International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Study of Vermicomposting with Coirpith, Eggshell, Vegetable Waste and Onion Peel

S.Sathiyavathi[1], S.Thamarai Selvi[2]

[1]Assistant Professor of Zoology, P G Research Department of Zoology, Adhiyaman Arts and Science College for Women, Uthangarai, Krishnagiri (Dt)

[2]PGstudent, P G Research Department of Zoology, Adhiyaman Arts and Science College for Women, Uthangarai, Krishnagiri (Dt)

Abstract

Vermicomposting the conversion of organic waste into vermicompost, is mediated by thecombined action of earthworms and microorganisms. This interesting and attractive alternative to composting turns organic waste into a substrate that can be used as a soil amendment and as a growing medium for use in horticulture. Soil not required in vermicomposting as the organic matter acts as both the substrate the food, and therefore only epigeic earthworms can be used in the process. Vermicompost is nutrient-rich casts generated by the earthworms that can be used as biofertilizers.

KEYWORDS: Organic waste, epigenic earthworm, vermicompost,

Introduction

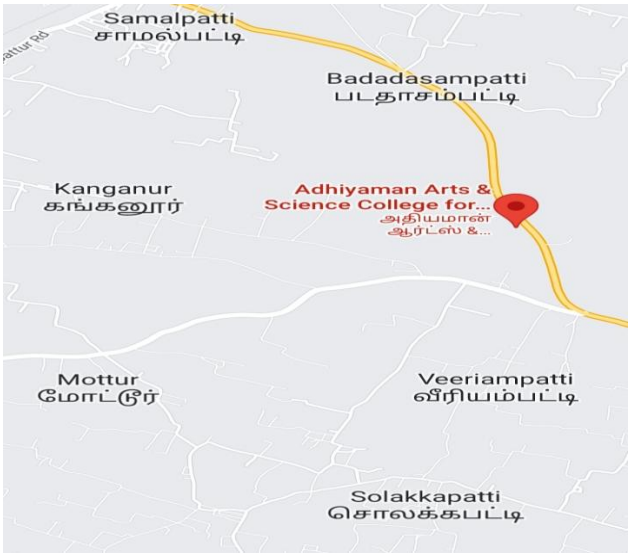
Vermicompost is the product of the decomposition process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. This process is called vermicomposting, with the rearing of worms for this purpose is called vermiculture. Vermicast (also called worm castings, worm humus, worm poop, worm manure, or worm faeces) is the end-product of the breakdown of organic matter by earthworms. These excreta have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than the organic materials before vermicomposting. Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner. It is used in gardening and sustainable, organic farming. Vermicomposting can also be applied for treatment of sewage. A variation of the process is vermifiltration or vermidigestion which is used to remove organic matter, pathogens, and oxygen demand from wastewater or directly from blackwater of flush toilets.

Vermicomposting has gained popularity in both industrial and domestic settings because, as compared with conventional composting, it provides a way to treat organic wastes more quickly. In manure composting, it also generates products that have lower salinity levels. The earthworm species or composting worms most often used are red wigglers Eisenia fetida or Eisenia andrei, though European nightcrawlers Eisenia hortensis, synonym Dendrobaena veneta and red earthworm Lumbricus rubellus could also be used. Red wigglers are recommended by most vermicomposting experts, as they have some of the best appetites and breed very quickly. Users refer to European nightcrawlers by a variety of other names, including dendrobaenas, dendras, Dutch nightcrawlers, and Belgian nightcrawlers

Vermicomosting has been recognized as an eco-friendly technology for converting organic wastes in to high value organic manure (Kale *et. al., 1982; Senapathi, 1994).* The potentiality of vermiculture technology in the disposal of organic waste is vast and deffersfrom other methods of composting (Gandhi *et.al., 1997).*Chemical pollutants are extremely dispersed in the environment and cause severe problems to human health, soil as well as the environment. In agro eco system , the use of synthetic toxic chemical pestisides affect the soil fertility and growth of cultivated craps (Ignasimuthu and vendan, 2007). For minimizing the accumulation of pollutants in agro eco system we should avoid the use of toxic chemical especially synthetic chemical pesticide and fertilizers in agricultural process. Organic product are eco-friendly natural sources , which can be considered as an alternative to sustainable agriculture development. In india as a step towards the expansion of native sources , the application of organic waste material will bwe useful for achieving higher production. Coir pith is known as organic waste comfort of lignocellulosic fibre materials, it is separated from the husk of the coconut fruit. (Ramalingam *et.al.*,2004).Earthworm plays a major role in plant materials degradation and is concept is used in vermicomposting technology with the supplement of cowdung source to enhance plant growth.

Study area

For this study, the vermicomposting is prepared in the of Adhiyaman arts and science college for women in kurusampatti village, Uthangarai taluk, Krishnagiri district, Tamilnadu



Materials and Methods

The compost was prepared with four different setups. For experimental purposes four plastic tubs were maintained namely A,B,C,D coir pith, egg shell& vegetable waste, cow dung& onion peel Control soil. The organic materials were mixed with soil for decomposition upto 45 days.

An attempt has been made to provide vermicompost by using coir pith, egg shell& vegetable waste, cow dung& onion peel.

1. The collection of earthworm from garden soil
2. Coir pith, egg shell& vegetable waste, cow dung& onion peel is collected from the home

3. Prepare the vermicompost bed with coir pith, egg shell& vegetable waste, cow dung& onion peel.

After composting is assayed to find the content of the vermicompost and production time and days For this study, the soil was collected from the garden of Adhiyaman arts and science college for women in kurusampatti village, Uthangarai taluk, Krishnagiri district, Tamilnadu. And also Earthworms were collected from the vermicomposting center of Krishnagiri District (Paiyur). In the college, there is a plenty of red soil is available and worms are also collected from the same garden. Where the soil was collected. In that garden ,**Eudrilus eugeniae** is more in population.Eudrilus eugeniae species of epigeic earthworm used for the preparation of vermiwash.Physical parameters like Moisture (%), Temperature (°C) and chemical parameters like PH,Organic Carbon (%), Nitrogen (%), Potassium (%), Phosphorus (ppm) C:N ratio, Iron (ppm),Zinc (ppm), Copper (ppm), Manganese (ppm) and Electric potential of soil. (Hemant Samadhiya et al., 2013).

COMPOSTING PROCESS:

Earthworms were introduced into the composting tray (45 × 30 × 30cm) containing wet soil and maintained for 50 days. New layers with the coir pith, cow dung& vegetables waste and egg shell& onion peel were applied to the beds; the earthworm moved upwords for feed. The tap water was introduced into the bed for maintaining the wet condition. A separate set of the same bed was maintained without any wastes materials and it used as a control. Four replicates were maintained for vermicompost and control compost.

Calculation For Organic Carbon (Walkley-Black method, FAO United Nations, 2019

$$\text{Organic Carbon\%} = \frac{(V_b - V_s) \times M_{Fe^{2+}} \times 0.39}{W}$$

Where,
V b = Volume of titrant blank in ml

Vs = Volume of titrant blank in ml

Molarity of FeSo4 solution

3 x 10 -3 x 100 x 1.4, where 4 is equivalent weight of sample and 1.4 is correction factor.

Procedure for Analysis of Macronutrients

Procedure of sample taken into test tubes and add 10 ml of Sulphuric acid and digest the

samples over heated in stand bath, upto 100ml distilled water. The content were their fed into

atomic absorption spectrophotometer with different nanometers like 204.6 nm for Fe, 118.8 nm for Zn, 304.5 nm for Mn, 424.2 nm for Cu. The corresponding ppm that read from the standard curve drawn. The level of nutrients in compost depends upon the source of raw material and the species of earthworm. A fine worm cast is rich in N P K besides other nutrients.Micronutrients are essential elements needed for crop growth that are required in relatively smallquantities. Even though demands for micronutrients directly affect crop growth and development.Micronutrients include elements such as Fe(Iron), Mn(Manganese), Zn(Zinc) and Cu(Copper) are the micronutrients of soil. Fe involves in the process of synthesis of chlorophyll, Mn involves in photosynthesis, Zn involves in weather resistance and Cu involves in respiratory and metabolic chains.

The macro and micronutrients were increased after the vermicomposting. Plant growth and development are largely determined by nutrient availability; therefore to ensure better productivity of crop plants, it becomes essential to understand the dynamics of nutrients of nutrients uptake, transport, assimilation and their biological interactions

PLANT GROWTH AND PRODUCTIVITY

Plants like other so called higher organisms, do not exist as entities unto themselves. They are biotic systems which consist of the plant plus innumerable microorganisms, the plant micro biome. This review considers plant associated bacteria and fungi, focusing on those that internally colonize plant roots as microbial endophytes. Plants, together with their associated micro biomes, function as complex multi-species entities referred to in the literature as holobionts (Margulis and Fester1991). The association can be detrimental to the plant if pathogens predominate, or it can be neutral. More often, it results in plants having better health, growth and performance. We are previously discussed endophytic root colonization and the resulting symbiotic increases in plants capabilities\using the concept of Enhanced plant Holobionts .

Result

Vermicompost is nutritionally rich natural organic fertilizer, which release nutrients in the soil and improves quality of the plants with renewed of physical and biological properties of soil. Inthe current study, nitrogen and content was higher in control and onion peels and the other samples.Phosphorous content is low in coir waste. Potassium is a very essential nutrient for plant growth and these highest value of macro and micro plants. eggshell compost has the nutrient soil calcium content than the other sample, naturally vegetable waste is very rich in potassium; hence the compost has potassium content.

Result

TEMPARETURE:

TABLE1: OPTIMUM TEMPERATURE MAINTAIN FOR VERMICOMPOSTING

SAMPLE/MONTH	JANUARY	FEBRUARY	MARCH
CONTROL(A)	26℃	27℃	28℃
COIRPITH(B)	26℃	27℃	28℃
EGGSHELL+VEGETABLES WASTE(C)	26℃	27℃	28℃
COWDUNG+ONION PEEL(D)	26℃	27℃	28℃

GRAFH 1: OPTIMUM TEMPERATURE MAINTAIN FOR COMPOSTING

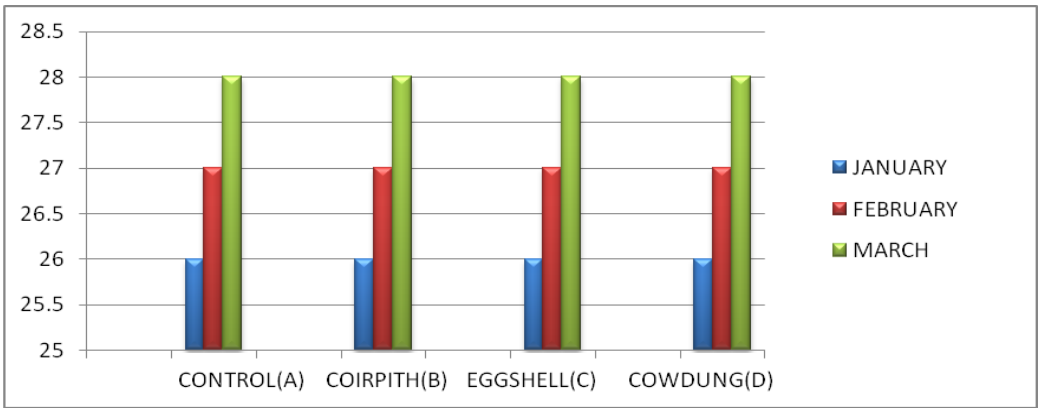


FIGURE 1: CONTROL (A)

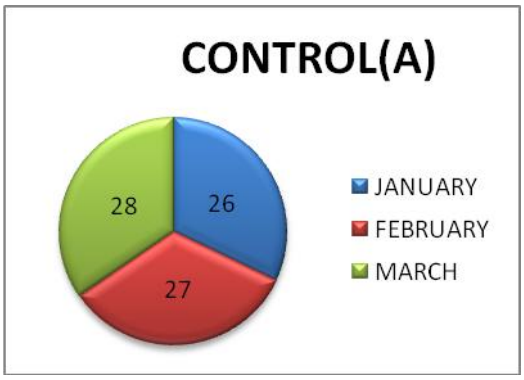


FIGURE 2: COIR PITH (B)

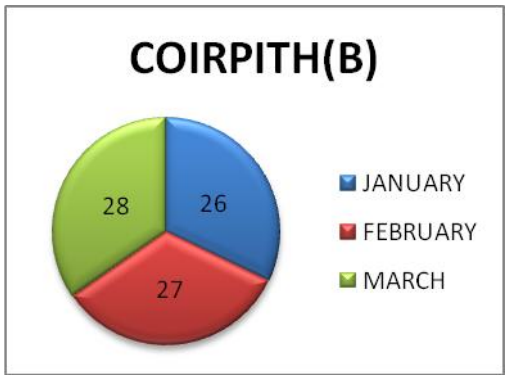


FIGURE 3: EGG SHELL (C)

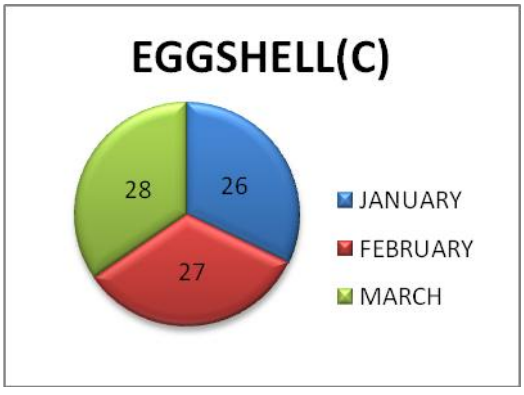
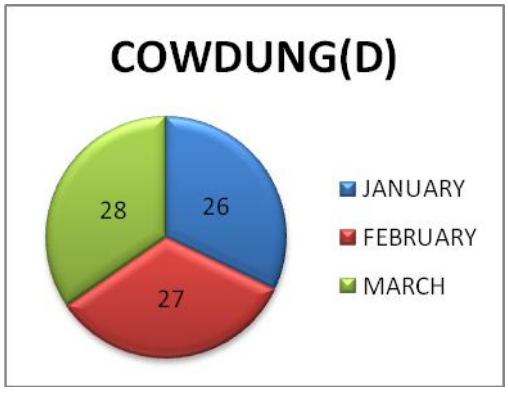


FIGURE 4: COWDUNG (D)



PH

TABLE 2: OPTIMUM pH MAINTAIN FOR COMPOSTING:

ELEMENTS	JANUARY	FEBRUARY	MARCH
CONTROL(A)	6.7	7.5	7.1
COIRPITH(B)	6.1	7.5	7.5
EGGSHELL+VEGETABLES WASTE(C)	6.9	7.5	7.9
COWDUNG+ONION PEEL(D)	7.1	7.5	7.7

GRAPH 2: OPTIMUM pH MAINTAIN FOR COMPOSTING

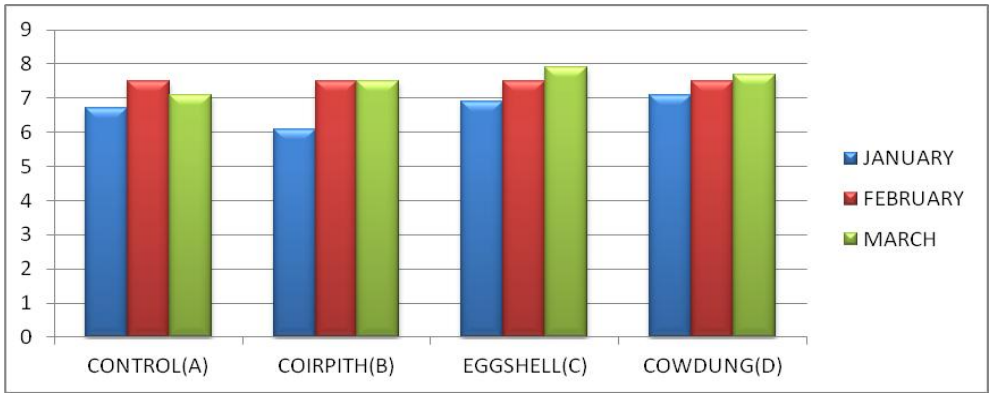


FIGURE 5: CONTROL(A)

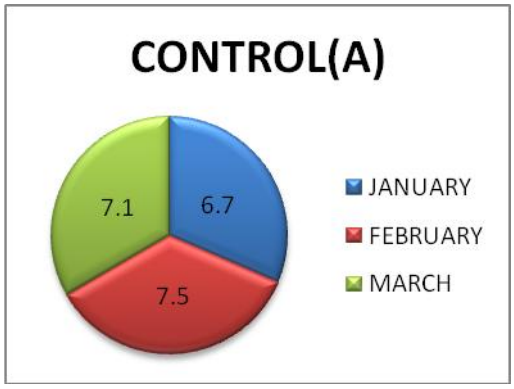


FIGURE 6:COIR PITH (B)

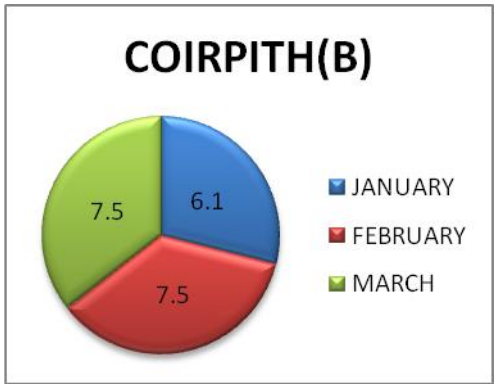


FIGURE 7: EGG SHELL (C)

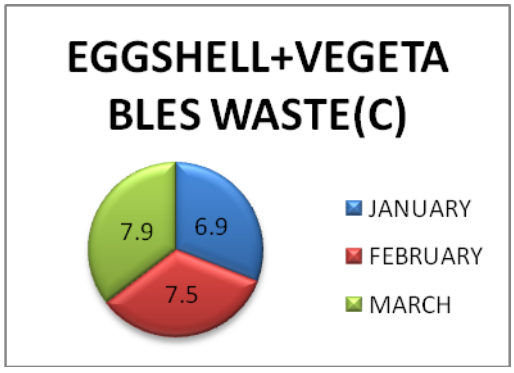
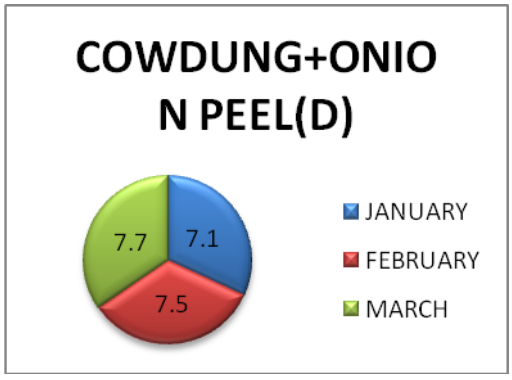


FIGURE 8: COW DUNG (D)



MACRONUTRIENTS:

TABLE 3: LEVEL OF NPK , SAMPLE (A):COTROL

NUTRIENTS /NO.OF DAYS	0-30 DAYS	30-60 DAYS	60-90 DAYS
NITROGEN	56	56	56
PHOSPHORUS	18	37	27
POTTASIUM	91	285	285

GRAPH 3: SAMPLE (A) CONTROL

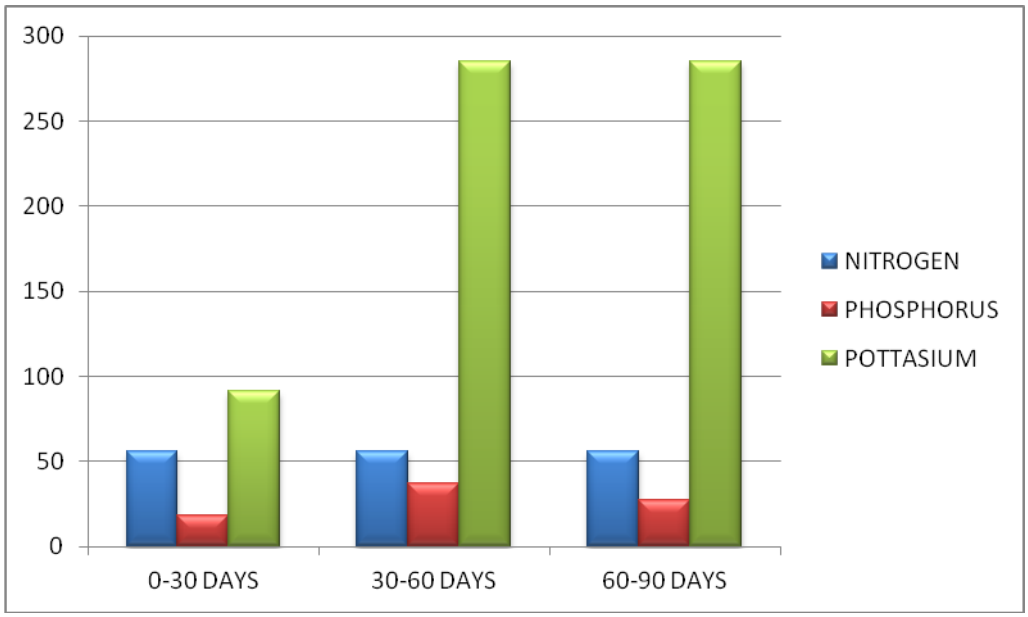


FIGURE 9: SAMPLE (A)

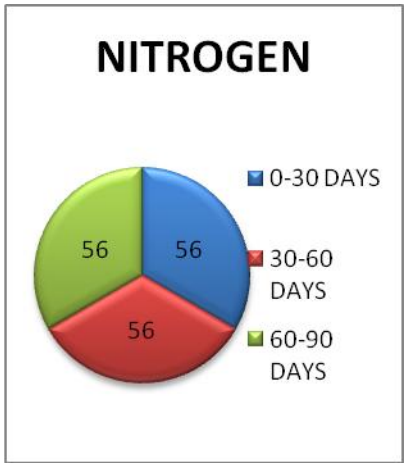


FIGURE 10: SAMPLE (A)

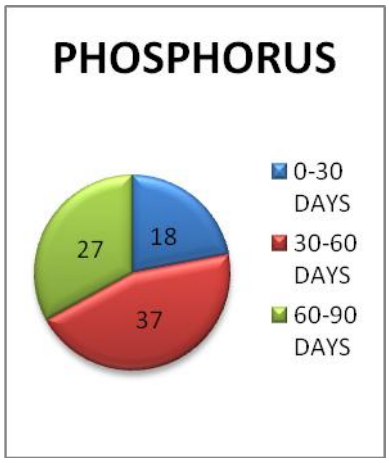


FIGURE 11: SAMPLE (A)

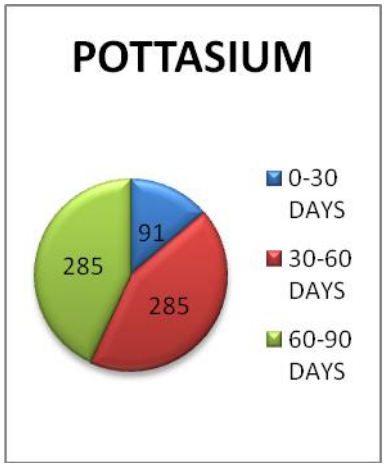


TABLE 4: SAMPLE (B) COIR PITH

NUTRIENTS/NO OF DAYS	0-30 DAYS	30-60 DAYS	60-90 DAYS
NITROGEN	56	56	56
PHOSPHORUS	21	35	40
POTTASIUM	314	400	500

GRAPH 4: SAMPLE (B) COIR PITH

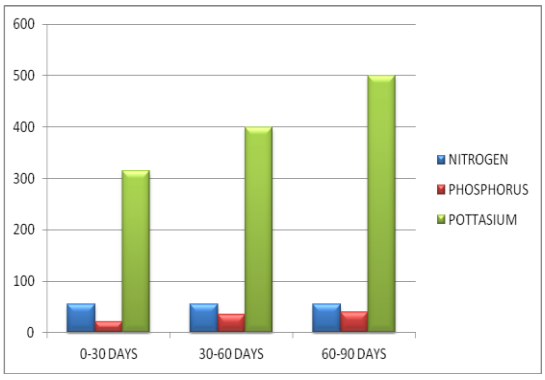
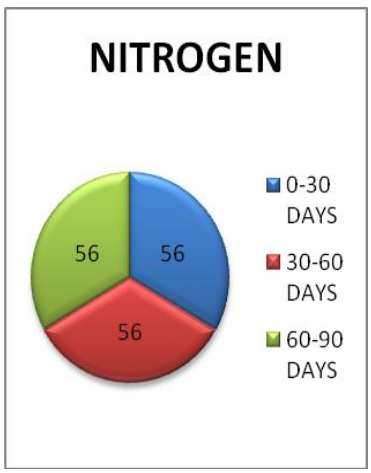
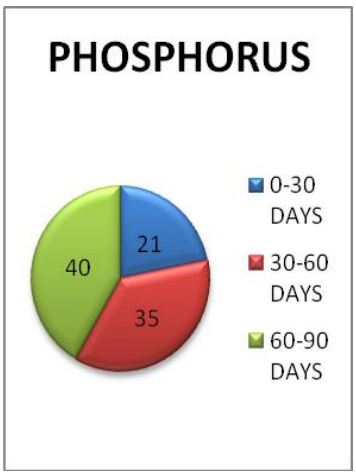


FIGURE 12:SAMPLE (B) **FIGURE 13:SAMPLE (B)** **FIGURE 14: SAMPLE (B)**





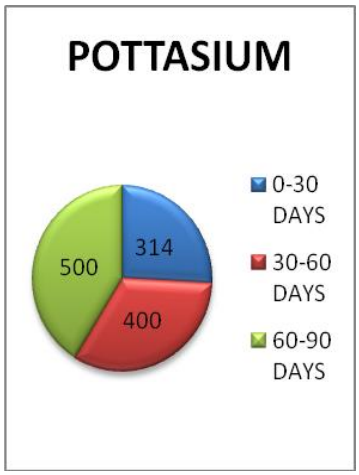


TABLE 5: SAMPLE (C) EGGSHELL& VEGETABLE WASTE

NUTRIENTS /NO.OF DAYS	0-30 DAYS	30-60 DAYS	60-90 DAYS
NITROGEN	56	56	93
PHOSPHORUS	3	10	34
POTTASIUM	195	359	477

GRAPH 5:SAMPLE (C)

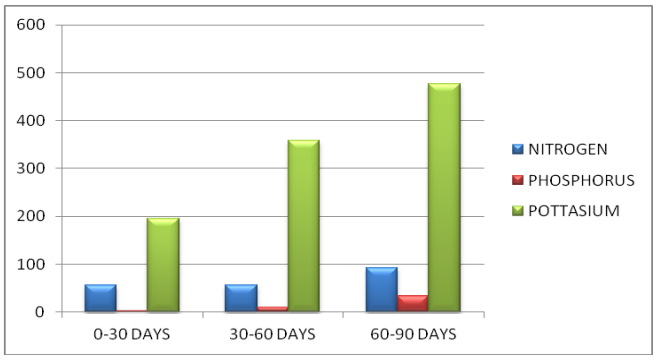


FIGURE 15:SAMPLE (C) **FIGURE 16:SAMPLE (C)** **FIGURE 17:SAMPLE (C)**

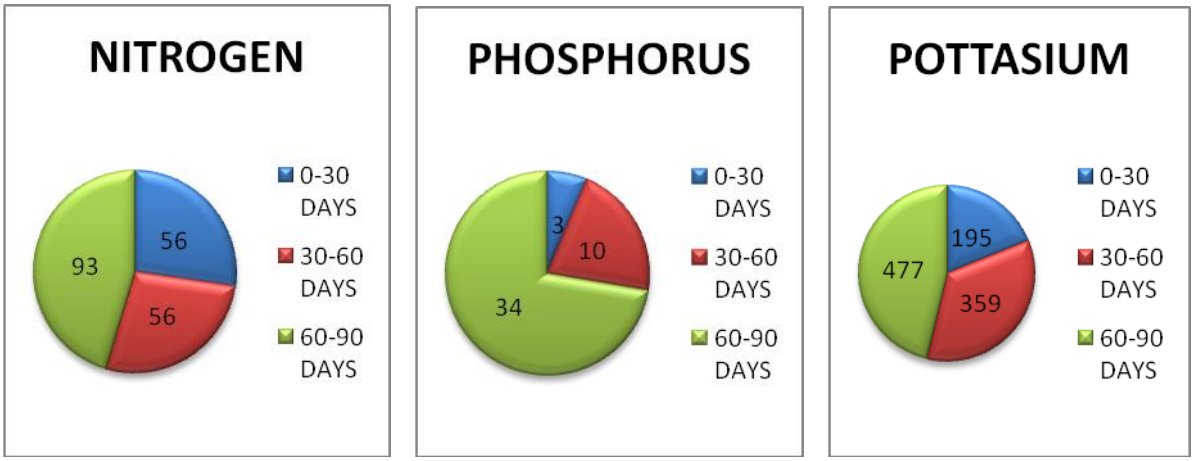


TABLE 6: SAMPLE (D) COWDUNG& ONION PEEL

NUTRIENTS/NO OF DAYS	0-30 DAYS	30-60 DAYS	60-90 DAYS
NITROGEN	56	56	68
PHOSPHORUS	7	15	25
POTTASIUM	59	205	350

GRAPH 6: SAMPLE (D) COWDUNG& ONION PEEL

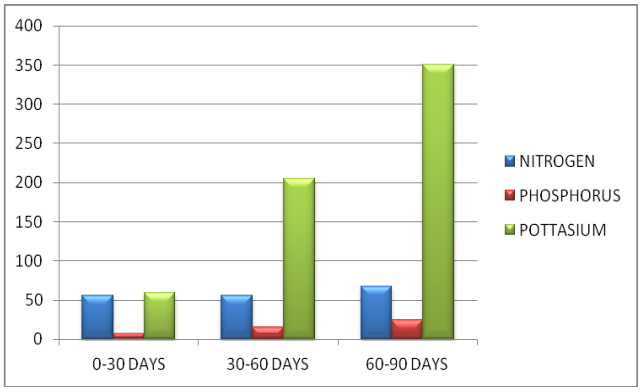
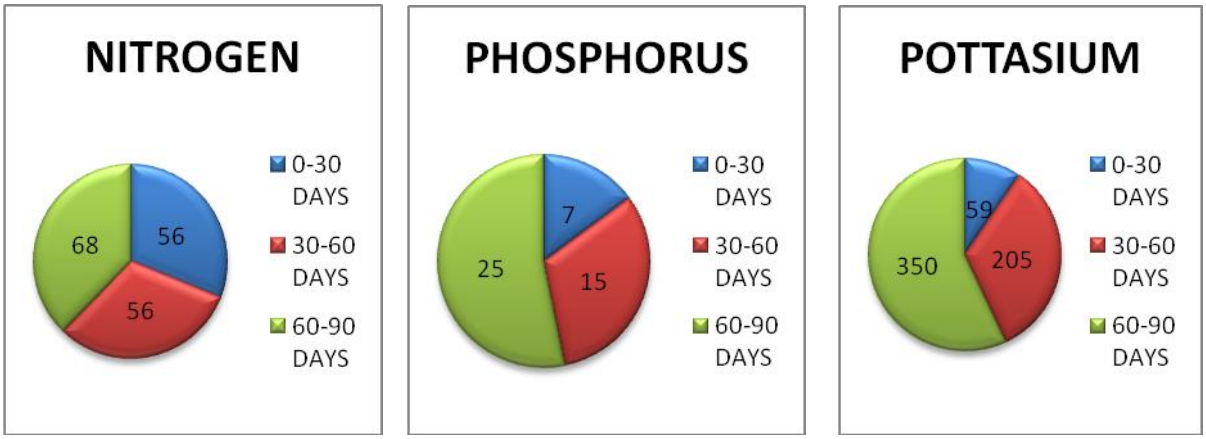


FIGURE 18:SAMPLE (D) **FIGURE 19:SAMPLE (D)** **FIGURE 20:SAMPLE (D)**



Summary

The higher amount of N, P, K, and useful microorganisms which essential for plant growth is made up of vermicompost.

In our present study, vermicomposting using earthworm (Eudrilus eugeniae) was found variable maintained as 23 for December, 23 for January, 24 for February, 25 for March, 27℃ for April, 27 for May. The population of the worms has been increased by the maintained of optimum temperature the development of earthworm was rapid and good at 27.

By maintains the optimum temperature the vermicomposting of produce quickly by the earthworms Eudrilus eugeniae the chemical contact of duct of the earthworm make, microbial activity of the soil with its soil contains of the Nitrogen, Phosphorous, and Potassium have been increasing and made the soil more fertile. Vermicompost samples were blackish moist and highly porous with the smell of the earth. During the process of composting, the substrate was added continuously for the first two weeks. They after, the total loss of the weight of the wastes were added in every two weeks. The decomposition rate of different types of substrate by Eudrilus eugeniae was found variable depending upon the waste type and composting. The faster decomposition of fruit waste was also recorded by Gandhi M *et.al.*,1997.

Coir pith, cow dung& vegetable waste, Egg shell& onion peel decomposed in 3 month needed for complete decomposition of Coir pith, cow dung& vegetables waste, egg shell& onion peel. Earthworm are considered as natural bio reactors while proliferate along with microorganisms and provide required conditions for the bio-degradable of waste.

Similar observation was also made by Bansal and Kapoor, 2000 showing increased nitrogen content as prepared from Coir pith, cow dung& vegetables waste, egg shell& onion peel.

Increase the amount of N, P, K, Ca and Mg are useful microorganisms, (bacteria, fungi, actinomycetes and protozoa) hormones enzymes and vitamins certain microorganisms needed for its growth. Jambhekar, 1992

In the present study, the Coir pith, cow dung &vegetable waste, egg shell& onion peel were found to be the best substrate increase the found rich in N, P and K contents. Nutritional composition of vermicompost varied with the substrate used. The Nitrogen content of vermicompost was higher than the control. The total nitrogen content of the vermicompost increased with time. Due to rapid mineralization of organic nitrogenus compounds.

CONCLUSION

The earthworms of the good products of compost, hence Nitrogen, Phosphorous and Potassium were increased in the vermicompost. Normal soil contains moderate amount of Nitrogen, Phosphorous and potassium, which is essential for seedlings contains more percentage of NPK, it enhances the growth of the microbial activities of the soil and also the made the soil more fertile.It has been proven that fertility of the soil is increasing by adding the vermicomposting. The rapid growth of seedling proven the fertility of the soil, which have been made of vermicompost. In our study, I find the NPK level of the soil have been monitored and also growth of the seedling of monitored as before the vermicompost, after compost and also addition of the compost. Earthworm are wonder worm, become they are converting the polluted soil into perfect fertile soil.

References

1. Hemant Samadhiya et al., 2013 P.S. Chauhan Published 2015, Vermicomposting.
2. Margulis andFester1991 The MIT Press Symbiosis as a source of Evolutionary Innovation
3. Ramalingam A, Gangatharan M, KasturiBai R 2004. ‘Solid state bio-treatment of coirpith and paddy straw’. Asian Journal of Microbiology, Biotechnology and Environmental Science, 6:141-142.
4. Ignacimuthu, S., Vendan, S.E., 2007. Botanical pesticides in insect pest management. Uttar Pradesh J. Zoo. 4 (Suppl. 1), 141–1
5. Bansal, S. and Kapoor, K. K., 2000. Vermicomposting of crop residues and cattle dung with Eisenia fetida, Bioresource Technology, 73: 95-9854
6. Gandhi, M., V. Sangwan, K.K. Kapoor, and N. Dilbaghi, Environ. Ecol., 1997, 15(2), 432 – 434.
7. Walkley-Black method, FAO United Nations, 2019 GLOSOLAN-SOP-02 SOIL ORGANIC CARBON WALKLEY-BLACK METHOD: Titration and Colorimetric Method Version number : 1 Page 1 of 25 Effective date : October 28, 2019