https://doi.org/10.29321/MAJ.10.A02761

Madras agric. J. 69. (9) : 590—592 September 1982

Enrichments of Nutrients in Organic Wastes Through Anaerobic Digestion

K. R. SWAMINATHAN[1], P. RAJASEKARAN[2], R. MANIAN[3], and S. KAMARAJ[4]

In a study on the comparison of various bio digested slurry specimens with the farm yard manure and compost. It was found that simultaneous production of manure and gas from cattle dung and organic waste was economical. Recycling of organic wastes for biogas generation as well as for production of manure appeared to be a worth while proposition to obtain maximum economic benefit.

In these days of increasing cost of fertilizers, there is a need to concentrate research efforts towards production of organic manure which forms a good source of plant food nutrients. The anaerobic breakdown of organic wastes in biogas plants results not only in the generation of methane rich biogas but also in the production of non-offensively smelling manure ready for application to crop fields. Biogasification has further great advantage that the nutrients in the waste materials-nitrogen, phosphorous and others are not wasted but are retained in a compact residue. This is more suitable for use as fertilizer than the original material. The preponderance of nutrients depends upon cellulose, protein contents etc., properties of substrates added.

It has also been reported that the digested slurry when applied to crops gave better response (Laura and Idnani,1972; Biswas, 1975). An attempt has been made in the present investigation to discuss and compare in detail the results of manurial values of various waste incorporated biodigested slurry specimens with the other forms of organic manure viz., farm yard manure and compost.

MATERIAL AND METHODS:

The organic wastes employed in the conduct of experiments viz., cowdung, biodigested slurry, groundnut shell, composite mixture of weeds (Parthenium, water hyacinth and saranai) farm yard manure and compost were collected locally from Tamil Nadu Agricultural University campus. The press mud was obtained from M/S. Sakthi Sugar Factory at Appakudal, Tamil Nadu. The various wastes were incorporated with cowdung and old slurry in the proportion of 4:1:1: (v/v) respectively, in five litre capacity digesters and the gas output (the results of which are not reported) was measured by water displacement method over 12 weeks period. The composite mixture of well mixed biodigested slurry specimens from the waste incorporated treatments in addition to farm yard manure and compost, were analysed following the method described by Humphries (1956) for total nitrogen, by Jackson,

1. Professor Head 2 & 3 Associate Professor, 4 Assistant Prof. Dept. of Farm Machinery, College of Agrl. Engineering, T. N. A. U., CBE-3.

(1962) for phosphorus and potassium respectively.

RESULTS AND DISCUSSION:

The analytical data of composite, waste incorporated biodigested slurry as well as cow dung, farm yard manure, compost etc. are presented in Table 1. The values varied with the wastes examined. The values for nitrogen was found maximum-the quantity estimated being 1.95 percent, with press mud followed by 1.42 percent with groundnut shell and 1.30 percent with the composite mixture of weeds incorporated treatments. The manurial values of biodigested cow dung slurry was better when compared with undigested cow dung recording 1.35 and 1.14 percent nitrogen respectively. The relative phosphorus (as its pentoxide) and potassium (as its oxide) values estimated are also depicted in Table 1.

For the establishment of proper microbial flora and in bringing about the biodigestion process efficiently, nitrogen is very much needed. If there is insufficient nitrogen, the gas generation will be very much limited. The increase in nitrogen content of all the wastes incorporated treatments when compared with the control (cowdung alone) might be attributed to the high initial nitrogen content of the wastes in addition to the build up of microbial biomass. During the degradation of waste materials, the carbon is utilized for energy and growth by the microorganisms in higher amounts compared to that of nitrogen. This results in a biodigested slurry having comparatively narrow C/N ratio. Further, ammonical nitrogen released due to the degradation of plant proteins are not lost by volatalization, but are recycled forming nitrates which can happen in an anaerobic environment (Waksman, 1957; Eckholm 1976) Singhal (1977) and Muraleedharan (1977) stated that the quantity and quality of nitrogen content of liquid slurry obtained from the gas plant is more when compared to cow dung lend support to the results obtained in the study. Mishra (1954). however could obtain only 0.931 percent nitrogen in the farm yard manure when compared to 1.23 percent in the present study. Nagar (1975) has stated that the cow dung manure is richer in the 'N' content (1.5%) against 0.753 percent in farm yard manure.

From this study, it is evident that simultaneous production of manure and gas from cattle dung and organic wastes is an attractive proposition, economically. Moreover, the utilization of organic wastes is of great economic significance from the points of view of public health, pollution control and environmental protection. In addition several reports (Krishnamoorthy and Ravikumar, 1973; Sankaran *et al*. 1981) indicate that the application of liquid as dried slurry has given the highest uptake of different nutrients as compared to other organic manurer. As such the application of biogas plant slurry seems to help in increasing the supply of plant food nutitents in a readily available form and in higher amounts for the benefit of crop growth. Trials conducted in China on the fertilization of wheat with biogas manure, gave a 17% increase in grain yield, over

conventional compost (Anonymons, 1978). Thus it is highly desirable and worthwhile to recycle the organic wastes not only for biogas generation through biogas digesters but also for the production of manure through this "Miniature manure factories" so as to obtain maximum economic benefits for mankind.

REFERENCES

ANONYMOUS, 1978. China: recycling of organic wastes in agriculture, *FAO Soils Bulletin* No. 40 FAO, Rome p. 47.

BISWAS, T. D. 1975. Cowdung gas plant for energy and manure *Fert News*, 17 (1) : 3-7.

ECKHOLM, E. R. 1976. The other energy crisis, *Yojana*, 20 : 16-17.

HUMPHRIES ,E. C. 1956. Mineral components and ash analysis. *Modern Method of Plant Analysis*. Springer-Verlong, Berlin, 1 : 468-502.

JACKSON, M. L. 1962. Soil Chemical Analysis Constable and Co., Ltd., London, pp. 498.

KRISHNAMOORTHY, K. K. and V. RAVIKUMAR, 1973. Bulletin on permanent manurial experiments, Tamil Nadu Agricultural University, Coimbatore.

LAURA, R. D. and I. IDNANI, 1972. Effect on wheat yield and nitrogen uptake from manures made from spent slurry. *Pl. soil* 32: 283-95.

MISHRA, U. P. 1954. Production of combustible gas and manure from bullock dung and other organic materials. Assoc. I. A. R. I. thesis, Indian Agricultural Research Institute, New Delhi.

MURALEEDHARAN, V. K. 1977. A simple model of Gobar gas plant. *Invention Intelligence*. 1 : 304-07.

NAGAR, S. 1975. Biogas plants based on night soil and/or animal dung. *IRCWD News*, 8:1-4

SANKARAN, K. , G. V. KOTHANDARAMAN, and T. S. MANICKAM, 1981. Efficiency o Digested Cowdung Slurry as a source o Plant Nutrient. Paper presented in the workshop on Microbiology of Biogas Fermentation, TNAU, Coimbatore held from 11-1 July 1981.

SINGHAL, R. C. 1977. Energy through Ureas from gobar gas plants. *Kurukshetra*, 25 23-25.

WAKSMAN, S. A. 1957. Soil Microbiology Willams and Wilkins Co., Baltimore, U. S. A

Table-1 Manurial Valves of the Organic Wastes

(Expressed in % on oven dry basis)

Treatments/Proportion (V/V)	N	P	K
CD : OS : GS 1 : 1 : 4	1.42	0.85	0.96
CD : OS : CMW 1 : 1 : 4	1.30	0.71	0.65
CD : OS : PM 1 : 1 : 4	1.95	2.94	0.83
CD : OS : Nil 1 : 1 : 0	1.29	0.76	—
Cow dung alone	1.14	0.66	0.64
Biodigested cow dung slurry	1.35	0.74	0.72
Farm Yard manure	1.23	0.62	0.80
Compost	1.29	0.93	0.98

CD = Cow dung OS = Old Slurry GS = Groundnut Shell
CMW = Composite Mixture of Weeds PM = Press Mud

(Figures represent mean of three replications)