
UNIVERSITI PUTRA MALAYSIA

# THE EFFECT OF LIVESTOCK MANURES ON GROWTH AND NUTRITIVE VALUES OF *Eisenia foetida*

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# THE EFFECT OF LIVESTOCK MANURES ON GROWTH AND NUTRITIVE VALUES OF *Eisenia foetida*

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**CERTIFICATION.**

Thesis entitle "**THE EFFECT OF LIVESTOCK MANURES ON GROWTH AND NUTRITIVE VALUES OF *Eisenia foetida*"** is prepared by FITRI AMIRUL BIN KHAIRUDIN submitted to the Faculty of Agriculture in fullfilment of course SHW 4999 (Final Year Project) for the requirement of Degree of Bachelor of Agriculture (Animal Science.)

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LIST OF ABBREVIATION


| | PAGE |
|---|---|
| N – Nitrogen | 16 |
| P- Phosphorus | 16 |
| K-Potassium | 16 |
| C:N : carbon to nitrogen | 15 |
| DM : Dry matter | 14 |
| TKN : Total Kjedahl Nitrogen | 16 |
| CP : Crude protein | 15 |

**TITLE :THE EFFECT OF LIVESTOCK MANURES ON GROWTH AND NUTRITIVE VALUES OF *Eisenia foetida***

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Keywords : *Eisenia foetida* ; vermicasts ; dry matter; biomass ; carbon nitrogen ratio ;vermicomposts ;manure .

## ABSTRACT

A study (5 weeks duration) was conducted to evaluate the efficiency of an exotic earthworm species (*Eisenia foetida*) for decomposition of four different types of organic materials ; peat soil as control,goat manures,cow manures and mixtures of goat and cow manures into valuable vermicompost . Each treatment group consisted of three replicates and worm vermicasts and earthworm were examined after 5 weeks .

The percentage of nitrogen, phosphorous and potassium in vermicompost was significantly increase ($p<0.05$) while pH and total organic carbon declined as a function of the vermicomposting period . The final percentage gains in vermicasts of total nitrogen and phosphorus in cow manure vermicasts were higher than those in control and goat manure. Cow vermicasts had a higher N content than goat vermicasts and also the C:N ratio of fresh materials was

higher than that of vermicasts for all treatment . There was a shift from the initial neutral pH condition towards an acidic condition due to the bioconversion of the organic material into various intermediate types of organic acid . Earthworm biomass weight gains showned no significant difference when compared to control although increase in all treatment . Earthworm biomass and dry matter (DM) of *Eisenia foetida* cultured in cow manure were higher than in goat manure , followed by mixture manures and peatsoil ( control ).

In conclusion, cow manure provided a more nutritious and friendly environment to the earthworms than peatsoil ,goat manure and mixture of manures . The hypothesis is accecpted .The data reveals that vermicomposting (using *Eisenia foetida*) is a suitable technology for the decomposition of different types of organic wastes (domestic as well as industrial) into value-added material .

## ABSTRAK

Sebuah eksperimen telah dijalamkan untuk menganalisa kecekapan spesis eksotik cacing . *Eisenia foetida* untuk mengurai empat jenis bahan organik iaitu tanah organik , tinja kambing , tinja lembu dan campuran tinja kambing dan lembu menjadi kompos yang bernilai .Setiap kumpulan rawatan terdiri daripada tiga kompos .Baja vermikompos ini dianalisa selama lima minggu .

Peratus nitrogen , phosphorus dan potassium di dalam vermikompos menunjukkan peningkatan ketara bagi setiap rawatan ($P<0.05$) sementara pH dan jumlah karbon organik menurun selama vermikompos berfungsi selama tiga

minggu .Peratus akhir nitrogen dan phosphorus di dalam tinja lembu lebih tinggi daripada pemalar dan di dalam tinja kambing . Tinja lembu mempunyai lebih tinggi nitrogen daripada tinja kambing dan nisbah karbon nitrogen lebih tinggi daripada semua rawatan lain . Terdapat pergerakan awal daripada nilai awal pH kepada keadaan asid disebabkan biotransformasi bahan organik kepada pelbagai jenis bahan perantaraan asid organik. Peningkatan berat biomas cacing menunjukkan tiada peningkatan ketara walaupun meningkat di dalam setiap rawatan . Biomass cacing tanah dan bahan kering *Eisenia foetida* yang dikultur di dalam tinja lembu lebeh tinggi dari pada tinja kambing , di ikuti tinja campuran dan tanah organik .

Kesimpulannya ,tinja lembu memberi lebih nutrisi dan persekitaran yang lebih mesra kepada cacing tanah jika dibandingkan dengan tanah organik , tinja kambing dan tinja campuran .Hipotesis diterima .Data menunjukkan vermikompos menggunakan *Eisenia foetida* merupakan teknologi yang sesuai untuk dekomposisi berlainan jenis bahan buangan organik sama ada tempatan atau industri untuk ditransformasikan kepada bahan bermanfaat .

# INTRODUCTION

Rapid industrialization of livestock industry in Malaysia have resulted in serious pollution and degradation . There is no point in sitting back and saying ‘the government should do something it.It was our responsibility and to make a contribution no matter how small it is . Huge amount of livestock waste being produced due to intensive operation in order to meet the market demand of protein from animal sources . Local farmers nowadays do not practice environtmentally friendly manure management of their farm. Farmer and the government must play their respective roles in order to minimize the impact of pollution to environtment . Moreover , no encouragement like subsidies and funding program given by the government to farmer for such purpose from the government . Until now , large amount of livestock wastes remain unutilized . These organic wastes can be converted to various end producrs (Hobson et al., 1974) or recycled as feed , fuel and fertilizer in order to reduce environtmental pollution .

Earthworms are very efficient at converting plant and animal wastes into biomass that can be used as a feed ingredient in animal production: a ton of animal waste will produce about 100 kg of worms (Edwards et al.,1985). Earthworms are a good quality protein for use in animal feeds, but the practical

use of earthworm meal is influenced by economic. Technology is available for large-scale production of earthworms, but separating the earthworms from the organic wastes in which they are growing is labor intensive, thus hindering the use of earthworm meal in developed countries. The potential is greater for producing earthworm meal in developing countries where labor costs are lower.

Although various physical, chemical and microbiological methods of disposal of organic solid wastes are currently in use, these methods are time consuming and involve high costs. Therefore, there is a pressing need to find out cost-effective alternative method of shorter duration particularly suited to Indian country climate and conditions. In this regard, vermicomposting has been reported to be a viable, cost-effective and rapid technique for the efficient management of the organic solid wastes (Raymond et al., 1988).The stability and maturity of the compost are essential for its successful application, particularly for composts used in high value horticultural crops (Wang et al., 2004). Many studies have been made on the vermicomposting of animal excreta, sewage sludge and agroindustrial wastes (Edwards, 1988). However, there is little information on the comparison of animal manures for the production of vermicompost under Malaysian conditions. The objectives of this study were to compare the quantity produced from three different types of livestock manure (cattle, and goat manure) by the worms and the effects of these manures on their growth and crude protein content in *Eisenia foetida*

since the worms themselves provide a protein source for animal feed especially for poultry industry .

## 1.1SIGNIFICANCE OF STUDY

Composting technique using earthworm will have an effect on mineral and carbon composition of the compost . This study will determined which livestock manures will result in good environtment for earthworm by growth and mineral composition . Also , this study will determine the protein content and amino acid composition by *Eisenia foetida* according to different materials they are being cultured .

## 1.2 OBJECTIVES:

To measure the effect of different livestock manures of compost and nutritives values of *Eisenia foetida*

Specific objective ;

1.To determine growth population of *Eisenia foetida* in different livestock manures and the nutritive content of *Eizasenia foetida* as a potential food supplement .

2.To determine the effect of mineral and carbon composition changes before and after the composting

3.To study the effect of protein content and amino acid composition of Eisenia foetida in different livestock manures .

## 1.3 HYPOTHESIS

*Eisenia foetida* growth in livestocks manures is higher than growth in soil.

## REFERENCES


Bansal, S., & Kapoor, K. (2000). Vermicomposting of crop residues and cattle dung with *Eisenia foetida* . Bioresource Technology, 73(2), 95-98.

Crawford, J.H., 1983. Review of composting. Process Biochem. 18, 14–15.

Edwards, C. A. (1988). Breakdown of animal, vegetable and industrial organic wastes by earthworms. Earthworms in Waste and Environmental management. Edited by Clive A. Edwards and Edward F. Neuhauser.

Garg, V., Gupta, R., & Yadav, A. (2010). Vermicomposting Technology for Solid Waste Management.

Gaur, A.C., Singh, G., 1995. Recycling of rural and urban waste through conventional and vermicomposting. In: Tondon, H.L.S. (Ed.), Recycling of Crop, Animal, Human and Industrial Waste in Agriculture. Fertilizer Development and Consultation Organization,New Delhi, pp. 31–49.

Loh, T.C Lee, Y., Liang, J., & Tan, D. (2005). Vermicomposting of cattle and goat manures by *Eisenia foetida* and their growth and reproduction performance. Bioresource Technology, 96(1), 111-114.

Ndegwa, P. M., & Thompson, S. (2000). Effects of C-to-N ratio on vermicomposting of biosolids. Bioresource Technology, 75(1), 7-12.

Ndegwa, P., & Thompson, S. (2001). Integrating composting and vermicomposting in the treatment and bioconversion of biosolids. Bioresource Technology, 76(2), 107-112.

Suc, N. Q. (2000). Le thi thu ha and dinh van binh 2000 manure from rabbits, goat cattle and buffaloes as substrate for earthworms. Workshop-Seminar. Making Better use of Local Feed Resources. SAREC-UAF,

Suthar, S. (2007). Vermicomposting potential of *Perionyx sansibaricus* (perrier) in different waste materials. Bioresource Technology, 98(6), 1231-1237.

Ndegwa, P., Thompson, S., & Das, K. (2000). Effects of stocking density and feeding rate on vermicomposting of biosolids. Bioresource Technology, 71(1), 5-12.

Hand P Hayes, W.A., Frankland, J.C., Satchell, J.E. 1988. The vermicomposting of cow slurry. In: Earthworms in Waste and Environmental Management, pp. 49–63

Lavelle,P.,Melenez,G.,Pashnasi,B.,Schaefer,R.,1992.Nitrogen mineralization and reorganization in casts of the geophagous tropical earthworm *Pontoscoles corethrurus* (Glossoscolecidae). Biol. Fertil. Soil 14, 49–53.

Hobson, P. N., S. Bousfield and R. Summers. 1974.Anaerobic digestion of organic matter. P.131.In CRC Critical Reviews in Environmental Control. Chemical Rubber Co., Cleveland,OH

C.L. Raymond, J.H. Martein Jr., E.F Neuhauser (1988). Stabilization of liquid municipal sludge using earthworms . Earthworms in Waste and in Environment Management, SPB Academic Publishing, The Netherlands (1988), pp. 95–110

Omrani G.H.Bodenzoologische, unter suchungen uber regenwurmer in zentral und Nordjran. Gissen . Germany.(1973)

Orozco F.H,Cegarra J , Trujillo L. M, Roig A. Biology and Fertility of soils. (1996) 22: 162-166

Atiyeh R.M, Dominguez J, Subler S, Edwards C. Journal of pedobiologia. (2000) 44: 409-424

Edwards CA, Lofty JR (1977) Biology of earthworms. John Wiley and Sons, New York.

Y.Y. Wang, G.Y. Tang, F.A.M. Koeck, B. Brown, J.M. Garguilo, R.J. Nemanich.Experimental studies of the formation process and morphologies of carbon nanotubes with bamboo mode structures Diamond Relat. Mater., 13 (2004), pp. 1287–1291.

Lung, A.J., Lin, C.-M., Kim, J.M., Marshall, M.R., Nordstedt, R., Thompson, N.P., Wei, C.I., 2001. Destruction of *Escherichia coli* O157:H7 and *Salmonella enteritidis* in cow manure composting. J. Food Protect. 64, 1309–1314.

E. Benitez, R. Nogales, C. Elvira, G. Masciandaro, B. Ceccanti .Enzyme activities as indicators of the stabilization of sewage sludges composting with *Eisenia foetida* Bioresource Technology, 67 (1999), pp. 297–303.

Kaushik, V.K. Garg Dynamics of biological and chemical parameters during vermicomposting of solid textile mill sludge mixed with cow dung and agricultural residueBioresource Technology, 94 (2004), pp. 203–209

R. Hartenstein, F. Hartenstein P Physicochemical changes effected in activated sludge by the earthworm *Eisenia foetida* J. Environ. Qual., 10 (1981), pp. 377–382

Renuka Gupta, Praveen Kumar Mutiyar, Naresh Kumar Rawat, Mahender Singh Saini, V.K. Garg. Development of a water hyacinth based vermireactor using an epigeic earthworm *Eisenia foetida* . Bioresource Technology Volume 98, Issue 13, September 2007, Pages 2605–2610

Viel, D. Sayag, L. Andre Optimization of agricultural, industrial waste management through in-vessel composting M. de Bertoldi (Ed.), Compost: Production, Quality and Use, Elsevier Sci. Essex (1987), pp. 230–237

R. Vielma-Rondón, J.F. Ovalles-Durán, A. León-Leal, A. Medina Valor nutritivo de la harina de lombric (Eisenia foetida) como fuente de aminoácidos y

su estimación cuantitativa mediante cromatografía en fase reversa (HPLC) y derivatización precolumna con o-ftaldehido (OPA)Ars Pharmaceutica, 44 (1) (2003), pp. 43–58

Albarran G. N., 1996 Formulacion de alimentos concentrados para animals a partir de harina de lombriz. [Tesis de licenciatura, Ingenieria]. Laboratorio de Ciencia de los Alimentos. Merida-Venezuela. Universida de Los Andes.

O.T. Fosgate, M.R. Babb Biodegradation of animal waste by *Lumbricus terrestrisJ.* Dairy Sci., 55 (1972), pp. 870–872

D. Kale, K. Bano, R.V. Krishnamoorthy Potential of *Perionyx excavatus* for utilization of organic wastes Pedobiologia, 23 (1982), pp. 419–42

Talashilkar, P.P. Bhangarath, V.B. Mehta Changes in chemical properties during composting of organic residues as influenced by earthworm activity J. Indian Soc. Soil Sci., 47 (1999), pp. 50–53

Cristina Lazcano,María Gómez-Brandón,Jorge Domínguez Comparison of the effectiveness of composting and vermicomposting for the biological stabilization of cattle manure Chemosphere Volume 72, Issue 7, July 2008, Pages 1013–1019

Ronald Klein,Barbara E.K. Klein, Kristine E. Lee, Changes in Visual Acuity in a Population : The Beaver Dam Eye Study Ophthalmology Volume 103, Issue 8, August 1996, Pages 1169–1178 .