U. of K. J. Agric. Sci. 23(2), 251-266, 2015

Anaerobic Composting of Farmyard Manure as Affected by Chicken Manure, Urea and Waste Water*

Hind Mohammed Sulieman and Elamin Abdedlmagid Elamin

Department of Soil and Environment Sciences, Faculty of Agriculture, Shambat, University of Khartoum, Sudan

Abstract: the objectives of this study were to investigate the stage of maturity and to determine nutrient contents of farmyard manure (FYM) composted with 2% chicken manure (CHM), 1% urea, and 25% waste water, during the summer seasons of 1997 and 1998. The treatments were replicated thrice in a completely randomized design. The total number of experimental units was repeated eight times for destructive sampling at 15 days intervals for a period of four months. The treatments were buried in auger holes (90-cm depth) and samples were collected and chemically analysed. The analysis included crude fibre, cellulose, starch, calcium, magnesium, sodium, nitrogen, phosphorus and potassium contents. The stage of maturity of FYM was measured by the biodegradation of crude fibre, cellulose and starch contents which decreased significantly ($P\leq 0.005$). The rate of crude fibre decomposition was highest in urea followed by CHM and waste water. The rate of cellulose decomposition of both urea and waste water treatments was significantly higher than the CHM and control treatments. Starch disappeared in the 12th week in CHM treatment and in the 14th week in waste water treatment. CHM treatment was superior in calcium release followed by waste water and urea treatments. The lowest sodium was detected in waste water treatment followed by both CHM and urea. Waste water, however, showed the highest nitrogen and phosphorus contents compared to the other treatments. Potassium content was the highest in CHM followed by urea and waste water. In conclusion, the best compost ripening time was after three months when its nutritive value was the highest and the physical properties were best.

Key words: Farmyard manure; chicken manure; urea; waste water

---

* Part of M. Sc. (Agric.) thesis by the first author, University of Khartoum, Sudan.

INTRODUTION

Chemical fertilizers have been thought to be the most crucial input for increasing crop yield, but it was soon realized that the intensive mineral fertilization has adverse, long environmental consequences (Sneh *et al.* 2005). Moreover, the production of chemical fertilizers in both monetary and energy terms and the need for conservation of resources forced the third-world countries, including Sudan, to look for alternatives. Hence, organic fertilizers gained great importance compared with synthetic fertilizers, although they contain relatively low concentrations of nutrients. They impart physical, chemical and biological changes on the soil by performing important functions which the synthetic formulations do not do (Mokolobate and Haynes 2002). Immature organic composts, however, may pose a number of problems during storage, marketing and use. The actively decomposing organic materials when added to soils or growth media may have negative impacts on plant growth due to reduced oxygen and/or available nitrogen or the presence of phytotoxic compounds (Schipper *et al*. 1994). Furthermore, composting is of great significance from the standpoint of killing weed seeds and plant pathogens, public hygiene, pollution control and environment protection (Habib *et al.* 2001; Robert 2001).

The soils of Sudan are known to be low in organic matter and nitrogen. In spite of this fact, there is a remarkable lag in the use of organic manure due to a variety of reasons. They include, and not limited to, unilateral development of crop and animal systems of production, lack of appreciation of the value of organic manures in the maintenance of soil fertility, ignorance of practicing the best applications and paucity of information on the scientific methods of making and storing organic fertilizer. A significant shift in crop fertilization can be made by using composted natural organic fertilizer, *e.g*., FYM and CHM, on large scale. Organic fertilizers from different sources are available in considerable amounts in Sudan as it has a very large livestock population and extensively cultivated lands. Composting these wastes under aerobic or anaerobic conditions seems to have a great potential. The nutrient needs of agriculture in Sudan can largely be met through an integrated system of organic and inorganic fertilization.

The objectives of this research were to study the effect of different chemical and natural additives on chemical composition of FYM, leading to a good quality fertilizer, and to understand the potential constraints of composting, which would help improve composting practices.

MATERIALS AND METHODS

Experiments were conducted at the Demonstration Farm of the Faculty of Agriculture, Shambat (Latitude 15°40´ N and Longitude 32° 32´E) for the two successive summer seasons of 1997 and 1998 with mean temperatures of 37.7°C and 38.0°C, respectively. The soil type is clay with pH of 7.9±0.1. Ninety-six auger pits were made each with 90 cm depth and diameter of 34.5 cm in an area of 0.11 hectare. FYM was collected from the Top Farm of Khartoum University where animals were fed ‘Abu Sabien’ (*Sorghum bicolor* L.) and concentrates. Chicken manure was brought from a private farm in ‘Hillat Kuku’ Khartoum North and waste water was collected from Shambat area. Urea (46% N) was used as a starter dose. Preliminary chemical analysis of FYM, CHM and waste water were done to determine the crude fibre, cellulose, starch, calcium, magnesium, potassium, and nitrogen and phosphorus contents (Table 1).
Treatments were as follows:

1. Four kgs of FYM (control).
2. Four kgs of FYM plus 2% CHM (80g), (CHM).
3. Four kgs of FYM plus 1% urea, (Urea).
4. Four kgs of FYM plus 25% waste water, (Waste water).

All treatments received a basal dose of super phosphate fertilizer, and the moisture content was brought to 50%. The treatments were replicated thrice in a completely randomized design and the means were separated using Duncan's Multiple Range Test (DMRT); (Gomez and Gomez 1984). The whole set was repeated to cater for destructive sampling at 15 days interval for a period of four months. The collected samples were air-dried, finely ground, sieved and kept for chemical analysis. Effects of added materials on maturity of FYM were assessed by measuring its biodegradation regarding cellulose, crude fibre decomposition, starch depletion and mineral elements. The concentrations of calcium, magnesium, sodium and potassium were determined, using atomic adsorption spectrophotometer. Starch was determined as described in

Kerr (1951).Crude fibre and nitrogen according to AOAC (1990). Phosphorus analysis was carried out, according to Chapman and Pratt (1961), and the pH was measured using pH metre.

RESULTS AND DISCUSSION

Crude fibre content

The first four weeks exhibited non-significant decrease of crude fibre among treatments, probably due to the microbial activity (Table 2). As time progressed, a gradual decrease in crude fibre content of FYM occurred which might be attributed to the log phase of the microbial growth (Abdelghni 1997). CHM treatment showed the lowest content of crude fibre at the end of the experiment because it was easily decomposed and was a high-energy supplier (Elamin 1991; Elamin and Elagib 2001). Urea treatment gave the highest significant decrease in crude fibre content at the 12^{th} week when FYM was mature. This was because of the supply of nitrogen from urea, hydrolysis to ammonia which was used by these organisms in their assimilation beside the carbonaceous compounds from the organic matter decomposition. The significant increase in the 10^{th} week in crude fibre with waste water treatment might be due to the accumulation of organic acids (Elamin and Elagib 2001) that lowered the pH consequently and led to decline in microbial activity (Elsheikh 1993). Generally, crude fibre had a high decomposition rate compared to cellulose and is considered a substrate for cellulose enzymes and cellulolytic microorganisms (Elsheikh 1993; Abdul Nasir *et al.* 2012).

Table 1. Preliminary chemical analysis of FYM and waster

Sample	Sodium mg/kg	Calcium mg/kg	Potassium mg/kg	Magnesium phosphorous %	Phosphorus %	Crude fibre %	Nitrogen %	Cellulose %	Starch %
FYM	60.1	385	462.5	120.0	1.00	22.6 0	1.19	27.54	0.17
CHM	83.5	438	250.0	304.6	3.80	4.20	1.83	14.89	0.04
Waste water	38.1	405	150.0	420.0	2.90	00.0	2.50	0.00	00.0

Table 2. Crude fibre, cellulose and starch contents of FYM as affected by treatments

Time weeks	Crude fibre (%)				Cellulose (%)				Starch (%)			
	Control	CHM	Urea	Waste Water	Control	CHM	Urea	Waste Water	Control	CHM	Urea	Waste Water
2nd	12.8a	7.8ab	11.6a	1.7a	33.9a	23.0b	15.1e	18.8c	0.06c	0.9b	0.9b	1.18b
4th	11.9a	7.9ab	13.3a	9.9ab	32.3a	29.9a	29.9a	20.0d	0.09a	0.08c	0.15b	2.42a
6th	15.3a	9.4b	9.2b	7.3d	30.8a	31.4a	17.6c	18.6c	0.42a	0.34a	0.52a	0.04c
8th	13.5a	6.4d	9.3b	5.5c	23.8a	29.8a	18.7c	16.9e	0.27b	0.28b	0.25b	0.04c
10th	11.4a	5.4c	7.2b	11.1a	32.6a	28.4b	17.7d	18.1c	0.09a	0.17b	0.012cd	0.13c
12th	6.9b	5.5c	2.2f	9.9ab	28.5b	26.7b	14.9d	15.8d	0.08b	0.00	0.04c	0.08b
14th	2.9d	2.9b	2.2f	4.2c	20.3c	27.8b	12.3f	11.8f	0.09a	0.00	0.09a	0.00
16th	6.4b	2.2f	3.2e	3.9c	27.8b	31.3a	15.5d	11.1f	0.06b	0.00	0.18a	0.00

- Means followed by the same letter (s) within each column or row are not significantly different at $P \leq 0.01$ according to DMRT
- The values above are the means of the two seasons

Cellulose content

Generally, cellulose has a slow degradation rate compared to starch, because of its unbreakable structure and high C/N ratio (Collins *et al*. 1990; Abdul Nasir *et al*. 2012). A highly significant decrease in cellulose content was observed, with time, in all treatments (Table 2), expressed in a weight loss and nutrient release which indicate residue decomposition (Midchinck and Monicilovic 2010). Waste water treatment showed rapid significant decomposition rate towards the end of the experiment compared to the other treatments, presumably facilitated by degradative microorganisms present in waste water*,* beside the abundance of nitrogen in the form of ammonium ions. The rate of cellulose decomposition of both urea and waste water treatments increased significantly compared to those of CHM and the control treatments which confirms that the presence of nitrogen in these additives enhanced cellulose decomposition.

Starch content

Starch content in FYM was very low compared to that of cellulose (Table 2). Except for waste water treatment, all others showed an increasing pattern. The starch content in CHM treatment significantly decreased. The reduction was due to chicken manure decomposition that produced heat which, in turn, enabled the degradative microorganisms to decompose starch (Elamin 1991; Eltilib *et al.* 1994; Abdelghani 1997). The starch disappeared completely at the 12th week in chicken manure and waste water treatments. Urea treatment significantly increased starch content up to the 6th week, because of the acidifying effect of urea hydrolysis, resulting in unfavourable conditions for soil micro flora to decompose starch. Urea was completely hydrolysed after six weeks producing ammonia, which enhanced the microbial activity that increased starch decomposition rate significantly (Mori *et al.* 1996). The starch content of waste water treatment significantly increased up to the 4th week, but this increase was lower than that of urea treatment in the 6th week. This might be attributed to the abundance of decomposing microorganisms in waste water which enabled starch decomposition to start earlier than in all other treatments (Midchinck and Monicilovic 2010).

Table 3. Calcium, magnesium and sodium controls of FYM as affected by treatments

Time weeks	Calcium (%)				Magnesium (%)				Sodium (%)			
	Control	CHM	Urea	Waste Water	Control	CHM	Urea	Waste Water	Control	CHM	Urea	Waste Water
2nd	33.2c	436ab	382bc	424ab	123.6cd	115.2d	159.6b	136.5c	85.1a	71.3b	85.1a	75.9c
4th	320c	434b	328c	344b	182.4d	2568b	146.0b	213.6c	80.5b	85.1a	89.7b	87.4b
6th	328b	472a	334b	340b	134.4c	133.4d	174.0b	238.8c	82.8bc	71.3b	87.4ab	80.5c
8th	314d	528b	172d	266b	176.4e	238.8d	363.6a	364.8a	78.2b	66.7b	73.6c	80.5d
10th	224c	214c	170d	318d	322.8b	200.4f	409.2a	249.8d	59.8c	82.2a	80.5a	69.0e
12th	446b	322c	336c	352c	3186a	2484c	381.6a	157.7e	48.3d	71.3b	87.4a	41.4c
14th	340bc	312c	334b	356c	354.0d	339.6d	387.6a	440.4a	96.6a	82.8ab	75.9de	69.0e
16th	314d	404ab	294d	424ab	489.6a	3.3.6d	346.2a	295.2d	85.1a	82.8a	82.8a	64.4c

- Means followed by the same letter (s) within each column or row are not significantly different at $P \leq 0.01$, according to D M RT
- The value above is the means of the two seasons

Calcium content

The preliminary high calcium content in chicken manure (Table 1), partly, explained the high calcium determined in CHM treatment (Table 3). In addition, the heat energy dissipated from chicken manure decomposition enhanced the function of the soil microorganisms, especially those producing phosphatase enzyme that enabled phosphorus mineralization and calcium release (Elsheikh 1993; Abdelghni 1997).The significant decrease in the content of calcium during this period might be due to the high degradation rate caused by the chicken manure. This led to the mineralization and movement of calcium ions to the soil solution compared to that of other treatments. In the first six weeks, calcium content in FYM increased due to the presumable acidifying effect of urea decomposition (Robert 2001). After the 10^{th} week, the organic acids accumulated and consequently the pH decreased which favoured calcium recomplexing and, therefore, the calcium content in the FYM started to increase again significantly. Waste water enhanced FYM biodegradation; by increasing the degradative action of soil microorganisms (Hue and Recheigh 1995); a considerable calcium complexion rate presumably occurred. The accumulation of organic acids after the 10^{th} week reduced the pH and thus enhanced calcium recomplexing (Barak *et al.*1990).

Magnesium content

CHM and waste water treatments showed an increasing trend of magnesium content up to the 8^{th} week, whereas the urea treatment showed the same trend of increase up to the 10^{th} week (Table 3). The significant decrease of magnesium in CHM treatment could be due to the initial magnesium content of chicken manure (Table 1). Although chicken manure was easily decomposable (Abdealghni 1997), its magnesium content increased with time due to the probable capturing of magnesium ions by organic acids produced (Elsheikh 1993). Urea treatment significantly increased magnesium content compared to the others due to its acceleration of FYM decomposition and thus the formation of magnesium organic salts (Hue and Recheigh 1995). Waste water treatment exhibited a significant decrease in soluble magnesium in the 12^{th} week. This was possibly due to the release of magnesium ions from FYM to soil due to the high activity of soil microorganisms (Hue and Recheigh 1995). After the 12^{th} week, the significant increase of magnesium content up to the 14^{th} week was probably attributed to the decomposition of more resistant fractions of organic matter (cellulose, lignin etc.), and thus magnesium was captured organically.

Sodium content

Generally, the sodium content in all treatments was the lowest among the other measured cations (Table 3).The relatively high sodium content in CHM treatment could be attributed to the originally high sodium content of the chicken manure (Table1). Urea treatment showed significant increase up to the 12th week when sodium content was the highest. Waste water treatment exhibited its lowest content in the 12th week. This might be due to the mineralization of sodium and leaching inside soil as compost started to mature in the third month after burying.

Nitrogen content

Significant differences were obtained in the nitrogen content in all treatments (Table 4). The increase in the nitrogen content might be attributed to the release of the organically-bonded nitrogen resulting from FYM decomposition (Elsheikh 1993). A significant decreasing trend in CHM treatment was then obtained presumably due to the volatilization of ammonia (NH_3) from organic form of nitrogen (Elsheikh 1993). Urea treatment showed a gradual decrease in nitrogen content after the 10th week, because FYM decomposition required much energy than the rapid hydrolysis of urea by urease enzyme. Waste water treatment showed the lowest nitrogen content in the 12th and 14th weeks. This might be due to the low amounts of the organic substrates that facilitated binding of nitrogen in organic form caused by the abundance of degradative microorganisms in waste water (Barak *et al.* 1990). So the significant decrease in the 12th week in the waste water treatment was probably caused by mineralization of nitrogen which was then released to soil solution in its soluble forms (William 1992).

Table 4. Nitrogen, phosphorus and potassium contents of FYM as affected by treatments

Nitrogen (%)				Phosphorus (%)				Potassium (%)				Time
Waste Water	Urea	CHM	Control	Waste Water	Urea	CHM	Control	Waste Water	Urea	CHM	Control	weeks
0.042c	0.048a	0.039cd	0.045b	1.8d	2.1b	1.8d	2.6a	1.6b	1.8a	1.4c	1.4c	2nd
0.044b	0.043b	0.043a	0.046b	2.8b	2.2c	2.3c	1.7d	1.6b	1.8a	1.8a	1.7b	4th
0.043ab	0.046a	0.037c	0.039cb	2.9ab	3.1b	2.3c	3.1a	1.5d	1.6c	1.4d	1.8a	6th
0.032c	0.046a	0.030c	0.041b	2.8c	3.4a	2.8c	2.9b	1.6a	1.7a	1.4d	1.6b	8th
0.033b	0.036ab	0.032b	0.020c	2.7d	3.2b	2.4e	3.8a	1.7ab	1.8a	2.1b	2.2a	10th
0.012c	0.040a	0.030d	0.020c	1.6d	3.2b	2.6c	3.0ab	1.1e	1.6a	1.6c	1.4c	12th
0.023d	0.044b	0.035c	0.024d	2.6a	3.1ab	3.1a	3.0ab	1.1c	1.4c	1.4d	1.4c	14th
0.016c	0.046b	0.041b	0.038e	3.3a	3.2b	3.28c	3.0ab	1.7a	1.2d	1.3d	1.4c	16th

- Means followed by the same letter (s) within each column or row are not significantly different at $P \leq 0.01$, according to DMRT
- The value above is the means of the two seasons

Phosphorus content

Phosphorus content in CHM and urea treatments increased up to the 8th week, whereas that of waste water treatment increased up to the 6th week (Table 4). This increase might be due to the addition of a basal dose of triple superphosphate that decreased the phosphorus adsorption and/or precipitation caused by organic acids released (pH effect). The phosphorus content of CHM treatment decreased significantly compared to the other treatments up to the 12th week. This might be attributed to the rapid decomposition of chicken manure and lowering of pH which enhanced the phosphorus release to the soil (Eltilib *et al.* 1994; Abdelghani 1997). Urea treatment significantly increased the phosphorus content probably through the enhancement of the microbial activity and hence the organic matter degradation. Waste water treatment showed a highly significant decrease in phosphorus between the 6th and the 12th weeks. This might be explained by the gradual increase in the microbial activity that reached its peak after three months of biodegradation indicating a positive relation between the microbial biomass and the phosphorus content (Hue and Recheigh 1995). In addition, the rate of phosphorus mineralization increased as the organic acids built up in the media and then activates phosphatase enzymes. Yet, the presence of acidic medium inhibited soil microorganisms, thus leading to recomplexing of phosphorus and might have decreased mineralization and release of phosphorus after the 14th week (Elsheikh 1993).

Potassium content

Data in Table 4 reveal that the potassium content of FYM decreased by treatments up to the 8th week. This could be explained by the release of potassium ions from FYM to the soil as illustrated by Dewes and Schmitt (1994). Urea treatment increased the potassium content significantly at the 12th week than the other treatments, presumably by increase of the biological degradation of organic matter and hence the formation of potassium carbonate that conserved potassium from being released to soil solution. Waste water treatment showed a significant potassium reduction in the 12th week than the other treatments. This could be attributed to the high degradation rate caused by the waste water treatment (Pozo *et al.* 2003). These conditions favoured potassium mineralization and its release to the soil solution. Potassium content tended to increase again after the

12th week due to the reaction between potassium salts and the carbonaceous compounds that resulting from the organic matter decomposition.

It is concluded that the maturity of FYM treated with chicken manure, waste water and urea was attained after three months of anaerobic composting and can be used after that period.

REFERENCES

AOAC (1990). *Official Methods of Analysis*. Association of Official Agricultural Chemists (AOAC).

Abdeaghani, M.E. (1997). *Effect of Rhizobium on N-fixation Yield and Seed Quality of Fenugreek (Trigonella foenum-graecum* L.). Ph.D. (agric.) Thesis. University of Khartoum, Sudan.

Abdul Nasir, M.U.K. Shafiq, A.; Chaundary, A.; Javed, A.I.M.; Sultan, M. (2012). Evaluation of Biofertilizer Application to Ameliorate the Environment and Crop Production. *Pakistan Journal Agricultural Science* 49(4) 11, 527-531.

Barak, P.B.; Monlina, J.A.; Hadas, A.H. and Chapp, C.E. (1990). Mineralization of amino acids evidence of direct assimilation of organic nitrogen. *Soil Science Society of America Journal* 54(3), 769-774.

Collins, H.P.; Elliot, L.F.; Richman, R.W.; Bezdicek, D.F. and Papendic, R.I. (1990). Decomposition and interaction among wheat residue components. *Soil Science Society of America Journal* 54, 780-785.

Chappman, H.D. and Pratt, P.F. (1961). *Methods of analysis for soils, plant and water*. Division of Agricultural Science, University of California. 309 p.

Dewes, T.D. and Schmitt, L.S. (1994). Deposition of nitrogen and potassium from farmyard manure heaps in the soil under long-term manure storage areas. *Agro biological Research* 47,115-120.

Elamin, A.E; and Elagib, M.A. (2001). Comparative study of organic and inorganic fertilizer on forage corn (*Zea mays* L.) grown on two types of soils. *Qatar journal of Science* 23, 47-54.

Elamin, E.E. (1991). *Effect of Organic Manure Decomposition on Some Soil Properties,* M. Sc. (Agric.) Thesis, University of Khartoum, Sudan.

Eltilib, A.M.; Ali, A. M. and Abdullah; M.A. (1994). Effect of chicken manure and salinity on growth and leaf nitrogen, phosphorus and potassium on Okra growth in two soil types. *University of Khartoum Journal of Agricultural Sciences* 1 (2), 16-36.

Elsheikh, E.A. (1993). *Soil Microbiology* (in Arabic) Khartoum University Press, Sudan.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical Procedures for Agricultural Research,* 2nd Edition. John Wiley and Sons, New York.

Habib, F.M.; Negm, M.A. and Hassan, N.M. (2001). Composting of sugar beet residues. A study on conditions and period of composting. *Egyptian Journal of Agricultural Research.* 79(2), 373-383.

Hue, N.V. and Recheigh, J.E. (1995). Sewage sludge. Soil amendments and environment quality 2, 199-204.

Kerr, R.W. (1951). *Chemistry and Industry of Starch*, 12p Academic Press, Inc., New York, N.Y.

Midchinck, P. and Momicilovic, D. (2010). Chemical structure analysis of starch cellulose derivatives. *Advances in Carbohydrates Chemistry and Biochemistry* 64, 117-210.

Mokolobate, M.S. and Haynes, R.J. (2002). Comparative liming effect of four organic residues applied to an acid soil. *Biology and fertility of soil* 3(2), 79-85.

Mori, T.M.; Fuji, K.F.; Kawastuka, S.A. and Katamaya, A.A. (1996). Acceleration microbial degradation of chrothalinol in soils amended with farmyard manure*, soil Science and. Plant Nutrition* 42 (2), 315-322.

Pozo, R.; Tas, D.O.; Dulkairoqlu, H.; Orhon, D. and Diez, V. (2003). Biodegradability of slaughterhouse waste water with high blood content under anaerobic and aerobic conditions. *Journal of Chemical Technology and Biotechnology* 78(4),384-391.

Robert, R. (2001). Exploring the economics of farm composting. *Bio cycle* 42(2),1-3.

Schipper, L.A.; Harfoot, C.G.; Mc Farlane, P.N. and Cooper, A.B. (1994). Anaerobic decomposition and denitrification during plant decomposition in organic soil. *Journal of Environmental Quality* 23(5), 923-928.

Sneh Goglas, S.K. Dhull, Kapoor, K.K. (2005). Chemical and biological changes during different organic aste and assessment of compost maturity. *Bio-resource Technology Journal* 96, 1584-1591.

William, E.J. (1992). Nitrogen fertilizer and dairy manure effects on corn yield and soil nitrate. *Soil Science Society of America Journal* 56(1), 148-154.

التحلل اللاهوائي للسماد البلدي المتأثر بإضافة زرق الدواجن واليوريا ومياه المجاري

هند محمد سليمان والأمين عبد الماجد الأمين

قسم علوم التربة والبيئة ، كلية الزراعة
جامعة الخرطوم ، السودان

المستخلص: هدفت هذه الدراسة لمعرفة تأثير إضافة زرق الدواجن بنسبة 2% واليوريا بنسبة 1% ومياه المجاري بنسبة 25% على إنضاج السماد البلدي ومحتواه من المواد الغذائية . أجريت هذه التجربة في صيف عامي 1997 و 1998 باستخدام التصميم الكامل العشوائية بثلاثة مكررات كما تم تكرار كل المعاملات ثمان مرات لأخذ عينات كل 15 يوم لمدة أربعة أشهر . دفنت المعاملات في حفر (بالبريمة) بعمق 90سم ، ثم جُمعت العينات وحُللت كيميائياً . شمل هذا التحليل: محتوى الألياف الخام والسيليلوز والنشا والكالسيوم والمغنيسيوم والصوديوم والنيتروجين والفسفور والبوتاسيوم ، وقد تم متابعة تحلل السماد البلدي عبر التحلل الحيوي للألياف الخام والسيليلوز والنشا التي إنخفضت معنوياً ($P\leq0.05$) . كان معدل تحلل الألياف الخام أعلى في اليوريا ثم زرق الداوجن ثم مياه المجاري . كان معدل تحلل السيليلوز بنفس المستوى في كل من معاملتي اليوريا ومياه المجاري أعلى من معاملة زرق الدواجن . إختفى النشا في معاملة زرق الداوجن في الأسبوع الثاني عشر وفي معاملة مياه المجاري في الأسبوع الرابع عشر . تفوقت معاملة زرق الدواجن في إطلاق الكالسيوم تليها معاملة مياه المجاري ثم معاملة اليوريا . محتوى الصوديوم كان أدنى في معاملة مياه المجاري تليها كل من معاملتي زرق الدواجن واليوريا . وأظهرت معاملة مياه المجاري أعلى محتوى من النيتروجين والفسوفور مقارنة بالمعاملات الأخرى . وقد كان أعلى محتوى من البوتاسيوم في كل من معاملتي زرق الداوجن واليوريا بينما كان أدنى مستوى في معاملة مياه المجاري . خلصت الدراسة إلى أن السماد كان في أفضل خصائصه الطبيعية ومحتواه الغذائي بعد ثلاثة أشهر .