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EVALUATION OF DIFFERENT COMPOST TYPES PROPERTIES AND THEIR FERTILIZATION VALUE

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ABSTRACT:

Two different types of compost, namely plant residues compost (PRC) and cattle manure compost (CMC), were characterized, irrespectively, for their physico-chemical, nutritional and microbiological, as well as maturity indices. Results cleared that different characteristics of the used compost types, Physico – chemical and nutritional properties, i.e., bulk density and C/N ratio of the two composts had a suitable values and both composts contained appreciable contents of macro- and micro-nutrients, particularly the CMC.

Microbiological aspects, both composts exhibited a distinct microbial potency, which was reflected by high numbers of the main groups of microorganisms, as well as the activity of dehydrogenase enzyme. CMC exhibited more microbial numbers than PRC, and the main groups of microorganisms, such as cellulose - decomposing and N_2 fixers were identified. The dominant mesophilic species isolated from PRC and CMC were Bacillus, Trichoderma and Streptomyces .

Maturity and stability indices of the two composts (e.g. C/N ratio, pH value, E_4/E_6 ratio, NH_4^+-N / NO_3^- -N ratio, seed germination index (for each of cress, barley, and faba bean, "as indicator plants") and evolution of CO_2 , indicated that such composts are well matured and may be used without any restrictions.

Key Words: ***Compost, plant residues, cattle manure, dehydrogenase enzyme and seed germination index.***

INTRODUCTION

One method of improving the quality of soils involves recycling of crop residues. The use of agricultural and municipal wastes through composting is increasing in many countries. Therefore, the recent trends in recycling of crop residues indicate the possibility of using certain efficient microflora particularly basidiomycetes, which are the best known cellulose and legnin degraders. If the microflora are added during composting process the time of composting might be reduced without deterioration of compost quality

(Buswell *et al*., 1994).The incorporation of organic remains in the form of compost, farmyard manure, crop residues and green manure is known to influence favorably the physical, chemical, and biological properties of soil (Gaur, 1987). Composts used as substrates should have a high degree of maturity, and adequate physical and chemical properties, such as particle size, porosity, water-holding capacity, air capacity, electrical conductivity and pH, which are even more important than the concentrations of nutrients, because these latter can be added by fertilization (Gouin, 1998). Composts usually show high porosity and air capacity, and a low water-holding capacity (Abad *et al*., 2001). They also have high salt and nutrient contents (Lopez-Real *et al*., 1989). (Sanchez-Monedero *et al*., 1997 and Eklind *et al*., 1998).

Benefits of animal manure compost have been attributed to the diversity of its microbial populations (Scheuerell, 2002) or to higher levels of available phosphorus, calcium and trace elements compared to garden organics and lawn trimmings derived composts (Pittaway, 2003). (Ingham,2005); claimed that composts produced from woody materials (resistant to rapid decay) with some manure or green vegetation material were likely to produce composts dominated by active fungal populations whilst composts produced from predominantly green material or manure with less woody material claimed to produce composts dominated by active bacterial populations .Disease suppression results are highly variable, as is to be expected where composts are indiscriminately applied in an emerging area with a limited knowledge of preferred characteristics, application rates and application timing, and the impact of environmental conditions, for example.

The objective of this work is to examine the different types of compost, namely plant residues compost and cattle manure compost for their physico-chemical, nutritional and microbiological properties.

MATERIALS AND METHODS

Two mature composts obtained from different sources were used in this work. The first was a plant residues compost (PRC), supplied by Ismailia Agricultural Research Station, ARC., it was made from rice straw and guava burning wastes amended with amount of natural soil . The second was a cattle manure compost (CMC), supplied by a private compost plant at El-Khatatba City, Minufiya Governorate. Representative samples from both composts were subjected for analyses to evaluate their chemical, nutritional and microbiological properties, as well as to detect some maturity and stability indices to satisfy the first aim of the present study.

A- Isolation and enumeration of most common microorganisms.

Samples were taken from the fresh composts to isolate and count the most common microbes, i.e., bacteria, fungi and actinomycetes by means of the dilution plate technique using nutrient agar media (Difico, 1984),

B. Purification and identification of selected microbes

Further purification was carried out for some selected isolates on different media, as follows: Nutrient agar medium for purification and identification of: bacteria (Difco, 1984), actinomycetes (Allen, 1950), fungal isolates were identified by specialists in the Faculty of Science, Cairo University, Egypt, according to Gilman, (1957), Ainsworth *et al.* (1973), bacterial isolates were identified in the Biotechnology and Applied Microbiology Center (BAMC), Al-Azhar Univ., Cairo, Egypt. Actinomycetes were identified in Microbiology Department National Research Center, Cairo; Egypt.

C. Chemical and physical determinations of Compost:

- pH was determined in 1:10 (compost : water) suspension (w/v), using glass electrode pH-meter, and Electrical conductivity "EC"(dS/m at 25°C), was determined in 1:10 (compost: water) extract as described by Jackson (1973).
- Organic carbon (%), was determined according to Walkley and Black method using O-phenanthroline as an indicator (Black *et al.*, 1965).
- Organic matter was content (%), calculated by multiplying organic carbon percent by 1.72 (Page *et al.*, 1982).
- Total nitrogen content, was determined in the dried compost samples using Kjeldahl digestion method as described by Jackson (1973).
- Total soluble nitrogen, content (ammoniacal and nitrate-N), was determined by steam distillation procedure using Mg Oxide-Devarda alloy method according to Black *et al.* (1965).
- Total phosphorus was determined Spectrophotometrically as described by Page *et al.* (1982).
- Total potassium was determined according to Page *et al.* (1982).
- Total iron, manganese, zinc and copper were determined by using atomic absorption spectrophotometer (model Phillips PU 9100), according to Jackson (1973).

- Determination of microbial population:

- Total counts of mesophilic and thermophilic bacteria were determined according to Clark (1965)., total counts of mesophilic and thermophilic fungi were determined according to Martin (1950), total counts of mesophilic and thermophilic actinomycetes were determined using Jensen,s medium as recommended by Allen (1959), counts of cellulose decomposers were estimated using Dubo,s cellulose medium (Dubos, 1928), counts of *Azotobacter* sp were determined using Ashby's medium as recommended by Allen (1959), counts of *Azospirillum* sp were determined using N-deficient medium, as recommended by Dobereiner *et al.* (1976), counts of N_2-Fixing Bacilli bacteria were determined, as recommended by Hino and Wilson (1958), viable numbers of *Azotobacter*, cellulose decomposers, *Azospirillum* and N_2- Fixing Bacilli bacteria were calculated on the basis of the most probable numbers (MPN), according to Cochran,s Table (1950).

- Measurement of compost maturity:

- Seed germination test, according to Pare *et al.* (1997), pH under anaerobic conditions was measured as an indicator for compost maturity according to Jann *et al.* (1959), C/N ratio could be considered as an important indicator for maturity,

E4/E6 ratio, Extinction coefficient (extinction factor or humification test) in aqueous and alkaline extract of compost was measured, according to Page *et al.* (1982) , mesophilic/thermophilic microbial population ratio in composts could be considered as an indicator for maturity, according to Jimenez and Garcia (1989),

Dehydrogenase activity (DHA) was assayed, according to Page *et al.* (1982),

- Nitrogenase activity (N_2-ase) was measured according to Hardy *et al.* (1973).

Microbial Respiration (CO_2 evolution): was determined by the procedure of Alef, and Nannipieri (1995).

RESULTS AND DISCUSSION

Compost is an end product, resulting from organic raw materials that exposed to decomposition process by numerous microbial communities. Therefore, monitoring the different characteristics of composts originated from different sources of raw materials, mainly plant residues or cattle manure may be a good indicator to judge their efficiency and quality as a growth media and biological control agent. These characteristics are including physco-chemical and microbiological properties as well as their curing aspects.

A. Physico – chemical and nutritional properties

The main physical and chemical properties of the two composts namely, plant Residue compost (PRC) and Cattle manure Compost (CMC), are presented in Table (41). It is evident that their bulk density and water holding capacity had reasonable values, indicating that these composts were at a considerable state of decomposition. Values of bulk density (591 and 594 kg $/m^3$ for PRC and CMC, respectively) are indicative incidence of intensive reduction of the volume of raw materials, as a result of decomposition process. These values are feasible of their incorporation with other mineral and organic materials, handling and transportation (Rynk , 1992 and Abdel-Wahab , 1999).

Regarding the chemical properties, data in Table (21) exerted that values of pH and EC were relatively high for the two tested composts, with CMC having higher values than PRC. The high values of EC may be due to a release of soluble salts during the decomposition of easily biodegradable organic substances (Wong *et al*., 2001 and Gomez- Brandon *et al*., 2008).

Data revealed that C/N ratio of the two composts had a suitable value i.e. 16. In this concern, many investigators stated that, when the C/N ratio is less than 20, the compost is considered mature and can be used without any restrictions Vuorinen and Saharinen, 1997.

From the agricultural standpoint, the nutrient contents of compost are very important aspect, hence the fertilizing value is evaluated through measurement of macro- and micro-nutrients. It was evident that our both composts contained appreciable contents of N, P and K, in total and available forms, beside their high contents of micronutrients, particularly the (CMC). Additionally, the presence of nutrients together with decomposing organic materials and humic substances in composts keep nutrients against loss by leaching, volatilization, precipitation or fixation, leading to increase their availability to plants (Manna *et al*., 2003 and Abdel Wahab, 2008).

Table (~~2~~1): The main physico-chemical and nutrional properties of both used composts

Property	Plant residue compost (PRC)	Cattle manure compost (CMC)
Bulk density (kg/m^3)	591	594
Moisture content (%)	25.7	27.4
WHC (%)*	134.6	121.5
pH (in 1:10 water suspension)	7.3	8.2
EC (in 1:10 water extract) (dSm^{-1})	3.45	3.95
Organic C (%)	17.28	20.19
Organic matter (%)	29.72	34.73
Total N (%)	1.03	1.25
C/N ratio	16.78	16.15
Total P (%)	0.52	0.57
Total K (%)	0.61	0.77
NH_4^+-N (ppm)	56.5	74.2
NO_3^- - N(ppm)	78.2	99.4
Total Fe (ppm)	135.4	178.8
Total Mn (ppm)	21.1	30.3
Total Zn (ppm)	27.3	43.3
Total Cu (ppm)	6.5	13.6

*Water holding capacity.

B. Microbiological aspects

Some microbiological aspects of plant residues compost (PRC) and cattle manure compost (CMC) are presented in Table (~~3~~2) . In general , both composts exhibited a distinct biotic potency, being reflected by the total numbers of main groups of microorganisms and confirmed by activity of dehydrogenase enzyme (172.3 and 180.0 mg TPF/ 100g compost respectively, for PRC and CMC).Such major enzyme is considered a good and real

indicator of overall microbial activity, as it is involved in the respiratory chains of all organisms and it refers to bioorganic catalytic groups of most endocellular enzymes, responsible for energy acquisition (Foster *et al*., 1993). In addition, the two composts attained high numbers of the mesophilic microorganisms than the thermophilic ones, particularly, bacteria, this indicated that these composts reached maturity. Moreover, data exerted that such compost samples displayed a high numbers of some beneficial microorganisms, and confirmed by the activity of nitrogenase enzyme (Table ~~3~~2). In other words, CMC contained 0.62 x 10^7 , 0.55 x 10^7 ,0.57 x 10^7 and 0.56 10^7 for *Bacillus* , *Azospirillum* , *Azotobacter* and cellulose decomposing bacteria, respectively. The corresponding values attained by PRC were 0.6 x10^7, 0.47 x10^7, 0.55 x10^7 and 0.51 x 10^7 , respectively .These results mean that these composts had diverse microbial communities and biochemical activities , which certainly leads to increase the plant growth promoting substances (Alvarez *et al*., 1995 and Abdel–Wahab, 2008) .Additionally, presence of these beneficial microorganisms in compost media act to maintain their survival and sustain their activities resulting in increasing their ability to suppress soil borne diseases (Hoitink and Changa , 2004).

Table (~~3~~2): Microbiological aspects of both used compost

Measure	Plant residues compost (PRC)	Cattle manure compost (CMC)
No. of mesoophilic bacteria (x 10^7cfu/g)	7.63	7.74
No.of thermophilic bacteria (x 10^7cfu/g)	0.39	0.37
No.of mesoophilic fungi (x 10^7cfu/g)	6.45	6.48
No.of thermophilic fungi(x 10^7cfu/g)	0.023	0.020
No.of mesoophilic actinomycets(x 10^7cfu/g)	6.85	6.95
No.of thermophilic actinomycets(x10^7cfu/g)	0.033	0.030
No. of *Bacillus* sp. (x 10^7cfu/g)	0.60	0.62
No.of *Azospirillum* (x 10^7cfu/g)	0.47	0.55
No.of *Azotobacter* (x 10^7cfu/g)	0.55	0.57
No.of Cellulose dec. bact. (x 10^7cfu/g)	0.51	0.56
Dehydrogenase activity (mg TPF/ g compost)	172.3	180.0
Nitrogenase activity (nmol C_2H_4 /g compost/ hr)	139.7	155.6
CO_2-evolution (mg CO_2/g)	1.67	1.73

Results illustrated in Table (43) show the common main groups of mesophilic and thermophilic microorganisms (bacteria, fungi and actinomycetes), isolated from the two compost types. As for bacteria ,the dominant mesophilic species isolated from PRC were *Bacillus subtilis*, *B.polymyxa* and *B.badies*, which had presence frequencies of 46.51,34.88 and 18.61 % , respectively, with one species of thermophilic bacteria identified as *Bacillus stearothermophilus,* which had a frequency of 100%. The dominant species inhabiting the CMC were *B.Subtilis*, *B.Polymyxa* and

B.brevis. with frequencies of, 36.36,36.36and 27.28, respectively, and the same thermophilic species, dominating in PRC.

Regarding the fungal species, data in Table (43) reveal that the dominant mesophilic fungi inhabitating the PRC were *Trichoderma viride* and *Fusarium solani*, having frequencies of 70 and 30%, respectively. Whereas, the dominant species of mesophilic fungi in CMC were *Trichoderma ressei* and *Penicillum citrinum* , with frequencies of 66.66 and 33.34%, respectively . As for thermophilic fungal species isolated from the two compost types, they recorded markedly low numbers lower than the mesophilic ones. The two types of compost had a 100% frequency for one thermophilic fungal species, identified as *Aspergillus* sp. Concerning the actinomycetes isolated from both compost types, results in Table (43) exerted that both composts had nearly the same mesophilic species. CMC harbored *Streptomyces antibioticus*, *St.roseus* and *St.gresous*, of frequencies of 44.44%, 33.33 and 22.23 %, respectively.

Table (43): The common main groups of microorganisms colonizing both used composts

Microbial groups	No. of Colonies	Freq. (%)	Identified microbial colony
Plant Residues Compost (PRC)			
Mesophilic bacteria	20	46.51	*Bacillus Subtilis*
Mesophilic bacteria	15	34.88	*Bacillus polymyxa*
Mesophilic bacteria	8	18.61	*Bacillus badies*
Thermophilic bacteria	3	100.00	*Bacillus sterothermophilic*
Mesophilic fungi	2	70.00	*Trichoderma viridi*
Mesophilic fungi	1	30.00	*Fusarium solani*
Thermophilic fungi	1	100.00	*Aspergillus sp.*
Mesophilic actionmycetes	5	71.42	*St. Antibioticus*
Mesophilic actionmycetes	2	28.58	*St. Roseus*
Thermophilic actinomycetes	1	50.00	*Thermoactinomycisdischot*
Thermophilic actinomycetes	1	50.00	*Thermophilicactinomyces sp*
Cattle Manure Compost (CMC)			
Mesophilic bacteria	20	36.36	*Bacillus subtilis*
Mesophilic bacteria	20	36.36	*Bacillus polymyxa*
Mesophilic bacteria	15	27.28	*Bacillus brevis*
Thermophilic bacteria	4	80.00	*B. stearothermophilus*
Thermophilic bacteria	1	20.00	*Bacillus sp.*
Mesophilic fungi.	2	66.66	*Trichoderma ressie*
Mesophilic fungi	1	33.34	*Pencillum citrinum*
Thermophilic fungi	1	100.00	*Aspergillus funigatus*
Mesophilic actinomycetes	4	44.44	*Streptomyces antibioticus*
Mesophilic actinomycetes	3	33.33	*St. .roseus*
Mesophilic actinomycetes	2	22.23	*St. .gresous*
Thermophilic actinomycetes	2	66.66	*Thermodischotomicus*
Thermophilic actinomycetes	1	33.34	*Thermoactinomyces sp.*

While in the PRC, there were only two species, *St. Antibioticus* and *St. roseus*, with frequencies of 71.42 and 28.58 %-, respectively . Regarding the thermophilic actinomycetes, two species were identified in both compost types, namely *Thermoactinomycetes dischotomicus* and *Thermoactinomycetes* sp., having high frequencies. From the mentioned results, it is obvious that *Bacillus subtilis* and *B. polymyxa* are the most dominant mesophilic bacterial species, whereas the most isolated fungi were belonged to the Deteyromycetes where the prevalent genera in the two compost types were *Trichoderma, Pencillum and Aspergillus* . Also, the genus *Streptomyces* was the most prevailing mesophilic genus of actinomycetes inhabitating the composts. In fact, composition of the microbial community during composting process of manures is determined by many factors. Temperature represents a major selective factor under aerobic conditions for populations determining the rate of metabolic activities. Since the kind of starting materials and process conditions determine the community composition to a large degree, it is difficult to generalize (Ryckeboer *et al*., 2003). Hence, the microbiology of compost is very complex and the isolation of all bacterial species present in the compost cannot be fully accomplished (Beffa *et al*., 1996 and Hassen *et al*., 2001). However, identification of the main genera of microbial communities is very important practice for the finished composts. The genera *Bacillus*, *Streptomyces*, *Trichoderma*, *Pencillum* and *Aspergillus* have a vital role beside bio- degradation of organic wastes, that their ability to suppress the soil borne phytopathogens and nematodes (Oka and Yermiyahu, 2003), as well as their ability to promote grown plants through their beneficial effects such as producing the growth promoting substances and improving the nutrient availability (Vessey, 2003).

Table (4): The common main groups of microorganisms colonizing both used composts

Microbial groups	No. of Colonies	Freq. (%)	Identified microbial colony
Plant Residues Compost (PRC)			
Mesophilic bacteria	20	46.51	*Bacillus Subtilis*
Mesophilic bacteria	15	34.88	*Bacillus polymyxa*
Mesophilic bacteria	8	18.61	*Bacillus badies*
Thermophilic bacteria	3	100.00	*Bacillus sterothermophilic*
Mesophilic fungi	2	70.00	*Trichoderma viridi*
Mesophilic fungi	1	30.00	*Fusarium solani*
Thermophilic fungi	1	100.00	*Aspergillus sp.*
Mesophilic actionmycetes	5	71.42	*St. Antibioticus*
Mesophilic actionmycetes	2	28.58	*St. Roseus*
Thermophilic actinomycetes	1	50.00	*Thermoactinomycisdischot*
Thermophilic actinomycetes	1	50.00	*Thermophilicactinomyces sp*
Cattle Manure Compost (CMC)			

Mesophilic bacteria	20	36.36	*Bacillus subtilis*
Mesophilic bacteria	20	36.36	*Bacillus polymyxa*
Mesophilic bacteria	15	27.28	*Bacillus brevis*
Thermophilic bacteria	4	80.00	*B. stearothermophilus*
Thermophilic bacteria	1	20.00	*Bacillus sp.*
Mesophilic fungi.	2	66.66	*Trichoderma ressie*
Mesophilic fungi	1	33.34	*Pencillum citrinum*
Thermophilic fungi	1	100.00	*Aspergillus funigatus*
Mesophilic actinomycetes	4	44.44	*Streptomyces antibioticus*
Mesophilic actinomycetes	3	33.33	*St. .roseus*
Mesophilic actinomycetes	2	22.23	*St. .gresous*
Thermophilic actinomycetes	2	66.66	*Thermodischotomicus*
Thermophilic actinomycetes	1	33.34	*Thermoactinomyces sp.*

the main genera of microbial communities is very important practice for the finished composts. The genera *Bacillus*, *Streptomyces*, *Trichoderma*, *Pencillum* and *Aspergillus* have a vital role beside bio- degradation of organic wastes, that their ability to suppress the soil borne phytopathogens and nematodes (Oka and Yermiyahu, 2003), as well as their ability to promote grown plants through their beneficial effects such as producing the growth promoting substances and improving the nutrient availability (Vessey, 2003).

C. Some maturity and stability indices

The successful utility a of compost for agricultural purposes critically depends on maturity / stability degree. Some indices of maturity and stability of the two tested composts are presented in Table (54). It is apparent that C/N ratio of both composts is at acceptable levels (16.75 and 16.15 for PRC and CMC, respectively.) in relation to the compost maturity. Composts are usually used when their C/N ratio lies between 15 and 20, without any restrictions (Vuorinen and Saharinen (1997) . pH value of the saturated compost samples, after incubation at 55^{0}C for 24 hr., tended to remain almost neutral or slightly alkaline, confirming their maturity (Jiminez and Garcia ,1989). Ratio of optical densities of the composts extracts, at 460 and 660 nm (E_4/E_6) reflected the degree of condensation of aromatic humus nuclei, indicating thus their maturity (Schnitzer *et al*., 1993). E_4/E_6 ratios of both tested composts were relatively higher in the aqueous extracts (particularly for CMC), than those in the alkaline one. The lower values of E4/E6 ratios shown in the alkaline extracts for the two composts may indicate higher rates of humification process (Wong *et al*., 2001).

Germination index (GI), which combines the measure of relative seed germination and relative root elongation of cress seeds (as a reference), is the most sensitive parameter used to evaluate the toxicity and degree of

maturity of compost (Zucconi *et al*.1981). The GI values of three tested reference plants, namely cress, barley and faba bean are shown in Table (5). It is evident that the obtained data for the two tested composts gave high GI values, which greatly exceeded 50 - 60 %, the values, which has been suggested as an indication of phytotoxin – free compost (Zucconi and de Bertoldi, 1987).

In respect to NH^{+}_{4}-N / NO^{-}_{3}-N ratio, as an index for nitrification process, the two composts attained low values (nitrates were more than ammonium) of such ratio, indicating that these composts had a prolonged curing stage. This means that the obtained values of NH^{+}_{4} / NO^{-}_{3} ratio reflect the maturity of both composts. These finding are in accordance with those of Bernal *et al*. (1998), Bentio *et al*. (2003) and Gomez-Brandon *et al*. (2008), who reported that nitrification process handily occurred under thermophilic conditions, since temperatures greater than 40 0c inhibit the activity and growth of nitrifiers. Hence, A NH^{+}_{4} / NO^{-}_{3}-N ratio, in favor of the oxidized form, is considered desirable for a mature compost. Accumulative CO_2 – evolution after 5 days for the two composts is considered a real index of their stability.

Data in Table (54) demonstrated that CO_2 values did not give a clear trend, and the overall CO_2 evolution rates were relatively low, indicating that the two tested composts were at a reasonable degree of stability. These results are in accordance with those obtained by Wu and Ma (2001), Bentio *et al*.(2003) and Abdel –Wahab *et al* (2008), who found that the CO_2 evolution rate remained nearly stable during the curing phase of composting. Moreover, the high ratio between mesophilic and thermophilic bacteria confirmed the alleviation of the active composting stage, which means that these composts reached the maturity stage.

Table (54): Some maturity and stability indices of the used composts

Parameter	Plant residues compost (PRC)	Cattle manure compost (CMC)
C/N ratio	16.78	16.15
PH of saturated water sample, at 55° C	7.28	7.10
E_4/E_6 ratio in aqueous extract (1:10)	3.62	4.91
E_4/E_6 ratio in alkaline extract (1:10)	1.58	1.60
NH_4^{+}-N/ NO_3^{-} - N ratio	0.72	0.75
Seed germination index (%), for each of: *		
Cress	91.15	87.80
Barley	92.89	90.14
faba bean	100.43	98.02
CO_2 evolution (mgCO_2/g/day), after:		
1st day	1.33	1.40

2st day	1.57	1.50
3st day	1.27	1.37
4st day	1.33	1.27
5st day	1.17	1.20
Ratio of meso/ thermophilic bacteria	2.09	2.19

*Reference plasnts.

REFERENCES

Abad, M., P. Noguera and S. Bures (2001). National inventory of organic wastes for use as growing media for ornamental potted plant production: Case study in Spain. Bioresources Technol. 77:197-200.

Abdel-Wahab, A.F.M. (1999). Iron-zinc-organic wastes interactions and their effects on biological nitrogen fixation in newly reclaimed soils. Ph.D. Thesis, Fac. of Agric., Ain Shams Univ., Egypt.

Abdel-Wahab, A. F. M. (2008). Evaluation of enriched compost and its role in synergy with rhizobacteria and N-fertilization for improving maize productivity in sandy soil. Arab.Uinv.J.Agric. Sci.,Ain Shams Univ.,16:319-334.

Ainsworth, G.C., F.K. Sparrow and A.S. Sussman (1973). The Fungi, An Advanced treatise Academic press, New York, pp. 57, 62, 63, 64, 111, 287, 425, 426, 429, 430, 430, 517, 534, and 540.

Alef, K., and P. Nannipieri (1995). Methods in Applied Soil Microbiology and Biochemistry. Academic Press, London pp. 565.

Allen, O. N. (1950). Experiments in soil bacteriology. Burgess publishing Co., U. S. A.

Allen, O. N. (1959). "Experiments in Soil Bacteriology".3rd ed. Burgess Publ. Co. USA. pp. 117.

Alvarez, M. A., S. Gagné and H. Antoun, (1995). Effect of compost on rhizosphere microflora of the tomato and on the incidence of plant growth-promoting *rhizobacteria.* Appl.Environ. Microbiol., 61:194-199

Beffa, T., M. Blanc, L. Marilley, J. Lott-Fisher and P.F. Lyon (1996). Taxonomic and metabolic microbial diversity during composting. Blackie Academic and Professional, Glasgow, UK, PP. 149 – 161.

Bentio, M., A. Masguer and A. Moliner (2003). Chemical and microbiological parameters for the characterization of the stability and maturity of pruning waste compost. Biol.Ferti.Soils.,37:184-189.

Bernal, M. P., C. Pardes, M. A. Sanchez-Monero and J. Ceggara (1998). Maturity and stability parameters of compost prepared with a wide range of organic wastes. Bioresour. Technol.,63:91-99.

Black, C. A., D. D. Evans, L.E. Ensminger, J.L. White, F.E. Clark and R.C. Dinauer (1965). “Methods of Soil Analysis”.Plant II Chemical and Microbiological Properties. Amer. Soc. Agron. Inc. Bull., Madison, Wisconsin., USA.

Buswell, J. A., Chang and Shu-Ting (1994). Biomass and extracellular hydrolytic Enzyme production by six mushroom species grown on soy bean waste. Biotechnol. Lett., 16 (12): 1317-1322.

Clark, F. E. (1965). Agar-plate methods for total microbial count. In C.A. Black *et al.* (ed.) Methods of Soil analysis, Part 2. Agronomy, 9: 1460-1466. Amer. Soc. of Agron., Inc, Madison, Wis., USA.

Cochran, W. G. (1950). Estimation of bacteria densities by means of the “most probable number”. Biometrics, 6: 105-116. Control. B. Sneh, S. Jabaji-Hare, S. Neate, and G. Dijst, eds. Kluwer

Difico Manual (1984). Dehydrated culture media and reagents for microbiology. 10^{th} Ed. Difco laboratories Defroit Michigan, 48232 USA, pp., 621.

Dobereiner, J., L.E. Marrial and M. Nery (1976). Ecological distribution of *Azospirillum lipoferum*. Beijerink. Can. J. Microbiol., 22: 1464-1473.

Dubos, R. J. (1928). The decomposition of cellulose by aerobic bacteria.Evolution of composted sewage sludge/straw mixture for horticultural utilization. Water Sci. Tech., 21: 889–897.

Eklind, Y., L. Salomonsson, L., M. Wivstad ,and M., B. R€eamert, B., (1998). Use of herbage compost as horticultural substrate and source of plant nutrients. Biol. Agric. Hortic. 16, 269–290

Forster, J. C., W. Zech and E. Wurdinger (1993). Comparison of chemical and microbiological methods for the characterization of the maturity of composts from contrasting sources. Biol. Fertil. Soils, 16: 93-99.

Gaur, A.C. (1987). Recycling of organic wastes by improved techniques of composting and other methods. Reso. and Cons.,13:157-174.

Gilman, J. C. (1957). A Manual of Soil Fungi. The Maple Co. New York, USA. Pp. 208, 217, 220, 223, 224, 225, 228, 232, 233, 246, 254, 274, 287, 334, 347, and 339.

Gomez-Brandon, M., C. Lazcano and J. Dominguez (2008). The evaluation of stability and maturity during the composting of cattle manure. Chemosphere. 70:436-444.

Gouin, F. R., (1998). Using compost in the ornamental horticulture industry. In: Brown, S., Angle, J.S., Jacobs, L. (Eds.), Beneficial

Co-Utilization of Agricultural, Municipal and Industrial Byproducts.Kluwer Academic Publishers, Netherlands, pp. 131–138.

Hardy, R. W. F., R. C. Burns and R. D. Holsten (1973). Application of the acetylene-ethylene assay for measurement of nitrogen fixation. Soil Biol. Biochem., 5: 47-81.

Hassen, A., K. Belguith, N. Jedid, A. Cherif, M. Cherif and A. Boudabous (2001). Microbial characterization during composting of municipal solid waste. Bioresour. Technol. 80 : 217-225.

Hino, S. and P. W. Wilson (1958). Nitrogen fixation by a facultative *Bacillus*. J. Bacteriol., 75: 403.

Hoitink, H. A. J. and C. Changa (2004). Production and utilization guidelines for disease suppressive compost. Acta Hort.,635:87-92.

Ingham, E. R. (2005). The compost tea brewing manual., US Printing, Soil Foodweb Incorporated, Oregon. USA. J. Bact., 15: 223.

Jackson, M. L. (1973). “Soil Chemical Analysis”. Prentice- Hall of India Private Limited, New Delhi. India.

Jann, G. J., D. H. Howard and A. J. Solle (1959). Methods for determination of competition of composting. Appl. Microbiol.,7:271-275.

Jimenez, E.I. and V.P. Garcia (1989). Evaluation of city refuse compost maturity, A Review. Biological Wastes., 27: 115-142.

Lopez-Real, J. M., E. Witter, F.N. Midmer, and B. A. O. Hewett (1989). Evolution of composted sewage sludge/straw mixture for horticultural utilization. Water Sci. Tech., 21: 889–897.

Manna, M. C., P. K. Ghosh and T. K. Gemguly (2003). Comparative performance of four sources of enriched phosphor compost and inorganic fertilizer application on yield ,uptake of nutrients and biological activity of soil under soybean –wheat rotation. Food, Agric. Environ.,1: 203-208.

Martin, J. P. (1950). Use of acid, rose bengal and streptomycin in the plate method for estimating soil fungi. Soil Sci., 69: 215-232.

Oka, Y. and U. Yermiyahu (2003). Nematode –suppressive effect of composts against the root rot ,nematode *Meloidogyne javanica* tomato. Nematology. 4: 891-898.

Page, A. L., R. H. Miller and D. R. Keeney (1982). "Methods of Soil Analysis". Parts I &II. Amer. Soc. Agron. Madison Wisconsin, USA.

Pare, T., E.G. Gregorich and H. Dinel (1997). Effects of stockpiled and composted manures on germination and initial growth of cress (*Lepidium sativum*). Biological Agric.& Hort., 14: 1-11.

Pittaway, P. (2003). Review of Dr. E. Ingham seminar: Soil Foodweb for Turf Pacific Golf Club Carindale, USA.

Ryckeboer, J., J. Mergaert, J. Coosemans, K. Deprins and J. Swings (2003). Microbiological aspects of biowaste during composting in monitored compost bin. J. Appl. Microbiol. 94: 127–137.

Rynk, R. (1992). On Farm composting Handbook. pp:23-35. Notheast Regional Agricultural Enginering Serivice, Cooperative Extension Ithaca, NY., USA.

Sanchez-Monedero, M. A., M.P. Bernal, A. Anton, P. Noguera, A. Abad, A. Roig and J. Cegarra (1997). Utilizacion del Compost como Sustratos para Semilleros de Plantas Hortıcolas en Cepellon, in: Proceedings of the I Congreso Iberico y III Nacional de Fertirrigacion, SEFV Ed., Murcia, pp. 78–85.

Scheuerell, S. J. (2002). Understanding how compost tea can control disease. Biocycle., 44(2): 20-25.

Schnitzer, M., H. Dinel, S. P. Mathur, H. R. Schullen and G. Owen (1993). Determination of compost biomaturity .III.Evaluation of a colorimetric test by C –NMR spectroscopy and pyrolysis –field ionization mass spectrometry . Biol.Agric.Hort., 10:109-123.

Vessey, J. K. (2003). Plant growth promoting rhizobacteria as biofertilizers. Plant Soil. 255:571-586.

Vuorinen, A. H. and M. H. Saharinen (1997). Evaluation of microbiological and chemical parameters during manure and straw co-composting in drum composting system. Agric. Ecosys. Environ., 66:19-29.

Wong, J. W. C., K. F. Mak, N. W. Chan, A. Lam, M. Fag, L. X. Zhou, Q. T. Wu and X. D. Liao (2001). Co-composting of soybean residues and leaves in Hong Kong. Bioresour. Technol., 76:99-106.

Wu, L. and L. O. Ma (2001). Effect of sample storage on biosolids compost stability and maturity evaluation. J. Environ. Qual.,30:222-228.

Zuccni, F., M. Forte, A. Manac and M. Beritodi (1981). Biological evaluation of compost maturity. Biocycle. 22: 27-29.

Zucconi, F. and M. deBertoldi (1987). Compost specifications for the production and characterization of compost from municipal solid waste. In: de Bertoldi, M. *et al.*, (eds). Compost production, Quality and use. Elsevier Applied Science, Essex,pp.30-50.Part 1: chemical and spectroscopic properties. Bioresour. Technol., 96: 471–478.

منسّق:كشيدة صغيرة، اليسار لليمين، الحدود: أسفل: (خط متصل فردي، تلقائي، 1.5 نقطة عرض الخط)

منسّق:الخط: ٥ نقطة، خط اللغة العربية وغيرها: ٥ نقطة

منسّق:الخط: غامق، خط اللغة العربية وغيرها: غامق

منسّق:الخط: غامق، خط اللغة العربية وغيرها: غامق

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منسّق:الخط: غامق، خط اللغة العربية وغيرها: غامق

منسّق:الخط: غامق، مائل، خط اللغة العربية وغيرها: غامق، مائل

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منسّق:اليسار لليمين، الحدود: أسفل: (خط متصل فردي، تلقائي، 5.1 نقطة عرض الخط)

منسّق:الخط: ٥ نقطة، خط اللغة العربية وغيرها: ٥ نقطة

منسّق

منسّق:اليسار لليمين

منسّق:الخط: ١٤ نقطة، خط اللغة العربية وغيرها: ١٦ نقطة

الملخص العربي

تقييم خواص أنواع مختلفة من الكمبوست وكذا القيمة التسميديه لهما

صلاح على ابو النجا، أسامه نجدي مسعود و شبل عبدا لله عبدا لجواد

قسم علوم الأراضي – كلية الزراعة – جامعة المنوفية

الملخص العربي

تم استخدام نوعين مختلفين من الكمبوست (كمبوست نباتي وكمبوست حيواني-)-، لدراسة الصفات الميكروبية والفيزيوكيماوية وكذا المحتوى الغذائى لكلا النوعين وايضا صفات النضج والثبات للكمبوست.

أظهرت النتائج تباين واضح للصفات الفيزوكيماوية لكلا النوعين من الكمبوست مثل الكثافة الظاهرية ، نسبة النيتروجين الى الكربون وكانت ذات قيم مناسبة وكلا النوعين يحتوى على كمية كبيرة من العناصر الغذائية وخاصة الكمبوست الحيواني-.

أظهرت الصفات الميكروبية تواجد عالى للمحتوى الميكروبى للمجموعات الرئيسية وكذلك انزيم الديهيدروجينيز وتفوق الكومبوست الحيوانى فى المحتوى الميكروبى مقارنة بالكومبوست النباتي وكانت أهم المجاميع الميكروبية المتواجدة هى : محللات السيليلوز – مثبتات النيتروجين الجوى وقد تم عمل عزلات منها وتعريفها وكانت اهم الانواع الميزوفيلية المتواجدة هي : الباسلس والترايكودرما والاستريتومايسس.

وتم فحص دلائل النضج والثبات لكلا النوعين للتأكد من جودة الكومبوست نسبة النيتروجين الى الكربون، رقم الحموضة والقلوية ، معامل الانطفاء ونسبة الامونيا الى النترات و دليل الإنبات ، وتقدير ثانى ثاني اكسيد أكسيد الكربون والذين أعطوا- دليلاً جيداً لنضج الكمبوست وثباته للاستخدام دون اى أي مشاكل .