

**COMPARATIVE QUALITY OF GOAT MANURE BASED COMPOST WITH
OR WITHOUT FERMENTATION ADDITIVE AND ITS EFFECT ON THE
GERMINATION OF PECHAY**

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An Undergraduate Thesis Submitted to the Faculty of the Department of Environmental
Science, College of Science, Central Luzon State University,
Science City of Muñoz, Nueva Ecija, Philippines
in Partial Fulfillment of the Requirements
for the Degree of

**BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCE
(Sustainable Agriculture)**

JULY 2023

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ABSTRACT

DOMINGO, APRILYN L., Department of Environmental Science, College of Science, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **July 2023, COMPARATIVE QUALITY OF GOAT MANURE BASED COMPOST WITH OR WITHOUT COMPOST ADDITIVE AND ITS EFFECT ON THE GERMINATION OF PECHAY**

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Utilizing goat manure for composting at the same time addressing environmental issues can be a feasible alternative for goat raisers. The study aimed to determine the effects of adding a rapid odor erasing and composting microbes (OECM) at different inclusion rates of; 350 grams per 100 kg raw material (50 kg goat manure + 50 kg fly ash) T2; 400 grams per 100 kg raw material (50 kg goat manure + 50 kg fly ash) T3, and 450 grams per 100 kg or raw material (50 kg goat manure + 50 kg fly ash) T4 on physical properties, temperature, pH, germination rate, percentage weight loss, and NPK analysis. The control T1 was 100 kg raw material with no OECM. A Complete Random Design (CRD) was used consisting of 4 treatments with each treatment replicated thrice. Tukey HSD was used to further analyze significant differences.

Result showed that the odor of treated compost was no longer evident on day 13 for T2, T3, and T4. The texture from coarse to slightly fine was observed in day 13 of T2, T3, and T4, while the color from black to grayish black was demonstrated on day 13 of T2, T3, and T4.

The temperature ($p. < 0.01$), pH ($p. < 0.01$), compost weight loss ($p. < 0.01$), germination rate ($p. < 0.01$), and NPK ($p. < 0.01$), were significantly different over the control. Therefore, the OECM at 350 grams, 400 grams, and 450 grams per 100 kg raw

material is an indispensable additive for goat-based manure as it significantly improved the varying compost quality parameters. Hence, on the NPK results show that the NPK content of Goat Based Manure was N (0.66), P (2.57) and K (11.51) for T1 (Control). For T2 the N content (0.30), P (2.63) and K (13.04). For T3 the N content (0.23), P (3.10) and K (11.62). For T4 the available N (0.47), P (3.36), and K (13.05). From the result, the N content did not reach the ideal N of a compost, but higher potassium level was considering that it is indispensable for grain development.

Keywords: compost; goat manure; organic fertilizer; pechay

LITERATURE CITED

- Agapito, A. J. I., & Mercado, S. M. (2022), uplb-biotech's Bio N may help ease PH farmers' fertilizer woes. University of the Philippines Los Baños <https://uplb.edu.ph/all-news/uplb-biotechs-bio-n-may-help-ease-ph-farmers-fertilizer-woes/>
- Ansa, J. (2021), Growth and yield performance of bell pepper (*capsicum annum*) to levels of goat manure in rivers state, southern Nigeria *International Journal of Soil Science*. doi:10.3923/ijss.2007.142.147
- Arancon, N.Q., Edwards, C.A., Dick, R., & Dick, L. (2017). Vermicompost tea production and plant growth impacts. *BioCycle*, 48(11), 51.
- Awodun M.A., Omonijo L.I. and Ojeniyi S.O., (2007), Effect of Goat Dung and NPK Fertilizer on Soil and Leaf Nutrient Content, Growth and Yield of Pepper. *International Journal of Soil Science*, 2: 142-147.
- Ayunin, R. W., Nugraha, W. D., Samudra, G., (2016) Biological test of compost made of rabbit faeces and the addition of banana peels on the vegetative growth of *Morus alba* and *Arachis pintoi*, <https://doi.org/10.1051/e3sconf/202233500034>
- Bal-ot, H. J. (2022), Personal Communication
- Batham, M., Gupta, R., & Tiwari, A. (2013), Implementation of bulking agents in composting: A review. *J Bioremed Biodeg* 4:205. doi:10.4172/2155-6199.1000205
- Barker, A.V. (2017) Composition and uses of compost. In: Rechcigl, J.E. and MacKinnon (Eds.) *Agricultural uses of by-products and wastes*. ACS Symposium Series 668. Washington: ACS (American Chemical Society), 140-161.
- Breitenbeck, G. A., & Schellinger D. (2013), Calculating the Reduction in Material Mass And Volume during Composting, *Compost Science & Utilization* 12(4):365-371, doi:10.1080/1065657X.2004.10702206
- Catelo, M. A. O., Narrod, C. A., & Tiongco, M. M. (2008). Structural changes in the Philippine pig industry and their environmental implications. Intl Food Policy Res Inst. *Ifpri discussion paper* <https://www.ifpri.org/publication/structural-changes-philippine-pig-industry-and-their-environmental-implications>
- DA Communication Group (2022), From business mirror: Uplb-Biotech's Bio N may help ease Ph farmers' fertilizer woes. <https://www.da.gov.ph/from-business-mirror-uplb-biotechs-bio-n-may-help-ease-ph-farmers-fertilizer-woes/>

- Fan W. (2021), Organic fertilizer market analysis in the Philippines. <https://fertilizer-machinery.com/solution/organic-fertilizer-market-analysis-in-phi.html>
- Haug, R. T. (1993), Process kinetics and product stability *The Practical Handbook of Compost Engineering*. Lewis Publishers; Boca Raton, FL, USA: 1993. pp. 335–383.
- Insam, H., & de Bertoldi, M. (2007), Chapter 3 Microbiology of the composting process *Waste Management Series Volume 8* doi.org/10.1016/S1478-7482(07)80006-6
- Istanti, D. A., Triasih, D., & Ton, S. (2019), Nitrogen levels of goat manure and chicken excreta bioculture with addition of gradual young coconut husk waste The Second International Conference on Food and Agriculture <https://publikasi.polije.ac.id/index.php/ProceedingICOFA/article/view/1893/1437>
- Jagdish (2021), Goat Manure Advantages and Disadvantages <https://www.agrifarming.in/goat-manure-advantages-and-disadvantages>
- Jusoh, M.L.C., Manaf, L.A. & Latiff, P.A. (2013) Composting of rice straw with effective microorganisms (EM) and its influence on compost quality. *J Environ Health Sci Engineer* 10, 17 (2013). <https://doi.org/10.1186/1735-2746-10-17>
- Kim, E., Lee, D.H, Won, S. & Ahn, H. (2016), Evaluation of Optimum Moisture Content for Composting of Beef Manure and Bedding Material Mixtures Using Oxygen Uptake Measurement *Asian-Australas J Anim Sci*. doi: 10.5713/ajas.15.0875
- Kim, T. I., Song, J. I., Chung, E.S., & Barroga, A. J. (2007), Microbial and enzyme dynamics of compost with additive. *Philippine Agricultural Scientist* 90(4):295-304. https://www.researchgate.net/publication/289836732_Microbial_and_enzyme_dynamics_of_compost_with_additive
- Koichi, U. (2020). CATELO Maria Angeles Ocampo (Doctoral dissertation, NAGOYA UNIVERSITY) https://nagoya.repo.nii.ac.jp/record/29807/filepreview/o7299_thesis.pdf
- Koul, B., Yakoob, M., & Shahb, M. P. (2022), Agricultural waste management strategies for environmental sustainability *Environmental Research Volume 206*. <https://doi.org/10.1016/j.envres.2021.112285>
- Landbank (2022), Landbank bankrolls P1.15B waste-to-energy power plant in Nueva Ecija. <https://pia.gov.ph/press-releases/2022/05/25/landbank-bankrolls-p115b-waste-to-energy-power-plant-in-nueva-ecija>

- Lague, C., & Eng, P. (2020) Challenges and Opportunities in Livestock Manure Management 2020. DOI: 10.1.1.493.2066
- Lewis, O. (2017), The basics of industrial composting, advanced composting technology <https://www.linkedin.com/pulse/basics-industrial-composting-advanced-technology-olivia-lewis/>
- Luo, Y., Liang, J., Zeng, G., Chen, M., Mo, D., Li, G., & Zhang, D. (2018), Seed germination test for toxicity evaluation of compost: Its roles, problems and prospects, *Waste Management Volume 71, January 2018, Pages 109-114*, <https://doi.org/10.1016/j.wasman.2017.09.023>
- MyBageecha (2021), Goat dung manure. <https://mybageecha.com/products/goat-dung-manure>
- Nguyen, M. K., Lina, C., Hoang, H. G., Sanderson, P., Dang, B. T., Bui, X. T., Nguyen, N. S. H., Vo, D. V. N., & Trank, H. T., (2022), Evaluate the role of biochar during the organic waste composting process: A critical review *Chemosphere Volume 299* doi.org/10.1016/j.chemosphere.2022.134488
- Ohio State University Extension (2014), Goat manure an 'effective fertilizer <https://www.sunstar.com.ph/article/340482/goat-manure-an-effective-fertilizer>
- Pandey, V. C. (2020), Fly ash application in reclamation of degraded land: opportunities and challenges *Phytomanagement of Fly Ash 2020, Pages 167-193*. <https://doi.org/10.1016/B978-0-12-818544-5.00006-7>
- Pace, M. G., Miller, B. E., and Farrel-Poe, K. L. (2015) The composting process (AGWM01). Available at: extension.usu.edu/files/agpubs/agwm01.pdf, Utah State University Extension, Accessed: 2017.
- Papale, M., Romano, I., Finore, I., Lo Giudice, A., Piccolo, A., Cangemi, S., Di Meo, V. Nicolaus, B., & Poli, A (2021), Prokaryotic Diversity of the Composting Thermophilic Phase: The Case of Ground Coffee Compost *National Library of Medicine National Center for Biotechnology Information* doi: 10.3390/microorganisms9020218
- Parihar, S. S., Saini, K. P. S., Lakhani, G. P., Jain, A., Roy, B., Ghosh, S., & Aharwal, B. (2018), Livestock waste management: A review *Journal of Entomology and Zoology Studies 2019, Vol. 7, Issue 3*. <https://www.entomoljournal.com/archives/2019/vol7issue3/PartG/6-6-95-692.pdf>

- Petruzzello, M. (2023) "compost". Encyclopedia Britannica, 28 May. 2023, <https://www.britannica.com/topic/compost>. Accessed 12 June 2023.
- Sahu, G., Bag, A. G., Chatterjee, N., & Mukherjee, A. (2017) Potential use of fly ash in agriculture: A way to improve soil health *Journal of Pharmacognosy and Phytochemistry* 2017; volume 6 <https://www.phytojournal.com/archives/2017.v6.i6.2172/potential-use-of-flyash-in-agriculture-a-way-to-improve-soil-health>
- Said-Pullicino, D., Erriquens, F.G. and Gigliotti, G. (2014) Changes in the chemical characteristics of water-extractable organic matter during composting and their influence on compost stability and maturity. *Bioresource Technology* 98, 1822-1831.
- Siddiquee, S., Shafawati, S. N., & Naher, L. (2017), Effective composting of empty fruit bunches using potential *Trichoderma* strains *Biotechnology Reports Volume 13* doi.org/10.1016/j.btre.2016.11.001
- Solsoloy, A. D. (2014), Goat manure an 'effective fertilizer <https://www.sunstar.com.ph/article/340482/goat-manure-an-effective-fertilizer>
- Sullivan, D. M., & Miller, R. (2001), Compost quality attributes, measurements, and variability *Compost Utilization in Horticultural Cropping Systems* DOI: 10.1201/9781420026221.ch4
- Stehouwer, R., Cooper, L., Rynk, R., Biala, J., Bonhotal, J., Antler, S., Lewandowski, L., & Nichols, H. (2022), Compost characteristics and quality *The Composting Handbook*, 2022. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/compost-quality>
- Tang, J.-C., Inoue, Y., Yasuta, T., Yoshida, S. and Katayama, A. (2013) Chemical and microbial properties of various compost products. *Soil Science and Plant Nutrition* 49 (2), 273-280.
- Tilley, N. (2021), Uses for goat manure – Using goat manure for fertilizer <https://www.gardeningknowhow.com/composting/manures/goat-manure-fertilizer.htm>
- Tognetti, C., Mazzarino, M. J., & Laos, F. (2011), Comprehensive quality assessment of municipal organic waste composts produced by different preparation methods *Waste Management Volume 31, Issue 6* doi.org/10.1016/j.wasman.2010.12.022

- Varma, V. S., Parajuli, R., Scott, E., Canter, T., Lim, T. T., Popp, J., & Thoma, G. (2021). Dairy and swine manure management—Challenges and perspectives for sustainable treatment technology *Science of The Total Environment*, 778, 146319 <https://doi.org/10.1016/j.scitotenv.2021.146319>
- Wang, Q., Awasthi, M. K., Ren, X., Zhao, J., Wang, M., Chen, H., & Zhang, Z. (2018), Recent advances in composting of organic and hazardous Waste: A road map to safer environment *Biosynthetic Technology and Environmental Challenges* (pp.307-329). DOI:10.1007/978-981-10-7434-9_17
- Zin, N. A., & Badaluddin, N. A. (2012), Biological functions of *Trichoderma* spp. for agriculture applications *Annals of Agricultural Sciences Volume 65, Issue 2, Pages 168-178*. <https://doi.org/10.1016/j.aoas.2020.09.003>