

**DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF
MOBILE LEAF SWEEPER WITH SHREDDER**

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An undergraduate thesis manuscript submitted to the faculty of the Department of
Agricultural and Biosystems Engineering, College of Engineering, Central
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in partial fulfillment of the requirements for the degree

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

JULY 2024

ACCEPTANCE SHEET

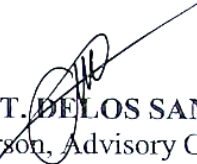
This undergraduate thesis entitled, **DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF MOBILE LEAF SWEEPER WITH SHREDDER** prepared and submitted by **JAMES BRYAN C. BALAGOT** and **CHRISTIAN PAOLO A MEÑA** in partial fulfillment of the requirements for the degree **BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING (AB Machinery and Power Engineering)**, is hereby accepted.


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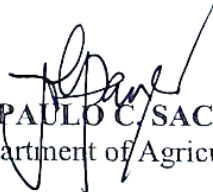

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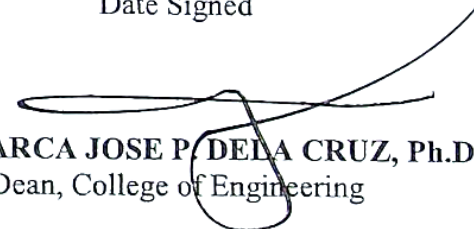

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He is currently enrolled at Central Luzon State University located at Bantug, Science City of Muñoz, Nueva Ecija taking a Bachelor of Science in Agricultural and Biosystems Engineering course. His passion for agriculture has been a guiding force since his early years, encouraging him to pursue various interests and develop strong academic skills. His aspiration to become an Agricultural and Biosystems Engineer is driven by his passion for enhancing the agricultural industry in the Philippines, striving to enhance the lives of farmers.

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He is currently enrolled at Central Luzon State University located at Bantug, Science City of Muñoz, Nueva Ecija taking a Bachelor of Science in Agricultural and Biosystems Engineering course. His passion for agriculture has been a guiding force since his early years, encouraging him to pursue various interests and develop strong academic skills. His aspiration to become an Agricultural and Biosystems Engineer is fueled by a desire to contribute to the development of the agricultural industry in the Philippines, aiming to enhance the lives of farmers.

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The author would like to express his gratitude to the following individuals for their assistance in making this humble piece of work possible:

Foremost, to the Almighty God, the provider of all things, for His unconditional love, blessings, and spiritual guidance. He has been his constant companion and protector throughout this endeavor;

To his family, especially his parents, Mr. Mario E. Meña and Mrs. Janet A. Meña, and his sister, Katrina Yvette M. Zamora, who supported him financially and emotionally throughout his academic journey. Their love and guidance have inspired and motivated him to pursue his dreams;

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To his classmates and friends, who have been with him in good and bad times, they have shared their insights, feedback, and encouragement in every step of his research process;

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Christian Paolo A. Meña

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quality of his research. The synergy of their ideas and the seamless teamwork they cultivated played a crucial role in the success of this thesis;

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James Bryan C. Balagot

TABLE OF CONTENTS

| | PAGE |
|--|------|
| LIST OF TABLES | xii |
| LIST OF FIGURES | xiii |
| LIST OF APPENDIX TABLES | xiv |
| LIST OF APPENDIX FIGURES | xv |
| ABSTRACT | xvi |
| INTRODUCTION | 1 |
| Background of the Study | 1 |
| Statement of the Problem | 2 |
| Objectives of the Study | 3 |
| Significance of the Study | 4 |
| Scope and Limitation of the Study | 5 |
| Time and Place of the Study | 5 |
| REVIEW OF RELATED LITERATURE | 6 |
| Brief History of Street Sweeping | 6 |
| Manual Sweeping | 7 |
| Mechanical Sweeping | 7 |
| Design and Fabrication Principle of Machine | 7 |
| Design of Vacuum and Collection System for Sweeper | 8 |
| Design of the Shredding System for Sweeper | 10 |
| Different speed for Shredder | 11 |
| Types of Sweeping Mechanisms | 12 |
| Existing Design of a Forage Sweeper | 13 |
| Sack Dimension | 15 |
| Belt and Pulley | 15 |
| Pitch Diameter and Drive Ratio | 16 |
| Load Capacity, Speed and Power of V Belt | 17 |
| Noise Level | 17 |
| Mechanical Efficiency | 18 |
| Power Transmission | 18 |
| PAES Machine Test | 19 |
| Machinery Cost | 19 |

| | |
|--|----|
| METHODOLOGY | 22 |
| Conceptualization of the Study | 22 |
| Design Considerations | 23 |
| Machine Design Conceptualization | 25 |
| Parts of the Machine | 26 |
| Engine | 26 |
| Vacuum Assembly | 27 |
| Shredding Component | 28 |
| Frame | 29 |
| Transmission Assembly | 30 |
| Fabrication Process of the Machine | 31 |
| Principle of Operation of the Machine | 32 |
| Testing Materials and Instruments | 33 |
| Preparation of Samples | 34 |
| Preliminary Testing | 34 |
| Final Testing | 35 |
| Data Gathering | 35 |
| Performance Parameters | 36 |
| Actual Sweeping Time | 36 |
| Machine Capacity | 36 |
| Collecting Efficiency | 37 |
| Shredding Efficiency | 37 |
| Fuel Consumption | 38 |
| Noise Level | 38 |
| Statistical Design and Analysis | 38 |
| Experimental Layout | 39 |
| RESULTS AND DISCUSSION | 42 |
| Description of the Mobile Street Sweeper with Shredder | 42 |
| Specification of the Machine | 43 |
| Performance Evaluation | 44 |
| Actual Sweeping Time | 44 |
| Machine Capacity | 45 |
| Collecting Efficiency | 46 |
| Shredding Efficiency | 48 |
| Fuel Consumption | 49 |
| Noise Level | 51 |
| Particle Size | 51 |
| Machine Cost Analysis | 52 |

| | |
|--|----|
| SUMMARY, CONCLUSION AND RECOMMENDATION | 56 |
| Summary | 56 |
| Conclusion | 57 |
| Recommendation | 59 |
| LITERATURE CITED | 60 |
| APPENDICES | 63 |
| Appendix Tables | 64 |
| Appendix Figures | 70 |

LIST OF TABLES

| TABLE | | PAGE |
|-------|---|------|
| 1 | Corresponding fabrication activities for each machine component | 32 |
| 2 | Testing materials and instruments | 33 |
| 3 | Summary used for the simple cost analysis of the study | 40 |
| 4 | Specification of the mobile leaf sweeper | 43 |
| 5 | Summary of treatment means for actual sweeping time | 45 |
| 6 | Summary of treatment means for Machine Capacity | 46 |
| 7 | Summary of treatment means for Collecting Efficiency | 47 |
| 8 | Summary of treatment means for Shredding Efficiency | 49 |
| 9 | Comparison among treatment means for fuel consumption | 50 |
| 10 | Range size of the shredded leaves | 52 |
| 11 | Assumptions for cost analysis | 53 |
| 12 | Summary of the result of cost analysis | 55 |

LIST OF FIGURES

| FIGURE | | PAGE |
|--------|--|------|
| 1 | Schematic Diagram of leaf collection and vacuum mechanism of the machine | 9 |
| 2 | The Vacuum System's plan of channels | 9 |
| 3 | The isometric and orthographic views of the shredder | 10 |
| 4 | Cutter assembly on the shaft | 11 |
| 5 | Existing forage sweeper | 14 |
| 6 | Flat belt drive with two pulley | 16 |
| 7 | Conceptual framework of the study | 23 |
| 8 | Isometric view of the Mobile Leaf Sweeper integrated with Shredder | 25 |
| 9 | Gasoline Engine | 26 |
| 10 | Design of the Vacuum | 27 |
| 11 | Blades of the Shredding Component | 28 |
| 12 | Shredding cover and assembly | 29 |
| 13 | Frame of the Machine | 30 |
| 14 | Transmission Assembly | 30 |
| 15 | Experimental Layout of the Study | 40 |
| 16 | Parts of the Mobile Street Sweeper with Integrated Shredder | 42 |

LIST OF APPENDIX TABLES

| TABLE | | PAGE |
|-------|--|------|
| 1 | Specification of the mobile leaf sweeper with shredder | 64 |
| 2 | Summary of treatment means for actual sweeping time, hr | 65 |
| 3 | Summary of treatment means for machine capacity, kg/hr | 65 |
| 4 | Summary of treatment means for collecting efficiency, % | 65 |
| 5 | Summary of treatment means for shredding efficiency, % | 65 |
| 6 | LSD test for fuel consumption, li/hr | 66 |
| 7 | Comparison among treatment means for fuel consumption, li/hr | 66 |
| 8 | Range size of the shredded leaves | 66 |
| 9 | Assumptions for cost analysis | 66 |
| 10 | Bills of Materials | 67 |

LIST OF APPENDIX FIGURES

| FIGURE | | PAGE |
|--------|---|------|
| 1a | Fabricated Mobile Leaf Sweeper with Integrated Shredder | 70 |
| 1b | Fabricated Mobile Leaf Sweeper with Integrated Shredder | 71 |
| 2 | Sample Set Up | 72 |
| 3 | Weight of Collection Losses | 73 |
| 4 | Actual sample of Collection Loss | 74 |
| 5 | Sample weight of leaves at 10 kg | 75 |
| 6 | Fuel Consumption | 76 |
| 7 | Shredded Leaves weight with a particle size of 4cm | 77 |
| 8 | Weight of un-shredded leaves which does not meet the target particle size | 78 |
| 9a | Fresh weight of sample leaves (150 kg) | 79 |
| 9b | Oven Drying Method | 79 |
| 9c | Dried weight of the sample leaves (92 kg) | 79 |

ABSTRACT

BALAGOT, JAMES BRYAN C. and MEÑA, CHRISTIAN PAOLO A.,
Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **JULY 2024,**
DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF MOBILE LEAF SWEEPER WITH SHREDDER

Adviser: MARLON T. DELOS SANTOS, M.Sc.

The study was carried out to design, fabricate, and evaluate the performance of a mobile leaf sweeper with a shredder in terms of collecting and shredding scattered leaves inside Central Luzon State University. The machine was fabricated based on the design plans, which included the five (5) main components: gasoline engine, vacuum system, shredding component, frame, and transmission assembly.

The mobile leaf sweeper with shredder was created to meet the need and ease the challenges of hand-held broom sweeping tasks in various places. The machine undergoes preliminary and final testing in which the machine capacity and efficiency were determined using different speed of shredder.

Based on the performance evaluation of the mobile leaf sweeper with shredder, the result shows that Treatment 1 (800 rpm) obtained the highest machine capacity of 74.39 kg/hr and also, collecting efficiency of 89.00%. While in terms of shredding efficiency of the machine, the test result revealed that T3 (1400 rpm), got the highest effectiveness in shredding the collected leaves with a 90.00% rate. Given the result, it was evident that the particle size was uniform at lower rpm with an average value of 73.33 % due to minimal suction pressure causing the leaves to stay in the shredding chamber longer and be shredded evenly. The study found that increasing vacuum

rotational speed led to higher fuel consumption, with the highest values observed at 1400 rpm with a value of 0.7433 li/hr.

The investment cost of mobile leaf sweeper with shredder was Php 46,541.00. The calculated shredding cost was Php 1.89/kg, and the custom rate was set at Php 2.45/kg. To cover the investment cost, the machine needed to shred a total of 18,996.33 kilograms of dried leaves. When operating the machine for custom services at a rate of Php 2.45 per kilogram, and with an annual usage of 1,248 working hours, the annual net income reached Php 255,677.74/yr. This result in a payback period of just 0.18 years, or 38 working days, assuming the machine operates 208 days per year to recover the initial investment.

Therefore, the study recommend 800 rpm to minimize fuel consumption while maintaining actual sweeping time, machine capacity, collecting efficiency, and shredding efficiency.

KEYWORDS: mobile; sweeper; shredder; capacity; collecting efficiency; shredding efficiency; fuel consumption.

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