VERMICULTURE AND VERMICOMPOSTING TECHNOLOGYS USE IN SUSTAINABLE AGRICULTURE IN EGYPT

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Abstract

This study presented the use of vermiculture and vermicomposting technologys in the sustainable agriculture in Egypt. The gas emession reduction, developing an environemental composting system for organic wastes using epigiec earthworms to increase the effeiciency of composting and introduce a new method for recycling urban organic wastes into nutrient-rich compost for sustainable agriculture were the targets under light. The study was conducted at Central Laboratory for Agricultural Climate (CLAC) during 2007, 2008 and 2009.

The type, growth and multiply rate of earthworms, the use of breeding and growing systems, feeding, watering, earthworm habits and composting effeiciency were under investigation. Epigiec earthwoms imported from Australia, Lumbriscus Rubellus (Red Worm), Eisenia Fetida (Tiger Worm), Perionyx Excavatus (Indian Blue) and Eudrilus Eugeniae (African Night Crawler) were used under this study beside the local type Allopophora.

The feeding list of earthworms was composing from horse, cattle and rabbit manure, vegetable and fruit waste (kitchen wastes), clipping grass, pre-composted agriculture wastes newspeper and cardboard.

Different systems were used in both of vermiculture and vermicomposting. For breeding system, plastic boxes were used in modified 21 days scale system. On the other hand, a containers made of brickes (1.25 x 0.75 x 4.0 m) were established to presented the growing system.

The comparison study between vermicomposting and conventional composting presented that vermicomposting process resulted in a compost with high content of N, P and K content compared to conventional composting, while it content of heavy metal content. High content of macro and micro elements were found in vermiliquid compared to compost-tea of conventional composting.

INTRODUCTION

In Ancient Egypt, earthworms were considered so indispensable to the agricultural economy that Cleopatra supposedly declared the earthworm sacred, and any export of earthworms was subjected to the death penalty.

Vermicomposting (Worm composting) is defined as a process in which earthworms play a major role with microbes in the conversion of organic solid waste into more stabilized dark, earth-smelling soil conditioner and nutrient-rich compost that is rich in major and micronutrients (Berritezetal.., 2002). During vermicomposting, organic matter is stabilized by the enhanced decomposition (humification) in presence of earthworms (Atiyeh *et al.*, 2001), but by a non-thermophilic process (Elvira et al., 1996, 1998).

The great advantage of worm composting is that this can be done indoors and outdoors, thus allowing year round composting. It also provides apartment dwellers with a means of composting. Vermicomposting allows obtaining organic sources of nutrients for the crops in relatively less time, which are physically, nutritionally and biochemically improved over composts. Vermicomposting is defined as a low cost technology system for processing or treatment of organic waste (Hand *et al.*, 1988b). Moreover, it does not require skilled personnel and mechanization.

Vermiculture is the culture of earthworms. The goal is to continually increase the number of worms in order to obtain a sustainable harvest. The worms are either used to expand a vermicomposting operation or sold to customers who use them for the same or other purposes

The huge amounts of biodegradable organic wastes that generate every day in urban and agriculture areas creating disposal problems on the environmental, gas emessions, public health, economic and social levels especially in under developed countries. These huge amounts of organic wastes could be a renewable source for many sectors (industrial & agricultural). In big cities espicially in a city like Cairo (about 18 million capita) produced around 12000 m^3 organic wastes/day, at the same time of the Egyptian agriculture faces a huge lack of their needs from organic fertilizer, substrates and feeder that lead to increase the prices of food generally (Kamergam *et al.*, 1999).

This wastes can be converted into valuable compost by applying vermi-composting technology. This approach reduces pollution and provides a valuable substitute for chemical fertilizers. This process is profitable at any scale of operation, provided proper process parameters are maintained.

The vermicompost technique could help directly in solving the problem of food security by offering the substrates and organic fertilizers that could be use for producing the needs from different vegetables or even from medicinal plants by use the house roofs as a green roof. This study is expected to has considerable impacts on the environmental, income and food security.

The use of vermicomposting (earthworms farm) in urban, food industries and farm organic wastes management has received increasing attention over the last 20 years where research programs and commercial projects have been developed in many countries on all continents.

Different organic wastes can be used in vermicompost production by different species of earthworms include horse waste (Hartenstein et al., 1979, Kaplan et al., 1980, Edwards *et al.*, 1998, Garg *et al.*, 2005), cattle dung (Edwards *et al.*, 1985, 1998, Mitchell, 1997, Bansal and Kapoor, 2000, Kaushik and Garg, 2003) cow slurry (Hand *et al.*, 1988), urban solid waste (Alves and Passoni, 1997), mango leaves (Talashilkar *et al.*, 1999), pig waste (Chan and Griffiths, 1988, Reeh, 1992, Edwards *et al.*, 1998), turkey waste (Edwards *et al.*, 1998), sheep waste (Edwards et al., 1985), poultry droppings (Ghosh *et al.*, 1999, Garg and Kaushik, 2005), city leaf litter and food wastes (Hand *et al.*, 1988a, Logsdon, 1994, Madan *et al.*,1988, Singh and Sharma, 2002), water hyacinth (Gajalakshmi *et al.*, 2001, Gupta *et al.*, 2007), paper waste (Gajalakshmi *et al.*, 2002), swine manure (Atiyeh *et al.*, 1999), residues of plant decomposition (Kamergam *et al.*, 1999), sewage sludge and sugarcane pulp (da Silva *et al.*, 2002), among others. The vermicompost can also be produced from cattle manure (Kiehl, 2001). Animal manures contain significant quantities of plant-available nutrients which could increase crop yields (Eneji *et al.*, 2001). Waste reduction by recycling is an important part of any integrated liquid waste-management system. But there are very few studies on the vermicomposting of industrial sludge. Kaushik and Garg (2004) have reported that vermicomposting of textile mill sludge using Eisenia foetida. Orozco *et al.* (1996) have reported the vermicomposting of coffee pulp using the earthworm E. foetida. Suthar (2007) has reported the vermicomposting of guar gum industrial waste using Perionyx 391ndrei391es. Butt (1993) showed that solid paper mill sludge was a suitable feed for Lumbricus terrestis under laboratory conditions. This sludge has no deleterious effect on earthworms, although growth rate was poor. The low level of nitrogen (0.5%) was considered as a limiting factor. Elvira *et al.* (1998) have reported vermicomposting of paper mill sludge using Eisenia andrei under laboratory as well as field conditions. Nogales *et al.* (2005) have reported the vermicomposting of winery waste using E. andrei under laboratory conditions.

Earthworm species vary in how they get food, and thus inhabit different parts of the soil, and have somewhat different effects on the soil environment. They fall into three distinct ecological groups based on feeding and burrowing habits.

1- Epigeic (litter dwelling) earthworms live and feed on surface litter. They move horizontally through leaf litter or compost with little ingestion of or burrowing into the soil. These worms are characteristically small and are not found in low organic matter soils. Lumbricus rubellus is an example of epigeic species. Epigeic forms of earthworms can hasten the composting process to a significant extent (Senapathi, 1988, Kale *et al.*, 1982, Tomati *et al.*, 1983), with production of better quality of composts, compared with those prepared through traditional methods (Tripathi and Bhardwaj, 2004).

2- Endogeic (shallow dwelling) earthworms are active in mineral topsoil layers and associated organic matter. They create a three-dimensional maze of burrows while consuming large quantities of soil. The genuses Diplocardia and Aporrectodea have endogeic life habits.

3- Anecic (deep burrowing) earthworms live in permanent, nearly vertical burrows that may extend several feet into the soil. They feed on surface residues and pull them into their burrows. Lumbricus terrestris is an example of an anecic species (Coleman and Crossley, 1996).

The most common types of earthworms used for vermicomposting are brandling worms (Eisenia foetida) and red worms or red wigglers (Lumbricus rubellus). Often found in aged manure piles, they generally have alternating red and buff-colored stripes. They are not to be confused with the common garden or field earthworm (Allolobophora caliginosa and other species).

Earthworms prefer a neutral to slightly alkaline pH. Liming in vermicompost bin generally enhance microbial population as well as earthworm activities. Therefore, changes in macronutrient content and some enzymatic activities of vermicompost due to lime addition to organic wastes could be an interesting study(Reinecke *et al.*, 1992).

Sustainable agriculture needs sustained support of organic fertilizers and good practices of organic wastes. Vermicomposting secures friendly environment recycling of organic wastes and creates the base for offering high nutrients value compost for sustainable agriculture. The main objectives of this study are transferring and localize the know-how of vermicomposting and vermiculture besides establishing the scientific base for the uses of vermicomposting in Egypt.

MATERIALS AND METHODS

The study was conducted at the Central Laboratory for Agricultural Climate (CLAC),Giza and Bossily site for the modern agriculture techniques, Rossita, Behira, Agriculture Researsh Center (ARC), Egypt, during 2007, 2008 and 2009.

2.1 The vermicomposting system study

2.1.1. breeding system

In case of increase the worms' biomass, breeding system had starting from the first stage. Every 30 days not 21 days, the juveniles of earthworms were moved to the growing bed and also select from the growing bed the mature worms to transfer to start a new breeding system.

Plastic, wodden and foam boxes were use as breeding systems. The breeding box covered by black net to offer the suitable ventilation and darkness for worms. Daily the worms were checked to assure the healty, safty and to avoid any problems . And every week turned upside down to offer the good ventilation and prevent the blocking of vermicompost. The bedding material and the top layers were shredded newspaper and cardboard.

Shredded newspaper, cardboard and vermicast were used as a bedding material to offer the suitable condition for earthworm growth. While the top layer of the breeding box was covered by shredded newspaper. The boxes covered by black net and put in layers. The foam trays used to cover the top box.

The feeding and watering of the breeding boxes were done every 3 days. The food put on the top layer after removing the shredded newspaper as blotches, and then backs the shredded newspaper to the top and watering.

The most important signs of good breeding system are showing the coocon (earthorm egg) and earthorm mating .

2.1.2 Growing systems

The system of Vermicomposting was established in bins form on concrete base by using bricks banded together with cement 1.25 x 4 x 0.75 m diamension, each system contain 5 kgm of epigiec earthworms in the first operating stage. Ten bins were establishment in the second stage while in the first stage were only three bins (0.6 m width x 1.4 m length x 0.6 m height) as illustrated .

Every day during the hot summer days, the growing beds turned and watering carefully. The feeding of earthworm done every two days and every 21 days the growing beds were fasting for 7 days to give earthworms the opportunities to re-eat the cast and to avoid non composted wastes. During the 7 days of fasting, the team work selected the mature worms for breeding boxes.

Pre-composting was done for about one week before feed it to worms to avoid any increase in the temperature. The pre-composted material also soaked in water for 0.5 to 1 hour to make sure it is not dry and put that it in lines along the bed with the soaked water.

2.1.3 Earthworm types

Allopophora spp. as domonant local type in Egypt was the first type used in the vermiculture and vermicompost.

Two Kgm of Epigiec earthowrms Lumbriscus Rubellus (Red Worm), Eisenia Fetida (Tiger Worm), Perionyx Excavatus (Indian Blue) and Eudrilus Eugeniae (African Night Crawler) were used in the vermicomposting bins. Worm diameter: 0.5 - 5mm and worm length: 10mm to 120m. The weight of 100 mature earthworm and multiply biomass rate measured every 3 months.

2.1.4 Fedding of earthworm

Horse manure(HM), cattle manure(CM), rabbit manure(RM), human solid wastes, vegetable and fruit wastes (FV), kitchen wastes (KW), clliping grass (CG), bread, pre-composted agricultural wastes(PC-A), cardboard and shraded newspaper wastes (NC) were used in feeding or traping the different types of earthworms.

The epigiec earthworm consume as much as their weight of different wastes. The use of newspaper, cardboard and any fiber material used as a bulk and water agent should not over than 50 % of proccessing waste.

2.1.4.1 Pre-composting the raw materials

On the other hand, pre-composting for 7 to 10 days was done for agricultural wastes such as different animal manure, peanut shells, faba bean straw, vegetables canopy, clipping grass, kitchen wastes and fresh manures to avoid the thermphilic stage of composting that could cause the death of earthworms in vermicompost systems.

Turning machine was use to accelerate the pre-composting operation by turninig the raw materials up side down for 6 Hrs./day to offer enough O_2 for aerobic condition and for well uniform pre-composted materials.

2.1.5 Watering and aireation of vermicompost systems.

Shredd newspaper was used to cover the bins to keep the bin from drying out during hot summer weather. Moisture content in the range of 60 – 70 % by watering every 2 or 3 days during hot days and every week during cold weather. Turning the bins was done every 1 to 3 days depend on the season to offer the aeration and to prevent the anaropic condition.

2.1.6 The pH of earthworm media

Earthworms prefer a neutral to slightly alkaline pH. pH meter was measuring the vermicompost pH every 15 days and in case of low pH, $Ca(CO_3)_2$ was used to reach slightly alkaline pH.

2.2. Comparison study between vermicomposting and conventional composting

Table (1) that presented the chemical composition of different wastes, the treatments set up for both vermicomposting (VC) and conventional composting (CC), of different wastes as follows :-

1. CM
2. HM
3. RM

4. VF
5. NC
6. VF + C M , (1: 1 v/v).
7. V F + H M, (1: 1 v/v).
8. V F + R M , (1: 1 v/v).
9. VF + N PW, (1: 1 v/v).
10. CM, HM and RM + NC (Mix 1), (1: 1 v/v).
11. C.M, H.M and RM + V&F + NC (Mix 2), (1: 1: 1 v/v).

Table 1. Chemical composition of different organic wastes.

Treatments	C/N ratio	Macro elements %				
		N	P	k	Ca	Mg
CM	24.17	1.78	0.41	1.94	1.07	1.31
HM	19.73	2.01	0.48	2.39	1.45	1.52
RM	21.00	0.95	0.42	0.85	1.19	0.76
VF	64.45	0.24	0.19	0.41	1.01	0.73
NC	178.45	0.02	0.01	0.0	0.21	0.01
VF + CM	41.34	1.03	0.56	1.14	1.06	1.04
VF + HM	38.58	1.14	0.34	1.37	1.25	1.14
VF + RM	40.91	0.60	0.31	0.89	1.12	0.76
VF + NPW	102.00	0.12	0.10	0.16	0.50	0.34
RHC + N (Mix1)	80.40	0.75	0.23	1.11	1.12	0.52
R, H, C + N + VF(Mix2)	93.26	0.90	0.31	1.26	1.21	0.66

Epigiec earthowrms and 7 bins of growing systems (each system contain 5 kgm of epigiec earthworms) were used in this study. The fedding rate of different wastes was as follows:- 5 Kg/day in the first 30 days, 7.5 Kg/day in the second 30 days and 10 Kg/day in the third 30 days.

The compost heaps of conventional composting (C.C) were made during the summer season, each heap was 1.25 x 1.5 x 0.75 m size. The composting procedures were done according to Abd-El-Wahab, (1999). The components of each heap were added in layers. Watering of each layer in the heap was applied. Plastic sheet was used to cover the ground before making the heap to keep up the leaching solution after watering and to prevent nutrients leaching. Also, each heap was covered by plastic sheet to keep up the moisture and to help in the decomposition work by increasing the temperature. The heaps were left without turning over with enough moisture for the first three weeks. Aeration and moistening were done regularly every week for air exchange within the heap for aerobic compositions as well as no percolation of compost exertion.

The samples of vermicomposts as shown in Image (4) were taken every 10 days and the conventional composting samples were taken after 3 months.

The mineral analysis of compost and vermicompost (N, P and K %) and (Pb, Ni, Cd and Co) were determined. Total nitrogen was estimated by Kjeldahl method. Phosphorus and Potassium were determined according to the methods of Watanabe and Olsen (1965) and Chapman and Pratt (1961) respictively. Phosphorus was determined by spectrophotometer and potassium by flame photometricall method. The metals Ca, Mg, Fe, Zn, Mn and Cu were determined using atomic absorption spectrophotometer as described by Chapman and Pratt (1961). The heavy metals (Cd, Pb, Co and Ni) were determined using Phillips Unicum Atomic Absorption spectrophotometer as described by Chapman and Pratt (1961).

RESULTS AND DISCUSSION

3.1 The vermicomposting system study

Allopophora spp. as domonant local type in Egypt during 7 months (Oct. 2007 to Apr. 2008) didn't present any vermicomposting activityand the multipling rate was complitly low, for these reasons it avoided to use in vermicomposting system.

Allopophora spp don't like high organic media and their biomass production potential is low about 4 to 6 months.

All aspects of the worm biology such as feeding habits, reproduction and biomass production potential must be known (Senapathi *et al.*, 1980, Bouche and Ferriere, 1986) in order to utilize the earthworms successfully in vermiculture. Since the diversity of earthworm species varies with different soil types and different agro climatic conditions, the species suited to a particular region must be identified.

Lumbriscus Rubellus (Red Worm), Eisenia Fetida (Tiger Worm), Perionyx Excavatus (Indian Blue) and Eudrilus Eugeniae (African Night Crawler) presented high vermicomposting activity beside the high multiply rate through Apr. 2008 to June 2009. Epigeic forms of earth worms can hasten the composting process to a significant extent (Senapathi, 1988, Kale *et al.*, 1982, Tomati et al., 1983), with production of better quality of composts, compared with those prepared through traditional methods (Tripathi and Bhardwaj, 2004).

The multipling rate of earthworm types increased from around 2 kgm in Apr. 2008 to around 100 kgm in June 2009.

The organic waste type had strong effect on average weight of earthworm and multiply rate as presented in Table (2). RHC. M + V & F + N feeding treatment recorded the hieghest multipling biomass rate while the lowest was R.M. On the other hand, R.M gave the highest average weight of 100 earthworms and V & F +N presented the lowest result of average weight of 100 earthworm.

3.2 The effect of vermicomposting and conventional composting

The obtained data from Table (2) indicated that, the vermicomposting treatment reduced the decomposting duration to less than 10 days compared to the conventional composting treatment (90 days).

Table (2) presented the effect of composting method on the macro elements composition (%) of different wastes. There is no difference between vermicomposting method and conventional composting in their effect on the chemical composition of different wastes.

The obtained results of the total N, P, K, Ca and Mg % of the mature composts showed an increase compared to that of the raw materials while C/N ratio decreased as a result of composting operation.

Table 2. The effect of composting method on the macro elements composition (%) of different wastes.

Waste type	Average weight/ gm of 100 earthworms	Multpling biomass rate % (3 months)
C.M	40.21	320
H.M	42.80	340
R.M	46.34	290
V & F	39.60	360
RHC. M + V & F	48.65	420
RHC. M + N	36.89	390
V &F+ N	32.40	412
RHC. M + V & F + N	44.33	440

The horse manure recorded the highest levels of total N, P, K, Ca and Mg % while the lowest results was recorded by vegetables & fruits wastes + newspaper wastes.

The lowest C/N ratio data was recorded for vegetables & fruits wastes + newspaper wastes compared to horse manure that recorded the highest level as Table (3) showed.

Table 3. The effect of composting method on the macro elements composition (%) of different wastes.

The waste types	N (%)		P (%)		K (%)		Ca (%)		Mg (%)	
	V.C	C.C	V.C	C.C	V.C	C.C	V.C	C.C	V.C	C.C
C.M.	2.21	1.43	0.43	0.43	2.27	2.41	1.21	1.19	1.48	1.41
H.M	2.31	1.93	0.68	0.66	2.61	2.78	1.51	1.54	1.61	1.46
R.M	1.56	0.95	0.48	0.45	0.91	1.03	1.21	1.13	0.94	1
V&F	0.97	0.64	0.34	0.31	1.04	1.01	1.54	1.51	0.81	0.64
V&F+C	1.59	1.24	0.51	0.47	1.06	1.14	1.23	1.18	1.11	0.97
V&F+H	1.64	1.29	0.64	0.62	1.32	1.59	1.48	1.37	1.34	1.13
V&F+R	1.41	1.09	0.51	0.48	0.99	0.84	1.12	0.86	0.91	0.85
V&F+N	0.41	0.38	0.43	0.42	0.82	0.73	0.69	0.71	0.42	0.43
Mix 1	1.08	0.89	0.43	0.41	0.88	0.54	0.61	0.63	0.71	0.68
Mix 2	1.34	1.3	0.57	0.55	1.04	0.91	1.12	1.11	0.9	0.79

The highest records of Fe and Mn were obtained by vermicompost of cattle manure while compost of horse manure gave the lowest result of Fe, the lowest value of Mn recorded by the compost of vegetable and fruit wastes as table (4) presented.

Table (4) showed that, the vermicompost of vegetable and fruit wastes recorded the highest value of Zn while the highest result Cu was recorded under the conventional compost of vegetable and fruit wastes. On the other hand the lowest records of Zn and Cu gave by the compost of horse manure and Mix 1 respectively.

Table 4. The effect of composting method on the micro elements composition (ppm) of different wastes.

The waste types	Fe (ppm)		Mn (ppm)		Zn (ppm)		Cu (ppm)	
	V.C	C.C	V.C	C.C	V.C	C.C	V.C	C.C
C.M.	26500	20800	255	230	86	80	15.72	13.26
H.M	5000	4156	227	214	66	59	23.58	19.49
R.M	14700	12900	265	225	116	102	14.15	13.97
V&F	11400	10650	169	148	162	149	29.87	30.11
V&F +C	20300	19210	202	191	112	111	20.44	19.27
V&F +H	12400	12000	194	175	111	106	25.16	27.34
V&F +R	16600	15750	210	187	141	128	17.3	16.71
V&F +N	6400	6200	159	137	119	106	15.72	16
Mix 1	14200	13800	172	149	136	130	11.3	10.67
Mix 2	16000	15500	182	164	141	132	13.54	13.91

Table (5) presented the effect of composting method on the heavy elements composition (ppm) of different wastes. In general, the heavy metals contents of different vermicomposts types were lower than the convential compost of different wastes.

The conventail compost of horse manure gave the highest value of Pb while the highest records of Ni and Cd recorded by conventail compost of cattle manure. The compost of vegetable and fruit wastes presented the highest value of Co.

Table 5. The effect of composting method on the heavy elements composition (ppm) of different wastes.

The waste types	Pb (ppm)		Ni (ppm)		Cd (ppm)		Co (ppm)	
	V.C	C.C	V.C	C.C	V.C	C.C	V.C	C.C
C.M.	44.13	62.68	18.21	20.5	5.23	7.63	1.14	3.81
H.M	41.25	74.08	2.05	3.81	0.72	1.14	1.14	3.81
R.M	21.09	39.89	2.93	5.86	0.28	1.39	2.01	3.81
V&F	5.7	5.86	9.26	14.04	0.14	0.69	7.01	11.42
V&F +C	18	22.79	8.01	11.71	4.01	4.66	3.85	5.23
V&F +H	17.12	22.79	7.14	8.2	2.23	2.47	4.39	6.01
V&F +R	11.4	17.1	8.65	8.79	2.11	3.47	4.39	5.49
V&F +N	28.18	34.25	14.71	14.64	1.59	2.08	3.81	8.91
Mix 1	23.76	29.31	18	17.57	2.37	4.66	0.76	1.14
Mix 2	11.17	18.91	6.31	8.2	1.09	1.89	1.98	4.02

The lowest values of Pb and Cd were obtained by vermicompost of vegetable and fruit wastes while the vermicompost of horse manure and Mix 1 gave the lowest results of Ni and Co respictively.

The highest macro and micro results of using vermicompost for recycling different wastes may led to recycle the leaching water during the composting process and prevent any nutrients to loss while the convential compost expossed to leach nutrient via leaching water during the long duration of composting and N emission from the heaps.

On the other hand, the vermicompost help in reduce the availabilty of heavy metals through the bio substances of earthworm beside the micro-organizms.

Vermicompost (Worm composting) is a method for recycling food waste into a rich, dark, earth-smelling soil conditioner. The great advantage of worm composting is that this can be done indoors and outdoors, thus allowing year round composting. It also provides apartment dwellers with a means of composting. Vermicomposting allows obtaining organic sources of nutrients for the crops in relatively less time, which are physically, nutritionally and biochemically improved over composts.

Vermicomposting is defined as a low cost technology system for processing or treatment of organic waste (Hand *et al.*, 1988b).

The growing interest toward applications of natural resources makes organic manures of particular importance. The recycling of organic wastes for maintenance of soil health by hygienic methods is vital for increasing crop production and welfare of mankind. The incorporation of organic remain in the form of compost, farmyard manure, cereal residue and green manure is known to influence favorably the physical, chemical and biological properties of the soil (Gaur, 1987). Dalzell et al (1987) reported that composting is the most important and rewarding method for increasing agricultural output by raising the level of soil fertility by improving a) the long-term structural stability, b) moisture retention of the soil and c) increasing the supply of plant nutrients.

The both of composting methods presented the positive effect on the chemical properties of different wastes. While the use of vermicomposting as a composting method presented higher effect on the composting duration instead of it's not popular to use it in Egypt. The short duration of composting by this method (less than 10 days) gave the high opportunity to produce compost during all the year with high nutrish value independent on the waste type.

On the other hand, the conventional composting method had the advantage of the low cost and easy management. The long duration of composting by this method (12 to 16 weeks) is the limited factor to replicate the composting (3 to 4 times per independent on the waste type).

The quality of composts depends on several factors viz. type of substrate (organic residues), aeration, humidity, pH, temperature, and the earthworm species used during vermicomposting. Therefore, it is necessary to evaluate specific characteristics, such as composition and abundance of microorganisms, organic C, total N, P and K content, humic acids (Has) and enzymatic activities, in order to know the dynamics of vermicomposting. Humic acids (Has) enhance nutrient uptake by the plants by increasing the permeability of root cell membrane (Valdrighi *et al.*, 1996), stimulating root growth, increasing proliferation of root-hairs (Tallini *et al.*, 1991).

CONCLUSION

Epigiec earthowrms Lumbriscus Rubellus (Red Worm), Eisenia Fetida (TIger Worm), Perionyx Excavatus (Indian Blue) and Eudrilus Eugeniae (African Night Crawler) could be use successfully in vermicomposting system compared to the local type Allopophora spp.

Earth worms could be successfully utilized to reduce the duration of compost production from agriculture and other organic wastes. A high value compost could be obtained through the proper management of organic wastes (vegetables, fruits and newspaper wastes, etc) beside the animal manures.

Further studies are required to develop operational system for large scale organic waste production. Shortening composting duration will mitigate the greenhouse gases (GHG) emissions from farm organic residues.

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تكنولوجيا تدوير المخلفات العضوية باستخدام دودالأرض واستخدامها فى الزراعة المستدامه فى مصر

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المعمل المركزي للمناخ الزراعى ، مركز البحوث الزراعية ، الجيزة.

تهدف هذه الدراسة الى استخدام تكنولوجيا تدوير المخلفات العضوية باستخدام مكمورة دود الأرض وذلك بغرض التنمية الزراعية المستدامه فى مصر.للحد من انبعاثات غازات الإحتباس الحرارى، حيث تم تطوير نظام تدوير المخلفات باستخدام ديدان الأرض للتخلص من المخلفات العضوية وانتاج سماد عضوى عالى الجوده حيث تعتبر هذه الطريقة مستحدثة لإنتاج السماد من المخلفات العضوية الغنية بالعناصر الغذائية وذلك من اجل الزراعة المستدامه.

اجريت هذه الدراسه فى المعمل المركزي للمناخ الزراعي فى الفترة من ٢٠٠٧ حتى ٢٠٠٩ بموقع الدقى.

تم دراسة كلاً من انواع دود الأرض، ومعدل النمو ، واستخدام نظم التربية والإكثار، والتغذية والترطيب وكفاءة انتاج الكمبوست باستخدام ديدان الأرض.

استخدم فى هذه الدراسة أربعة أنواع من الديدان المستورده من استراليا وهى، Lumbriscus Rubellus (الدود الأحمر) ، EiseniaFetida (تايجر الدود) و Perionyx Excavatus (الهندي الأزرق) و Eudrilus Eugeniae (الإفريقي الليلى الزاحف)، هذا الى جانب النوع المحلى Allopophora.

تتكون قائمة تغذية الدود من مخلفات حيوانية(بقر،جاموس، خيول والأرانب) بالإضافة الى مخلفات المطبخ (خضر وفاكهة) وبعض االمخلفات النباتية بالإضافة الى أوراق الجرائد والكرتون.

تم استخدام نظم مختلفة فى اكثار وتربية الديدان و انتاج الكمبوست. استخدمت صناديق بلاستيكية كفترة تعديل لمدة ٢١ يوم. من ناحية اخري، تم انشاء حاويات مصنوعه من الطوب الأحمر عرض ٠,٧٥X١,٢٥ سم ارتفاع و ٤ م طول) وذلك لهذا النظام المتنامى.

بالمقارنة بين انتاج الكمبوست باستخدام دود الأرض وانتاج الكمبوست بالطرق التقليدية وجد ان الكمبوست المنتج باستخدام دود الأرض وجد ان الكمبوست المنتج بالدود به نسب عالية من النتروجين والفوسفور والبوتاسيوم ، وفى نفس الوقت انخفض محتوى المعادن الثقيلة. ارتفاع محتوى العناصر الكلي والجزئي للعناصر وايضا المحتوى السائل للكمبوست (شاى) بالمقارنة بالكمبوست ت (شاي الكمبوست) التقليلدي.