

**DESIGN, FABRICATION, AND PERFORMANCE EVALUATION OF
VERMICOMPOST HARVESTER**

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An Undergraduate Thesis Submitted to the Faculty of the Department
of Agricultural and Biosystems Engineering, College of Engineering,
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the Requirements for the Degree of

**BACHELOR OF SCIENCE IN AGRICULTURAL
AND BIOSYSTEMS ENGINEERING
(AB Machinery and Power Engineering)**

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ABSTRACT

BAYTEN, MIKAELA O. & GALVAN, JALLERIZZA A., Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, **February 2024, DESIGN, FABRICATION, AND PERFORMANCE EVALUATION OF A BIOMASS SHREDDER**

Adviser: JEFFREY A. LAVARIAS, Ph.D.

Size reduction is important for decomposition as it increases the surface area of organic materials and speeds up microbial access and activity. Smaller particles facilitate a quicker and more effective composting process. Reduced particle size also helps maintain ideal moisture levels and enhances aeration, which fosters microbial development and raises the overall quality of compost.

The study developed a biomass shredder. The machine was designed and fabricated to address the needs of RM-CARES regarding composting as well as problems to the existing biomass shredder about the use of flat bars as shredding mechanism and the need to change if worn out by detaching the shafting and re-welding a new set of sharpened bars. The major components of the machine include circular saw, shaft, washers, top cover, housing, discharge chute, frame, and power and transmission system.

The working performance of the biomass shredder machine was evaluated using three rotational speeds as treatments: $T_1 = 1600$ rpm, $T_2 = 2000$ rpm, and $T_3 = 2400$ rpm. Each treatment had three replications. Results have shown that the optimum rotational speed was 2400 rpm for rice straw which gave a lowest unshredded biomass material of 6.67 %, input shredding capacity of 49.84 kg/hr, output shredding capacity of 15.52 kg/hr, highest shredding efficiency of 93.33 %, and power consumption of 0.03484 kW-hr. For

leaves, the optimum rotational speed was 2000 rpm that resulted to a lowest unshredded biomass material of 13.33 %, input shredding capacity of 28.48 kg/hr, output shredding capacity of 8.25 kg/hr, highest shredding efficiency of 86.67 %, and power consumption of 0.05528 kW-hr.

The cost of using the machine was computed at Php 6.12/kg of shredded biomass. The custom rate was computed to be Php 7.95/kg, and the break-even point was reached when the machine operated a total weight of shredded biomass about 1810.75 kg/yr. The machine has a total net income of about Php 59, 227.60 if the biomass shredder ran annually. The total operating cost of the machine was Php 197,425.34 per year. The break-even point was 1,810.47 kg/yr and a payback period of 0.34 years or 89 working days.

Keywords: biomass shredder; compost; unshredded biomass; shredding capacity; shredding efficiency

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