Bulletin of High Institute of Public Health
Vol. 29 No. 3 [1999]

Efficiency of cattle manure composting at farms in one of the Delta villages, Egypt

Mohamed Ramadan* Osama Awad† Nadia Abu EL-Ela† Hanan Shatat† Magda Abd EL-Atty*

Abstract: In Egypt, 60% of the population are living in villages. Farmers are piling the generated manures from their barns into different dimensions. The present study aims at evaluating the physico-chemical stabilization, and pathogenic and entomolyic destruction of the composted manure. A representative sample of fifteen piles representing different durations was selected. Most of the studied pile dimensions were not optimum. Time allowed for fermentation was not enough to stabilize it. None of the piles surveyed had undergone turning. The presence of poor conditions of fermentation will not allow temperature to build up and hasten the decomposition. The slightly alkaline medium is extremely useful in application on acidic soils. Sodium Chloride, total nitrogen, and organic carbon conform with the decree of Egyptian Minister of Agriculture No. 100/1967. C/N is not in agreement with the limits stated by the said decree. The high values prove the ineffectiveness of the fermentation process. Heavy metals were present in very small concentrations. The presence of high values of total and fecal coliforms indicated that none of the piles was stabilized. The presence of larvae house and blow flies indicated that the materials undergone fermentation were a good media for flies breeding. The isolation of parasites in 90% of the piles means that the temperature did not increase to a degree enough to kill various parasitic stages. For proper manure management, local farmers should be instructed to follow systematic operating practices with emphasis on producing a high quality and pathogen free compost.

INTRODUCTION

According to the Food and Agriculture Organization [FAO], there are about 600 million undernourished people in the world today. Experts estimate that 30-50% of today's crop production comes directly from fertilizers. Fertilizer is any material containing one or more of the essential nutrients that are added to the soil for the purpose of supplementing the plant nutrient supply. As yields continue to increase, fertilizers will become even more important because the gap between native soil fertility and crop nutrient requirements will widen.[1]

Manures are good soil amendments. They add quantities of organic matter to the soil along with small amounts of plant nutrients.[2] Animal manures can also be

* Environmental Health Dept., High Institute of Public Health
†Tropical Health Dept., High Institute of Public Health

valuable sources of humus.[3] They are a wonderful source of nitrogen and microorganisms which are necessary for the formation of compost.[4] They contain nitrogen, phosphorus, and potassium nutrients to meet crop needs.[5]

Some farms produce more manure than they can use on their crop fields or to sell it. They spread manure heavily on the fields closest to the barn, whether or not these fields need the extra nutrients. Organic fertilizers of animal or human origin are obviously the most likely to contain gastrointestinal parasites.[6] Spreading uncomposted manure on soil or composting the manure in an improper site will pollute the nearby surface water and groundwater. Therefore, composting is considered one of the most important manure management alternatives.[5]

Composting utilizing organic wastes for conversion to beneficial organic soil amendments. Composts are particularly beneficial for soils low in organic matter and where frequent tillage and complete removal of crops may lead to soil deterioration.[7] Composted manure is a more desirable fertilizer than raw manure because the heat and time of contact in a compost pile kill most weed seeds and pathogens, allowing the composted manure to be applied to crops where raw manure cannot.[5]

In Egypt, 60% of the population are living in villages.[8] Each farm in each village has at least one or more cows. A village with hundreds of cows will produce up to thousands tons of manure each year. The present study aims at evaluating the physico-chemical stabilization, and pathogenic and entomolyic destruction of the composted manure.

MATERIAL AND METHODS

Farmers are piling the generated manure from their barns into different dimensions in front of their houses. The management of this manure has been studied through the following :

A questionnaire has been prepared to collect information from the owners of 15 piles. It included a series of questions about the methods of dealing with manure, manure

piles dimensions, contents of the piles, operating conditions, age of the pile at the day of survey, turning frequency, the daily amount of generated manure, duration of fermentation, and the reasons of shortening the fermentation time.

These data were analyzed to assess how well the piles were meeting physical/chemical stabilization, low pathogen, and vector attraction reduction requirements for composting. A representative sample of fifteen piles with different durations was selected.

The procedure of evaluation included the following :

1- Temperature measurement was carried out at different sites for each pile.

2- A composite sample of at least 10 subsamples from the material under fermentation was collected and mixed for each pile to produce a representative sample of 5kg. Samples were analyzed for :

* Physico-chemical characteristics as : moisture, volatile solids, conductivity, pH, sodium chloride, ammonia, nitrate, total nitrogen, nutrient elements [K, P, Ca, and Mg], and heavy metals according to World Health Organization,[9]

* Bacteriological examination: Total plate count at 35°c, total and fecal coliforms, Streptococcus fecalis, and fungi according to Standard Methods for the Examination of Water and Wastewater,[10]

* Entomological examination: Larvae of house and blow flies according to Haines,[11] and

* Parasitological examination: Equal amounts from each pile were examined and counted for parasitic cysts, eggs, and larvae using a modification of the centrifugal floatation technique.[12]

RESULTS AND DISCUSSION

1- Field survey results

The results of the field survey presented in table [1] show that the dimensions of the piles ranged as follow: length 2-5 , width 1-3 , and height 0.5-1.5m. Most of the studied pile dimensions differed from that mentioned by Gotass[13] who stated that the width of compost heaps should be about 2.4-3.6m for

Table (1) : Physico-chemical characteristics of samples collected from the fermentation piles of cattle manure at farms in one of the Delta villages, 1998

No of sample		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean	Range
Parameter																		
Temperature °C		25-25	31-31	42-50	36-44	29-32	32-38	32-42	30-33	32-35	34-39	34-49	46-56	37-45	27-29	33-37		25-56
Pile dimensions (m)	Length	1.5	2	2	2	2	2	4	3	5	4	3	2.5	3	2	5	2.9	1.5-5
	Width	1.5	1.5	1	1	1.5	1.5	2	1.5	3	2	2	2	1.5	1	3	1.7	1.0 - 3.0
	Height	0.5	1.2	0.5	1.5	0.5	0.5	1.5	0.7	1	1.5	1.5	1	0.8	0.7	1.5	1	0.5 - 1.5
Pile Volume (m^3)		1.125	3.6	1	3	1.5	1.5	12	3.15	15	12	9	5	3.6	2.1	22.5	6.4	1-22.5
Time of sampling after starting fermentation (days)		7	14	7	7	7	7	14	30	14	30	90	10	14	45	90	25	7.0-90
Amount generated daily (kg)		40	20	10		2	30	100	30	30	30	30	30	30	20	50	31	2 - 100
Time allowed for fermentation (days)		30	14	7	14	10	14	21	30	90	90	75	30	30	90	120	45	7 - 120
Moisture %		84.9	66.1	74	72.9	71	70.9	71.3	76.9	72	81	70.8	82.5	80.7	76.4	78.1	75.3	66.1-84.9
Volatile solids %		72.1	35	60.6	45.4	57.7	58.4	52.1	59.3	45.3	71.6	48.4	74.2	72.9	56.7	58	57.8	35-72.9
Ash %		30.4	63.4	37.4	52.8	40.5	40.1	45.1	38.5	51.1	25.9	48.9	23.6	25.7	40.6	38.6	40.2	23.6-63.4
Conductivity µS/cm		1165	1120	1260	1093	1394	1494	1806	1451	1842	1369	1075	886	954	1758	1363	1335	886-1842
pH		7.7	8.1	8.1	7.9	7.9	8	7.9	7.8	7.8	7.9	8.1	7.9	7.9	8.3	8.2		7.7-8.3
NaCl %		0.058	0.119	0.183	0.051	0.094	0.102	0.102	0.127	0.117	0.198	0.127	0.094	0.097	0.165	0.249	0.126	0.051-0.249
NH_3-N (gm/kg)		0.64	0.12	0.15	0.19	0.13	0.63	0.08	0.24	0.19	0.23	0.08	1.23	0.31	0.1	0.26	0.31	0.08-1.23
NO_3-N (gm/kg)		0.08	0.05	0.12	0.01	0.03	0.04	0.35	0.22	0.54	0.17	0.12	0.11	0.16	0.13	0.11	0.15	0.01-0.54
Carbon %		37.5	18.2	31.5	23.6	30	30.4	27.1	30.8	23.6	37.2	25.2	38.6	37.9	29.5	30.2	30.1	18.2-38.6
Total Nitrogen %		1.15	0.9	1.13	0.49	1.11	1.12	1.37	1.22	1.85	1.16	1.41	1.4	1.29	1.26	1.26	1.21	0.49-1.85
C/N		32.6	20.2	27.9	47.2	27	27.1	19.8	25.2	12.8	32.1	17.9	27.6	29.4	23.4	24	26.3	12.8-47.2

convenience in turning and heat insulation. It also stated that the optimum height had to range between 1.6-2m. The length has no effect on the biological operation.

It was planned to evaluate the fermentation process of 2-3 piles. However, the survey indicated that the time of fermentation was neither based on stabilization of the contents of the piles nor pathogen destruction. Therefore, it was decided to collect samples from different 15 piles for once identifying the time of starting fermentation and the time allowed for completing the fermentation for each pile.

It was found that the time allowed for fermentation for all the piles ranged between 7-120 days. The majority of them [10 piles] are to be fermented for a time not exceeding one month, four of them not exceeding 3 months, and one not exceeding 4 months.

None of the piles was turned during the composting period. It was stated that the typical time for composting with turning was 3-8 months and without turning 5-14 months.[5] This means that the time allowed for storing the materials under fermentation is not enough to stabilize it. Stephen Farley[4] mentioned that compost would be ready in 1 month if it would be turned every week, 2 months if turned every other week, 3-4 months if turned every month, and 6-9 months if turned every other month. The operating conditions in the present study were also not in agreement with what had been mentioned by Johnson and Matkin[7] who stated that in farm and garden practices, the compost should be turned every three or four days.

The amount generated and stored per each pile per year ranges between 0.73 to 36.5 tons with a mean of 11.3 tons. This did not agree with what had been found by WQDP[5] which stated that a single dairy cow produces about 21 tons of manure a year. This is attributed to that the low values of 0.73 and 11.3 tons/year did not represent the actual generation as the farmers knew that their methods for storing manure were hazardous and a big source of disease transmission. This concept is transferred to them through health inspectors.

2- Physico-chemical characteristics :

It has been found that the temperature did not exceed 50°C for all the piles except for 2 piles [ranges between 42-50 and 46-56°C, respectively] [table 1& fig.1]. It means that the conditions of fermentation did not allow temperature to build up and hasten the decomposition. Also, it will not allow the high-temperature activated organisms to complete the composting process. Johnson et. al.[7] recommended that building up the temperature is important to hasten the decomposition.

Moisture ranged between 66.1 and 84.9% [table 1]. This high moisture content affected the process of fermentation and delayed it. Golueke[14] found that a moisture of 50-60% was the optimum for aerobic decomposition and decomposition was slowed down when the heap was drier. He also stated that anaerobic conditions existed particularly at the bottom of the heap, where it was wetter. It is also higher than that found by Edmond et. al.,[15] who stated that the moisture content of beef feedlot was 68%.

Electrical Conductivity [EC] ranged between 886 to 1842 µS/cm. These values will not be a problem for the growth of the different kinds of crops. This is in agreement with another study[16] which gave the relation between the EC and yield loss of the least resistant crops : zero, 10%, 25%, and 50% loss with EC of 0.7, 0.9, 1.2, and 1.7 dS/cm, respectively.

pH, ranges between 7.7 to 8.3. It is slightly higher than that recommended by Page[17] who stated that the optimum pH range recommended for most crops was 6-7.5. However, this ranges of pH appear to be extremely useful in case of application on acidic soils avoiding the risk of toxicity by aluminum or manganese which takes place when pH values are below 5. [18]

Sodium chloride ranges between 0.051-0.249%. These values are within the limits stated by the decree of Egyptian Minister of Agriculture No. 100/1967[22] which stated that the amount of sodium chloride should not exceed 5±0.5% and agreed with the results obtained by Zucconi et. al.[19] Also, these results agreed with Christie,[20] who declared that chlorides in relatively small

Table (2): Characterization of the nutrient elements of the samples collected from the fermentation piles of cattle manure at farms in one of the Delta villages, 1998

No of sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean	Range
Parameter																	
K %	0.047	0.053	0.027	0.038	0.026	0.083	0.065	0.063	0.06	0.011	0.012	0.009	0.011	0.066	0.013	0.039	0.009-0.083
P %	0.27	0.33	0.28	0.28	0.28	0.33	0.33	0.28	0.37	0.22	0.18	0.34	0.31	0.49	0.24	0.3	0.18-0.49
Mg %	0.043	0.3	0.213	0.402	0.223	0.182	0.238	0.232	0.223	0.115	0.16	0.226	0.325	0.204	0.134	0.215	0.043-0.402
Ca %	0.142	0.694	0.334	0.238	0.166	0.142	0.16	0.166	0.25	0.19	0.238	0.358	0.166	0.19	0.19	0.242	0.142-0.694
Na %	0.023	0.047	0.072	0.02	0.04	0.04	0.04	0.05	0.046	0.078	0.05	0.037	0.038	0.065	0.098	0.05	0.02-0.098
K_2O %	0.057	0.064	0.033	0.046	0.032	0.1	0.078	0.076	0.073	0.013	0.014	0.011	0.013	0.08	0.015	0.047	0.011-0.01
P_2O_5 %	1.24	1.51	1.28	1.28	1.28	1.51	1.51	1.28	1.7	1.01	0.82	1.56	1.42	2.25	1.1	1.38	0.82-2.25
MgO %	0.07	0.5	0.35	0.67	0.37	0.3	0.4	0.39	0.37	0.19	0.27	0.38	0.54	0.34	0.22	0.36	0.07-0.67
CaO %	0.2	0.97	0.47	0.33	0.23	0.2	0.22	0.23	0.35	0.27	0.33	0.5	0.23	0.27	0.27	0.34	0.2-0.97

Table (3): Heavy metal analysis of samples collected from the fermentation piles of cattle manure at farms in one of the Delta villages, 1998

No of sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean	Range
Parameter																	
Pb (gm/kg)	0.012	0.036	0.016	0.055	0.03	0.024	0.033	0.009	0.06	0.02	0.03	0.021	0.016	0.027	0.029	0.028	0.009-0.06
Cd (gm/kg)	0.0061	ND	0.0018	0.0057	0.004	0.0038	0.011	ND	0.0027	0.0011	0.0022	0.0002	0.0147	0.0081	0.004	0.0043	ND-0.0147
Ni (gm/kg)	0.0108	0.0256	0.015	0.02	0.025	0.0277	0.012	0.005	0.0126	0.0087	0.0172	0.0099	0.0093	0.0302	0.017	0.0164	0.005-0.0302
Mn (gm/kg)	0.1773	0.904	0.1968	0.514	0.114	0.1236	0.383	0.1482	0.307	0.1718	0.1755	0.1879	0.1631	0.361	0.1718	0.2733	0.114-0.904

amounts were necessary for plant growth.

Ammonia and nitrate range between 0.08-1.23 and 0.01-0.54 gm/kg. Reed[21] stated that "an arbitrary guide to maturity is when the nitrate level is greater than ammonium level, the ammonium level is less than 50 mg/kg. At this stage the risk of ammonium ion toxicity is reduced to a minimum and there is ample nitrogen fixed in the form of nitrate for plant growth. This view point proves the immaturity of the considered composts.

The total nitrogen ranges between 0.49 and 1.85% with a mean of 1.21%. Most of the total nitrogen results are lower than what has been found by Vogtmann et. al.,[23] who analyzed three manure composts for N% [1.63, 2.3, and 2.09%]. This may be attributed to the fact that farmers are getting rid of their inert sweepings on the piles. On the other hand, the results of nitrogen content almost agree with the decree of Egyptian Minister of Agriculture No. 100/1967 which stated that the nitrogen content should not be less than 0.5% of dry weight. on the other hand, the nitrogen results of the present study are higher than what has been found by Edmond et. al.,[15] who stated that the N% of beef feedlot was 0.71%.

The organic carbon content ranges between 18.2-38.6%. These values as well agreed with that of the decree of Egyptian Minister of Agriculture No. 100/1967 which stated that carbon content should not be less than 18±1%.

Carbon/nitrogen ratio [C/N] ranges between 12.8 and 47.2 [table 1 & fig 1]. Six of these values were in agreement with the limits stated by the decree of Egyptian Minister of Agriculture No. 100/1967 which stated that the C/N should be between 18 and 25. The low recorded values do not mean that the content is stabilized as these piles are containing a lot of inert materials. The high values prove the ineffectiveness of composting conditions. Duggan[24] stated that materials with a very high C/N can immobilize soil nitrogen and rob the growing plants of it. The addition of immature compost to soil with a C/N above 30 produces a biological blockage of available nitrogen due to the accelerated growth of microflora that use nitrogen for their own development.

Table [2] presents the nutritional elements analyses. The ranges of K_2O%, MgO%, and CaO% in the studied piles are 0.011-0.1%, 0.07-0.67%, and 0.2-0.97%, respectively. They are lower than that the values recorded by Vogtmann et. al.,[22] who found that K_2O%, MgO, and CaO% of farm yard manure compost were 2.75-5.8, 0.68-1.44%, and 3.01-4.1%, respectively. The range of P_2O_5% in the studied piles is between 0.82-2.25%. This is approximately similar to what has been found by Vogtmann et. al.,[22] who stated that the P_2O_5% of farm yard manure was o.85-1.56%. Sodium ranges between 0.02-0.098%. A study carried out by Christie[20] showed that there was a problem with Sodium Absorption Ratio [SAR] when the compost contains 0.011% or less of either sodium or chloride. This SAR is important for soil permeability.

Four of the common heavy metals have been analyzed, the results are shown in table [3]. It has been found that lead ranges between 0.009-0.06 g/kg. Cadmium ranges between ND-0.015 g/kg. Nickel ranges between 0.005-0.03 g/kg. Manganese ranges between 0.114-0.904 g/kg. In general, their concentrations are very low and is not expected to affect the fermentation process.

3- Biological examination :

It is clear from table [4] and fig [1] that total plate count, total coliform, fecal coliform, and streptococcus fecalis range between 103-15x10^5, 3.6-11x10^6,zero-11x10^6, and zero-39x10^3, respectively. The highest values for all the bacteriological agents were recorded in pile No. 6. This pile had low temperature, small volume, high moisture content, inadequate time of fermentation, no turning, and addition of the daily generated raw manure on the pile. All of these conditions will not allow proper fermentation. With pile No. 15, although the sample has been collected at the 90th day of fermentation and its volume is 22.5m^3, the microbiological results were poor. This proves that the time and dimensions are not alone the controlling factors as the other operating conditions [temperature 33-37°C and moisture 78.1%] were not suitable for fermenting the raw manure. This agreed with a study carried out by Hay et. al.,[25] who

Table (4): Insects, parasites, and biological analyses of samples collected from the fermentation piles of cattle manure at farms in one of the delta villages, 1998

No of sample		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Range
Parameter																	
Larvae House Fly	No of inscet/kgm manure	34	25	71	0	81	45	60	ND	ND	23	28	91	22	55	32	22-91
Larvae Blow Fly	No of inscet/kgm manure	231	ND	155	150	ND	147	100	ND	ND	147	21	39	ND	39	85	21-231
Mean No. of	Toxocara egg	0	0	0	0	2	0	2	0	4	12	0	0	0	12	0	ve - 12
Parasites/ gm	Hymenolepis nana egg	5	0	0	3	0	0	1	0	0	6	2	8	0	0	5	ve - 8
manure	Entamoeba coli cysts	20	0	10	0	8	0	0	0	0	0	4	0	22	0	0	ve - 22
	Ascaris egg	0	0	2	2	2	0	0	0	6	3	1	0	0	2	0	ve - 6
	Fasciola egg	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	ve - 1
	Trichostrongylous egg	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	ve - 10
	Unidentified Larvae	0	0	0	10	0	15	0	0	12	0	0	11	15	20	0	ve - 20
Bacteria	Total Plate Count (MPN/gm)	103	$72x10^4$	106	$11x10^5$	$75x10^2$	$15x10^5$	$25x10^3$	$2x10^4$	$3x10^5$	$25x10^4$	$7x10^3$	$17x10^4$	$75x10^3$	$7x10^5$	$27x10^4$	$103-15x10^5$
	Total Coliform (MPN/gm)	$46x10^3$	$46x10^3$	93	93	3.6	$11x10^6$	$75x10^4$	$2x10^3$	91x10	63	63	$11x10^6$	$23x10^5$	73x10	$46x10^3$	$3.6-11x10^6$
	Faecal Coliform (MPN/gmy)	$46x10^3$	$46x10^3$	15	23	zero	$46x10^5$	$15x10^4$	36x10	zero	zero	36	$11x10^6$	$23x10^5$	73x10	$46x10^3$	zero-$11x10^5$
	Streptococcus (MPN/gm)	$39x10^3$	$72x10^2$	$36x10^2$	zero	zero	$11x10^3$	$3x10^3$	$73x10^2$	$14x10^2$	36x10	$2x10^3$	$73x10^2$	$11x10^3$	zero	$73x10^2$	zero-$39x10^3$
Fungi	The dominant species of fungi present in all samples included Penicilium, Aspergillus, Rhizopus, and Yeasts																
NB	ND: Not Determined																

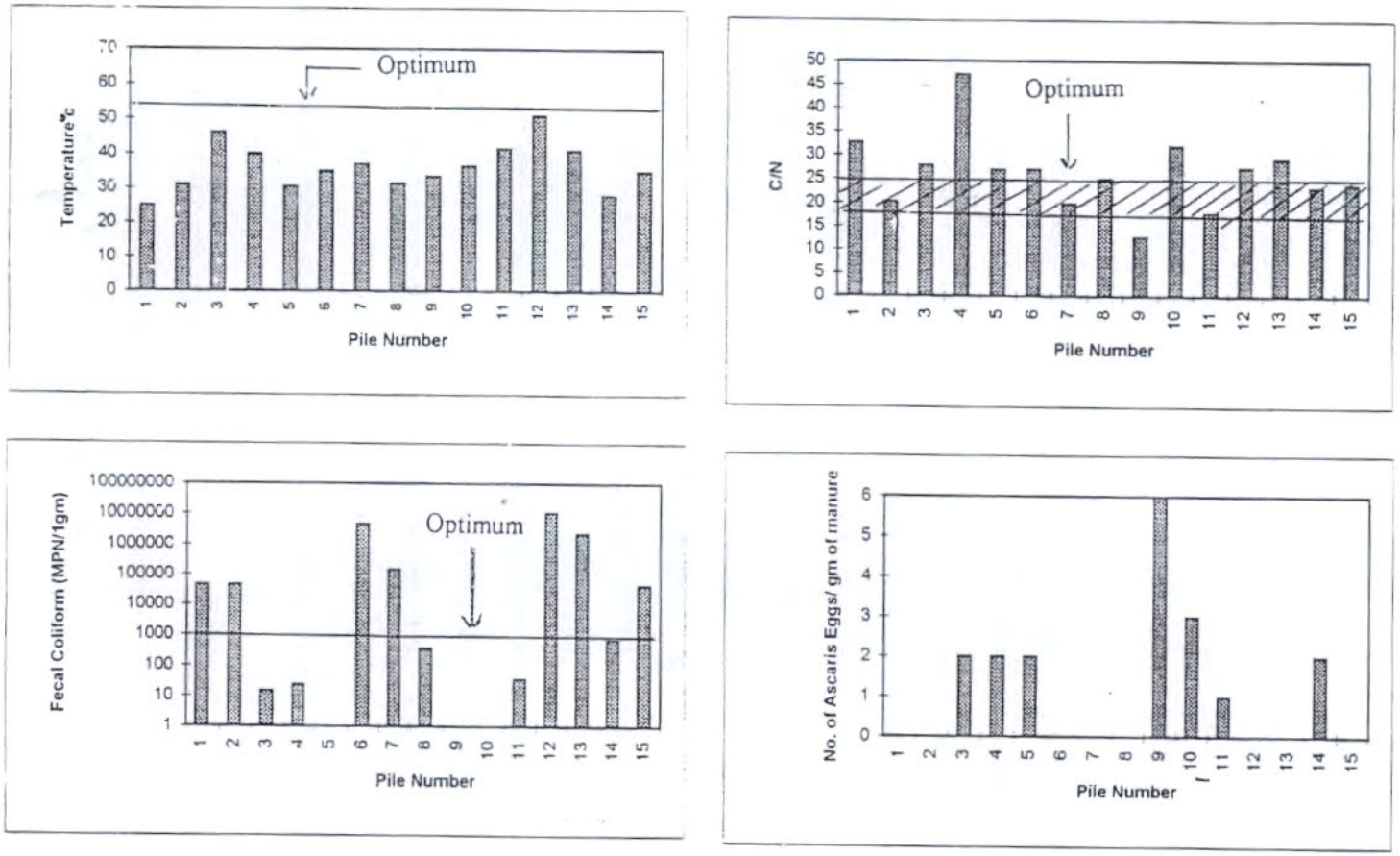

Fig . 1: Temperature, C/N, Fecal Coliform, and Ascaris eggs of samples collected from the fermentation piles of cattle maure at farms in one of the Delta Villages, 1998

stated that after 15 days of exposure to temperatures of 55°C and more, there were 98%, and 99% probabilities of inactivation of total coliforms. It took 56 days and 90 days for the densities of fecal coliforms to decline below the detection limit. Hay[26] stated that the minimum temperature time requirement for windrow facilities was 55°C for 15 days, with a minimum of five turnings during that period. These conditions must be achieved consistently. Studies at the Los Angeles County facility determined that the fecal coliforms concentrations of less than 1000 MPN/g indicated a high probability of destruction of bacteria, parasitic, and viral pathogens. [27]

The dominant species of fungi present in all the samples include Penicillium, Aspergillus, Rhizopus, and Yeasts. The recorded values of all the above mentioned mycological agents indicate that none of the studied pile were stabilized.

4- Entomological examination:

It is clear from table [4] that all the collected samples from the different piles show the presence of larvae house and blow flies. The number of larvae house and blow flies/kg of manure ranged between 22-91 and 21-231, respectively. The lowest larvae house fly index was recorded in piles No.10&13 with 23 and 22 larvae/kg of manure respectively. The temperature ranges of these piles were 34-39 and 37-45°C, moisture ranges were 81 and 80.7%, volume ranges were 12 & 3.6 m^3, C/N ranges were 32.1 & 29.4, sampling time were 30 & 14 days, respectively. Although the time and volumes were different, they did not have any effect on the fermentation process. All of these operating conditions will not sustain the process of fermentation and will render the piles a good media for flies breeding. Hay [26] stated that aerobic treatment of biosolids for 14 days or longer during which the temperature exceeded 40°C and the average temperature above 45°C would reduce vector attraction. The highest larvae house fly result was recorded in pile No. 12 with 91 insect/kg of manure. Although a temperature of 56°C has been recorded in one location in the pile but it does not represent the average temperature of the pile. Also, the high

moisture content [82.5%] will reduce the effect of temperature through water evaporation. The dimensions also, length 2.5m - width 2m - height 1m, are not suitable for the fermentation process. All of these results indicate immaturity of pile contents.

The lowest value of larvae blow fly/kg manure [21 insect/kg] was recorded in pile No. 11 with temperature of 34-49°C, moisture 70.8%, pile dimensions [length 3m, width 2m, and height 1.5m], time of fermentation 90 days, and C/N 17.9. The highest values of blow flies/kg manure was recorded in pile 1 with temperature 25°C, moisture 84.9%, pile dimensions [length 1.5m, width 1.5m, and height 0.5m], time of fermentation 7days, and C/N 32.6. Although it seems that there is a difference between the operating conditions in both of them, still blow flies were recorded in each one of them. These operating conditions will not allow proper fermentation.

5- Parasitological examination:

The results presented in table [4] show that only two piles, [No 2&8], were free from parasites. The other thirteen piles had one or more species of parasites. Toxocara eggs were present in 5 piles with a range of 2-12 eggs/gm manure. Trichostrongylus was isolated in only one pile [No 10] with a count of 10/gm. Fasciola eggs were found in two piles only [No 6&9] with 1/gm in each.

Other species as Hymenolepis nana egg and Entamoeba coli cysts were isolated in 5-7 piles with higher numbers than the previously mentioned species. Ascaris eggs were isolated in 7 piles with a count ranging from 1-6 eggs/gm manure. Abundant unidentified larvae were isolated, but it was not known whether they belonged to pathogenic or non pathogenic parasites.

It is well known that parasites are destroyed by high temperature. In the considered study the process of fermentation was improper as the temperature was not high enough to kill the isolated parasites. Hay[26] stated that composting temperature standards were derived from inactivation data of parasites because they were the most heat resistant pathogens. Farrell[28] reported that there was a distinct temperature threshold of 51°C for helminth egg destruction. Thus, no parasitic destruction will occur below this

temperature but above it ova die-off increases with increasing temperature. He also concluded that maintenance of compost at 55°C in equilibrium with an atmosphere at near 100% relative humidity for 24 hours would destroy all pathogenic bacteria, viruses, and parasites. Also, the moisture content of the different piles allow developing anaerobic conditions assisting in growth of the different species of parasites. The presence of parasites coincides with the physical, chemical, microbiological, and entomological results.

CONCLUSION AND RECOMMENDATIONS

The present study aims at evaluating the physico-chemical stabilization and pathogenic destruction of the stored cattle manure in one of the Egyptian villages. The poor current practices and physical conditions which include piles with no optimum dimensions, no turnings, short fermentation time, low temperatures, and very high moisture contents will not allow physico-chemical stabilization and pathogenic destruction.

The slightly alkaline medium is extremely useful in application on acidic soils. Sodium Chloride, total nitrogen, and organic carbon conform with the decree of Egyptian Minister of Agriculture No. 100/1967. C/N is not in agreement with the limits stated by the said decree. The high values prove the ineffectiveness of the fermentation process. Heavy metals were present in very small concentrations.

The presence of high values of total plate count, total Coliform, fecal coliform, and sreptococcus fecalis indicated that none of the piles was stabilized and the piles conditions will not sustain proper fermentation. The presence of larvae house and blow flies indicated that the materials undergone fermentation were a good media for flies breeding. At least one species of parasites has been found in 90% of the piles means that the temperature did not increase to a degree enough to kill various parasitic stages.

It is recommended for proper manure management that local farmers should be instructed to bring all piles into consistent

compliance with the process and microbiological requirements and ensure that all compost products are hygienically safe to use. This could be achieved through systematic operating practices. Improvements should be carried out by reducing the moisture content using a bulking agent, adjusting the C/N, using the standard dimensions, and turning which will sustain the fermentation process through supplying oxygen; and maintaining high temperature. If these improvements are difficult to achieve, manure can be composted in anaerobic underground pits.

REFERENCES

1. Soil Improvement Committee-California Fertilizer Association. Western Fertilizer Handbook, 1985, 701-12th street, Sacramento, California 95814, Interstate printers and publishers, Inc., DANVILLE, ILLINOIS 61832-0594, USA.
2. Soil Fertility and Fertilizers, Fourth Edition. S.L. Tisdale and W.L. Nelson. The Macmillan Company, 1985.
3. The nature and properties of soils, Eighth Edition. N.C. Brady. The Macmillan Company, 1974.
4. Stephen Farley Design. "Composting with Animal Manure". [520] 320-0044, Website sfarley @igc.apc.org.
5. Water Quality Demonstration Project [WQDP]-East River Navigation Page, Innovative Manure Management, 1992, Wisconsin, USA.
6. Pratt PF, Broadbent FE, Martin JP. Using organic wastes as nitrogen fertilizers. California Agriculture, 1973, 27:6.
7. Johnson P, Matkin OA. Horticultural and agricultural uses of sawdust and soil amendments. Technical Bulletin, copyright 1968, Paul Johnson.
8. Central Agency for Public Mobilization and Statistics. General Accounting for Buildings, people, and enterprises, [In Arabic], 1996.
9. WHO International Reference Center Disposal, "Methods of Analysis of Sewage, Sludges, Wastes, Solid Wastes, and Compost", CH-8600, Dubendorf, Switzerland, 1978.
10. APHA, AWWA, WPCF. Standard Methods for the Examination of Water and Wastewater, 18th ed. Amer. Public Health Assoc., 1992.
11. Haines TW. Breeding media of common flies in rural area. American Journal of Tropical Medicine and Hygiene, 1955, 4, 1125-1130.
12. Caveness FE, Jensen HJ. Modification of the centrifugal floatation technique for the isolation and concentration of nematodes and their eggs from soil and plant tissue. Proc. Helminthol. Soc. Washington 1955; 22, 87-9. In: Saad LM. Study of the impact of environmental conditions of day care centers in Alexandria on the spread of parasites among their children. Doctor P.H. Thesis, 1984, HIPH, Alex. Univ.
13. Gotass HB. Composting: Sanitary Disposal and Reclamation of Organic Wastes", WHO, Geneva, SEA, Number 1, 1956.
14. Golueke CG, "Principles of Biological Resource Recovery", BioCycle, 1981, 22[4]: 36-40.

15. Edmond JB, Musser AM, Andrews FS. "Fundamentals of Horticulture", 1975, Fourth Edition, McGraw-Hill Book Co.
16. Anonymous, "Salt Tolerance of Fruit Crops", USDA Agricultural Information. Bulletin 292, 1980.
17. Page AL. "Methods of soil analysis, part II", 1980, American Society of Agronomy.
18. Thompson LM, Troeh FR. "Soils and Soil Fertility", 1978, Mc-Graw-Hill, New York, 516pp.
19. Zucconi F, De Bertoldi M. "Specifications for Solid Waste Composting", BioCycle, 1987, 28[5]:56-61.
20. Christie BR, Salt tolerance of plants. "E.V.Maas in Handbook of Plant Science. 1984, CRC press, Inc.
21. Reed SC. Middlebrooks EJ, Crites RW. "Natural Systems for Waste Management and Treatment", 1988, McGraw-Hill, Inc.
22. Vogtmann H, Matthies K, Kehres B, Meier-Ploeger A. "Enhanced Food Quality induced by Compost Applications". In: Hoitink HAJ, Keener HM. "Science and Engineering of Composting: Design, Environmental, Microbiological, and Utilization Aspects", 1993, Renaissance Publications, Worthington, Ohio, USA.
23. Minister of Agriculture. "Decree No. 100 for 1967, Legislation Bulletin", 1967, No. 100, Cairo, Egypt.
24. Duggan j. "Utilization of Municipal Refuse Compost", I. Field Scale Compost Demonstrations, Compost Sci., 1973, 14[2],1.
25. Hay JC, Caballero RC, Horvath RW. "Disinfection of Sewage Sludge by Windrow Composting", 1984, Proc-Disinfection of wastewater effluent and sludges, University of Miami, College of Engineering and National Science Foundation, Miami, Florida.
26. Hay JC. "Pathogenic Destruction and Biosolids Composting", BioCycle, 1996, June, PP. 67-76.
27. Hay JC et.al., "Windrow Composting in Los Angeles County [Part 1 & 2]", BioCycle, 1985, 26[7], 24 & 38-44.
28. Farrell JB. "Memo to Emery Lazar, Documentation of Scientific Bases for Best Management Definitions",1979,USEPA, Cincinnati, Ohio. In: Hay JC. "Pathogenic Destruction and Biosolids Composting", BioCycle, 1996, June, PP. 67-76.