete potassium (K in g kg^{-1}), all out manganese (Mn in ppm), all out copper (Cu in ppm), all out zinc (Zn in ppm) and all out iron (Fe in g kg^{-1}) by the retention strategy utilizing the Nuclear Assimilation Spectrophotometer (AAS).

The suspensions glass fleece filtrates were utilized for the assurance of pH and electrical conductivity (Garg *et.al.* 2006) [38]. Colorimetric estimation of complete phosphorus and fire photometer assurance of absolute potassium, sodium was finished by following the strategy for (Bansal and Kapoor 2000) [35]. Calcium and Magnesium were evaluated by EDTA titration strategy (Flautist *et.al.* 1966). Every other micronutrient was broke down by fire nuclear retention spectrometry (Perkin Elmer Nuclear Ingestion Spectrophotometer) in the wake of separating the concentrates got from the absorption of the remains with 3N HCl. The obtained information were communicated as mean ±SD of 3 duplicates. Two path examination of fluctuation (ANOVA) was applied to decide any noteworthy ($P<0.05$) distinction among the parameters watched.

Chemical analysis of harvested vermicompost:

The physicochemical qualities of the gathered vermicompost were broke down by standard techniques (Trivedy *et al.* 1987; APHA *et.al*. 1998) [40, 41]. the subtleties procedures of the contemplated parameters are referenced underneath in result and talk.

Results & Discussion

Physico-chemical changes during Vermicomposting

Physico-substance qualities of the underlying feed blends and vermicompost following 90 days of vermicomposting are exhibited in Table 2: A decline in pH was recorded in all medicines (T_1-T_5) during vermicomposting. The most extreme decrease for pH (when contrasted with starting qualities) was in T_1 and least in T_4. Different creators have discovered comparable outcomes in vermicomposting tests and have recommended that the mineralization of nitrogen and phosphorus exacerbates, the arrival of CO2 and natural acids by microbial digestion and the generation of humic and fulvic acids, as conceivable reason for the abatement in pH (Gunadi and Edwards 2003; Sangwan *et al*. 2008) [42, 9]. The adjustments in pH during the investigation could be because of microbial disintegration during the procedure of vermicomposting. TOC of the last vermicompost was altogether ($P<0.05$) decreased toward the finish of the test, when contrasted with the underlying feed blends (Table 2). The most extreme decrease in TOC was for T_1 treatment (lower than starting worth) trailed by T_2, T_3 T_5 and T_4. The outcomes got in this investigation propose that net natural issue adjustment in the substrate material was because of joined activity of worms and microorganisms. A high TOC misfortune design in T_1, T_2 and T_3 treatment could be credited to the fast microbial breath rate during vermicomposting (Gupta and Garg, 2008) [43]. The watched outcomes are bolstered by those of different creators (Yadav *et al.* 2008; Khawairakpam and Bhargava 2009) [14, 4], who have announced a noteworthy decrease in natural carbon in night crawler handled substrate material toward the finish of vermicomposting period.

The natural carbon (TOC) was declined (444.55 to 348.21 (g kg^{-1}) during this period. Most extreme decrease in TOC might be because of the respiratory movement of night crawlers and microorganisms (Curry *et al.* 1995) [45]. Worms alter the substrate condition which thus advances the carbon misfortunes from the substrate through microbial breath in type of CO2 and even through mineralization of natural issue (Bansal and Kapoor 2000) [35]. The watched outcomes are bolstered by those of different scientists (Kaviraj and Sharma 2003, Khwairakpam and Bhargava 2009; Vasanthi *et al.* 2011) [44, 47] who have announced 20-45% and 40-half decrease of TOC as CO2 during vermicomposting of city or mechanical squanders and channel mud separately.

The EC was expanded in the scope of (1.61-1.71 (mS cm^{-1})) for various medications following 90 days of vermicomposting yet the variety was unimportant among every one of the medicines (Table 2). Increment in EC was additionally revealed by certain creators during vermicomposting of sewage muck utilizing *Eudrilus eugeniae, L. mauritii and Perionyx exhumes* (Gupta and Garg 2008; Khawairakpam and Bhargava 2009) [38, 44]. The expansion in EC might be because of loss of natural issue and arrival of various mineral salts in accessible structures (phosphate, ammonium, potassium, and so forth.) during vermicomposting (Kaviraj and Sharma 2003). TKN was essentially higher at last item than beginning substrate material (Table 2). The most extreme TKN increment was in T_1 pursued by T_2, T_3, T_5 and T_4. The distinction in the TKN substance of the vermicompost acquired from T_1, T_2 and T_3 medications was not factually noteworthy ($P<0.05$). (Elvira *et. al.*1998) have detailed that TKN content expanded fundamentally toward the finish of the vermicomposting time frame, presumably due to mineralization of the natural issue. The outcomes showed that nitrogen enhancement example and mineralization exercises essentially rely on the aggregate sum of N in the underlying substrate material (Adi and. Noor 2009; Prakash and Karmega 2010) [48, 10]. Earthworm movement advances the nitrogen profile of vermicompost through microbial interceded nitrogen change, through expansion of bodily fluid and nitrogenous squanders discharged by night crawlers. Lessening in pH might be a significant factor in nitrogen maintenance as N_2 is lost as unpredictable smelling salts at high pH esteems. Increment in nitrogen content in vermicompost of sugarcane junk and dairy animals compost substrate when contrasted with controls was accounted for by (Ramalingam and Thilagar 2000) [49]. (Atiyeh *et al.* 2000) [50] announced that by improving nitrogen mineralization, night crawlers greatly affect nitrogen change in excrement, with the goal that nitrogen held in the nitrate structure. Table 2. Shows, toward the finish of the vermicomposting test most extreme increment (contrasted with its underlying worth) in TP was enlisted in T_3, trailed by T_1, T_2, T_4 and T_5 treatment. Be that as it may, the distinctions in TP fixation in T_1, T_2 and T_3 were not altogether unique, demonstrating the reasonableness of substrate material (CFA, ST and Compact disc in fitting proportion) for giving better P nourishment. In the present investigation, the expansion in TP during vermicomposting is most likely through mineralization and preparation of phosphorus by bacterial and fecal phosphatase action of night crawlers, direct activity of worm gut catalysts and in a roundabout way by incitement of the microflora (Lazcano *et al*. 2008; Sen. and Chandra 2009) [51, 52]. As indicated by (Ghosh et. al.1999; Adi and Noor 2009) [53, 48] vermicomposting can be an effective innovation for the change of inaccessible types of the phosphorus to effectively accessible structures for plants.

Table 2: Physico-chemical qualities of starting substrate and vermicompost acquired from various treatments

Physico-chemical characteristics of initial substrate and vermicompost obtained from different treatments						
Treatment	**pH**	**EC (mS cm^{-1})**	**TOC (g kg^{-1})**	**TKN (g kg^{-1})**	**TP (g kg-1)**	**TK (g kg^{-1})**
Physico-chemical characteristics of initial substrate in different treatments after pre-composting of 14 days						
T_1	7.5±0.1	1.51±0.27	444.55±29.2	11.5±1.2	5.1±0.1	14.5±1.2
T_2	7.9±0.2	1.50±0.13	437.71±18.1	11.8±3.1	4.7±0.2	14.1±1.4
T_3	8.1±0.1	1.43±0.21	422.32±11.3	11.6±2.4	4.5±0.1	13.5±1.2
T_4	8.3±0.3	1.41±0.32	416.43±18.6	11.3±1.6	4.2±0.2	12.4±1.3
T_5	7.7±0.1	1.44±0.11	420.48±11.2	11.9±2.7	4.6±0.4	12.9±1.1
Physico-chemical characteristics of vermicompost obtained from different treatments after 90 days of vermicomposting (mean±SD., n = 3)						
T_1	6.8±0.2^{a}	1.70±0.21^{a}	348.21±16.2^{a}	22.3±2.3^{a}	10.6±0.3^{b}	13.3±1.2^{b}
T_2	7.2±0.1^{ab}	1.71±0.17^{a}	350.68±28.3^{a}	21.2±1.3^{a}	8.7±0.2^{b}	12.6±1.5^{b}
T_3	7.4±0.2^{b}	1.62±0.19^{a}	351.37±20.2^{a}	21.1±1.7^{a}	8.6±0.5^{b}	12.2±0.6^{ab}
T_4	7.5±0.2^{c}	1.61±0.24^{a}	380.51±14.1^{ab}	14.4±3.2^{b}	7.2±0.4^{a}	10.2±0.9^{a}
T_5	7.1±0.3^{ab}	1.63±0.13^{a}	379.33±13.3^{ab}	15.6±2.4^{b}	7.3±0.3^{a}	11.3±0.7^{ab}

Mean value followed by different letters (a-c) is statistically different (ANOVA, Tukey's test, $P<0.05$)

Table 3: Physico-chemical characteristics of initial substrate in different treatments after pre-composting of 14 day

Treatments	**pH**	**EC (mS cm^{1})**	**Ca (g kg^{-1})**	**Mg (g kg^{-1})**	**Na (g kg^{-1})**	**Cu (ppm)**	**Zn (ppm)**	**Mn (ppm)**	**Fe (ppm)**
T_1	7.5±0.2*	1.51±0.27*	16.3±0.40*	14.9±0.31*	23.1±0.30*	135±2.79*	155±3.29*	392±1.09*	998±6.21*
T_2	7.9±0.1*	1.50±0.13*	15.9±0.31*	14.2±1.3*	23.8±0.2*	133±1.53*	151±1.50*	390±1.50*	969±3.50*
T_3	8.1±0.2*	1.43±0.21*	13.7±0.22*	12.5±1.7*	20.9±0.5*	129±3.41*	149±2.63*	387±2.10*	954±4.02*
T_4	8.3±0.2*	1.41±0.32*	13.5±0.12*	13.7±3.2*	22.3±0.3*	129±1.80*	148±1.95*	389±1.80*	988±2.60*
T_5	7.7±0.3*	1.44±0.11*	16.0±0.35*	13.9±2.4*	22.8±0.3*	131±2.85*	150±2.70*	388±2.30*	987±4.54*

*Significant at $P<0.05$

Table 4: Physico-chemical characteristics of vermicompost obtained from different treatments after 90 days of vermicomposting (mean±SD. n = 3)

Treatments	**pH**	**EC (mS cm^{1})**	**Ca (g kg^{-1})**	**Mg (g kg^{-1})**	**Na (g kg^{-1})**	**Cu (ppm)**	**Zn (ppm)**	**Mn (ppm)**	**Fe (ppm)**
T_1	6.9±0.2*	1.70±0.21*	23.3±0.40*	19.9±0.31*	33.5±0.30*	165±2.79*	169±3.29*	402±1.09*	1054±6.21*
T_2	7.2±0.1*	1.71±0.17*	21.9±0.31*	20.2±1.3*	32.8±0.2*	162±1.53*	166±1.50*	397±1.50*	1049±3.50*
T_3	7.3±0.2*	1.62±0.19*	19.7±0.22*	18.5±1.7*	29.5±0.5*	158±3.41*	167±2.63*	396±2.10*	1020±4.02*
T_4	7.6±0.2*	1.61±0.24*	20.5±0.12*	16.4±3.2*	30.8±0.3*	160±1.80*	162±1.95*	392±1.80*	1018±2.60*
T_5	7.1±0.3*	1.63±0.13*	21.2±0.35*	17.9±2.4*	32.2±0.3*	159±2.85*	160±2.70*	398±2.30*	1039±4.54*

*Significant at $P<0.05$

Physiochemical characteristics of the vermicompost prepared from sugarcane waste, coal fly ash and cow dung

Changes in pH, electrical conductivity, calcium, magnesium, sodium and micronutrients are exhibited in table 3 and 4. The outcomes recommended that night crawlers assume a significant job in handling sugarcane squanders in to natural fertilizer by quickening the procedure of decay and the excrement was increasingly homogenous following 90 days (application. 12 weeks).

As the vermicomposting advanced, pH tended towards nonpartisan (8.3 to 7.5) and the decline in pH was brought about by the volatilization of ammonical nitrogen and H^+ discharged because of microbial nitrification process by nitrifying microorganisms (Eklind and Kirchmann 2000) [54]. Different analysts (Suthar and Singh 2008) [56] have demonstrated higher decrease in pH in the vermireactors. The EC was diminished (1.51 to 1.41 mS cm^{-1}) and it might be expected the loss of weight of natural issue and arrival of various mineral salts in accessible structure. A few analysts (Sibi and Manpreet 2011; Meena and Ajay 2011) [56, 57] have demonstrated decrease in EC in different vermireactor.

Absolute phosphorus content was more prominent toward the finish of vermicomposting (10.6g kg^{-1}) than the underlying day (5.1g kg^{-1}). Increment in the measure of phosphorus in the vermicompost with the advancement of time was accounted for by (Tripathi and Bharadwaj 2004) [58] and arrival of phosphorus in accessible structure is incompletely accessible by night crawler gut phosphatases (Lee *et.al.* 1992) [59].

The potassium and sodium content were expanded (12.4 to 14.5 and 10.2 to 13.3 (g kg^{-1})) toward the finish of study. Which might be because of the metabolic action of microorganisms present in night crawler's gut? Solubilization of inorganic sodium and potassium in natural squanders by microorganisms through corrosive creation was guaranteed by (Premuzic *et al.*1998) [60]. (Suthar *et al.* 2007) [61] recommended that night crawler prepared waste material contains high grouping of interchangeable Na and K, because of improved microbial action during the vermicomposting procedure, which thus upgrade the pace of mineralization.

There was a reduction in TK in all medicines before the finish of vermicomposting and the greatest abatements were in T_4, though T_1, T_3 and T_2 indicated the least diminishes for TK (Table 2). Comparative outcomes were accounted for by (Orozco *et al*. 1996) [62] and (Kaushik and Garg 2003) [63] for decline in TK toward the finish of vermicomposting. Increment in TK was additionally detailed by certain creators during vermicomposting (Delgado *et al.* 1995; Suthar *et.al.* 2007) [64, 61].

Calcium, magnesium and sodium content were expanded inT_1, T_2 and T_1treatment (lower than introductory worth) trailed by T_3 T_5 and T_4 which showed in table no. 3 and 4 (16.3 to 23.3, 14.9 to 20.2 and 23.1-32.8 (g kg^{-1}) during the investigation time frame. It proposed that gut procedure related with calcium & magnesium digestion are essentially answerable for improved substance of inorganic calcium and magnesium content in worm cast. In any case, the comparable example of calcium &magnesium improvement is very much recorded in accessible writing (Garg *et al.* 2006) [38]. Micronutrient substance were fundamentally expanded toward the finish of weeks when contrast with the underlying day.

Cooper content were expanded inT_1, T_2 and T_4 treatment (lower than introductory worth) trailed by T_5 and T_3 which appeared in table no. 3 and 4 (135 to 165 ppm) during the investigation time frame. While zinc content was expanded inT_1, T_3 and T_2 treatment (lower than introductory worth) trailed by T_4 and T_5 which appeared in table no. 3 and 4 (155 to 169 ppm) during the examination time frame. Manganese (Mn) content was more prominent toward the finish of vermicomposting (392 ppm) than the underlying day (402 ppm) in T_1, T_5 and T_2 treatment (lower than starting worth) trailed by T_3 and T_4 which appeared in table no. 3 and 4.While Iron (Fe) were expanded inT_2, T_3 and T_5 treatment (lower than beginning worth) trailed by T_1 and T_4 which demonstrated in table no. 3 and 4 (990 to 1064 ppm) during the 90 days' investigation.

Table 5: Dehydrogenase activity (μg TPF g^{-1} h^{-1}) during composting of organic wastes

Treatments	Day 0	Days 15	Days 30	Days 60	Days 90
T_1	515	1141	1281	1545	989
T_2	463	1183	1429	1867	982
T_3	434	605	847	1052	1016
T_4	415	620	937	1169	838
T_5	360	622	843	1017	938

The dehydrogenase movement expanded quickly in the underlying phases of treating the compost (Table 5) as long as 60 days and diminished by 90-days testing. There was more dehydrogenase action in T_2 medications than in medicines T_1, T_3, T_4 and T_5.

Development and Multiplication Rate by Eisenia fetida in Various Treatments: In the present investigation, the expansion in worm biomass (development) and propagation rate (casing creation and hatchlings number) indicated variety with various proportions of CFA, CD and ST in the medicines (Table 5). The most noteworthy biomass of *Eisenia fetida* was seen in T_1 treatment (984.2±17.22^b mg worm-1) and the least in the T_4 treatment (880.2±12.26^a mg $worm^{-1}$). The biomass generation was fundamentally (P<0.05) diminished with expanding proportion of CFA and ST with CD in medications (T_4 and T_5). The net biomass by *Eisenia fetida* was altogether (P<0.05) higher in T_1, T_2 and T_3 medications than different medicines (T_4 and T_5) and most extreme worm biomass was accomplished following 6-7 weeks of vermicomposting (Table 6). The development pace of *Eisenia fetida* (mg $worm^{-1}$ day^{-1}) was in the scope of 14.5±0.38^c (T_1) to 10.3±0.28^a (T_4) during this vermicomposting period.

Table 6: Growth of *Eisenia fetida* in different treatments (mean±SD., n = 3)

Treatment	Mean initial biomass $worm^{-1}$ (mg)	Maximum biomass achieved $worm^{-1}$ (mg)	Net biomass gained $worm^{-1}$ (mg)	Maximum biomass achieved (week)	Growth rate $worm^{-1}$ day^{-1}(mg)
T_1	377.3±2.61^a	984.2±18.21^b	607.9±16.30^c	6	14.5±0.38^c
T_2	379.0±4.76^a	961.3±17.24^b	581.3±20.21^b	6	12.9±0.49^b
T_3	381.6±3.42a	960.6±31.23^b	578.0±26.12^b	6	12.8±0.62^b
T_4	380.5±5.73^a	880.5±13.27^a	500.0±10.18^a	7	10.3±0.28^a
T_5	379.6±4.81^a	892.2±11.52^a	512.6±11.21^a	7	10.6±0.22^a

Mean values followed by different letter in same column are statistically different (ANOVA; Tukey's test, P<0.05)

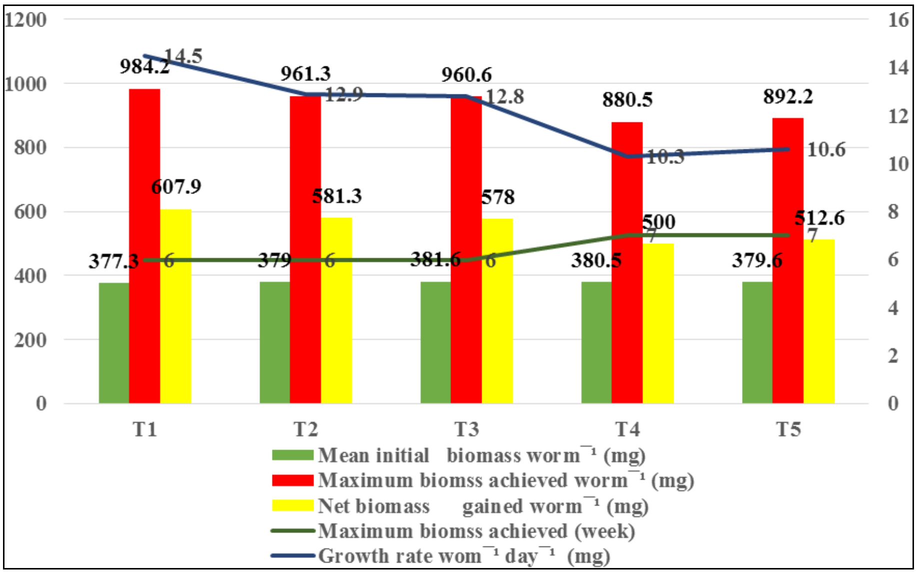

Fig 5: Growth of *Eisenia fetida* in different treatments (mean ±SD. n = 3)

As indicated by (Edwards *et. al.* 1998) [26] the development rate (biomass mg worm^{-1} day^{-1}) has been viewed as a decent near file to analyze the development of night crawlers in various natural waste materials. As of late (Suthar *et al.* 2007) [61] announced that the development design in fertilizing the soil worm relies upon microbial populace and supplement quality in sustains. In this manner, the watched contrast in development pace of *Eisenia fetida* among various medicines was done to differing substrate quality. It has been discovered that blending of bovine manure in coal fly debris and press mud before vermicomposting can quicken night crawler fertilizing the soil proficiency. The outcomes demonstrated that more prominent level of CFA and ST in the medicines (T_4 and T_5) altogether influenced the development of *Eisenia fetida*.

Summary & Conclusion

Thinking about this perspective, in the present investigation, microbial progression during vermicomposting of most reasonable bio-burn through in various timeframe were contemplated by taking the appropriate worm species. Considering the significance of natural framing just as practical agribusiness; the effect of different revisions, for example, application vermicompost, NPK and incorporated use of vermicompost and NPK profitability were explored. Vermicompost has been found to improve the microbial synthesis of soil which thusly expanded the dirt fruitfulness level.

In the present examination, the vermicomposting of CFA and ST blended in with Compact disc brought about the transformation of waste into esteem included item, i.e., vermicompost. Investigation of vermicompost got from various medications plainly demonstrates the utilization of *Eisenia fetida* for vermicomposting of CFA and ST with Compact disc in suitable proportions (dry weight extents). Higher level of CFA and ST in the substrate material hindered the development of night crawlers and furthermore influenced the physico-concoction nature of the substrate. Wanted degree of synthesis of supplements in the vermicompost i.e., macronutrients (C, N, P, K, Na, Ca, and Mg in (g kg^{-1})) and micronutrients (Fe, Zn, Mn and Cu in ppm) was nearly superior to the underlying worth. The outcomes affirmed the vermicomposting as an elective innovation for the administration of CFA and ST whenever blended in with Album in suitable proportions.

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