

**DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF AN ONION  
(*Allium cepa L.*) GRADING MACHINE**

**SHROEDER A. VALDEZ**

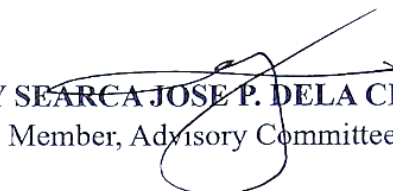
An Undergraduate Thesis Submitted to the Faculty of the Department of Agricultural  
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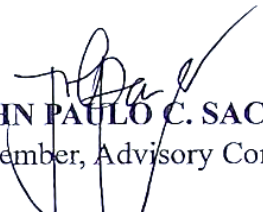
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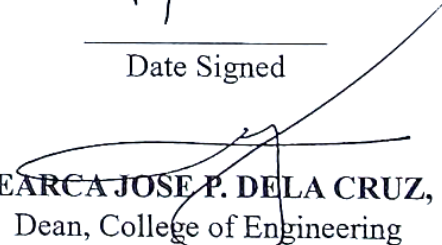
  
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## **BIOGRAPHICAL SKETCH**

Shroeder Ancheta Valdez was born on May 21, 1998, in Barangay Sta. Filomena, San Mariano, Isabela. He is the son of Mr. William Camat Valdez and Mrs. Aida Ancheta Valdez, and the younger sibling to Sorary Jean Valdez Argoncillo, Silvester Ancheta Valdez, and Joyce Charmaine Ancheta Valdez. He was raised in a modest environment, grew up as a devout and humble individual, deeply guided by his faith.

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## ABSTRACT

**VALDEZ, SHROEDER ANCHETA**, Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines, July 2024, **DESIGN, FABRICATION, AND PERFORMANCE EVALUATION OF AN ONION (*Allium cepa L.*) GRADING MACHINE.**

Adviser: **RUEL G. PENEYRA, M.Sc.**

Onions (*Allium cepa L.*) are a significant agricultural product worldwide, recognized for their culinary and nutritional benefits. However, the traditional method of manual grading by size poses challenges for onion farmers; it is labor-intensive, inconsistent, and time-consuming, ultimately diminishing the market value of ungraded produce. This study sought to tackle these issues by designing, fabricating, and evaluating an onion grading machine aimed at enhancing grading efficiency, increasing capacity, and minimizing mechanical damage.

The machine was conceptualized and built using readily available materials. Its main components consist of a grading assembly featuring four oscillating sieve layers, each engineered to categorize onions into four distinct size groups: small, medium, large, and jumbo. Additional features include a hopper for onion feeding, a receiving funnel for collecting sorted produce, and a power transmission system for operation. The design focused on user-friendliness, simplicity, and low maintenance.

Performance evaluations were conducted to assess the machine's grading capacity, efficiency, and the percentage of mechanical damage across three oscillation speeds: 30 Hz, 35 Hz, and 40 Hz. The findings revealed that grading capacity improved with increased

oscillation speeds, reaching a maximum of 1443.18 kg/hr. at 40 Hz. Conversely, the highest grading efficiency was recorded at 35 Hz with an efficiency of 52.192%, while the lowest mechanical damage was noted at 30 Hz with just 1.24% damage. Statistical analysis confirmed significant performance variations at different speeds, designating 35 Hz as the optimal speed for achieving a balance between efficiency and damage reduction.

A cost analysis estimated the machine's annual operating costs at ₱67,587.2, with labor, repair, and power being the primary cost contributors. The study concludes that the onion grading machine presents a practical and effective solution for small to medium-scale onion farmers, significantly enhancing productivity and profitability through improved grading processes.

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