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Enhancing Nutrients Content of *Leucaena leucocephala* By Solid-state Fermentation

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Structured Abstract

Background: *Leucaena leucocephala*, commonly known as Petai Belalang, is a protein-dense legume with high potential for animal feed; however, its moderate crude fiber content often limits its digestibility and inclusion in livestock diets. This study utilizes solid-state fermentation (SSF) with *Rhizopus oligosporus* as a biotechnological strategy to achieve significant fiber reduction and protein enrichment. Key parameters investigated include fermentation duration and moisture content, which are critical for optimizing microbial growth and the secretion of cellulolytic enzymes. While moisture facilitates nutrient transport, a carefully balanced timeline is necessary to prevent protein degradation and microbial autolysis. This research examines the nutritional dynamics of *Leucaena* leaves over a seven-day period at varying moisture levels to establish the ideal conditions for scalable, high-quality feed production.

Methods: The methodology involved sterilizing powdered *Leucaena* leaves (0.2 mm) and adjusting moisture levels to 50%, 60%, and 70%. Samples were inoculated with a *R. oligosporus* spore suspension and incubated at 30°C for three, five, and seven days. Crude fiber content was determined through successive boiling in acid (0.128 M H_2SO_4) and base (0.313 M NaOH), followed by drying and ashing at 550°C. Crude protein content was measured using a CHNS Elemental Analyzer via flash combustion at 1000°C, applying a conversion factor of 6.25 to the nitrogen percentages to track enrichment levels.

Results: The results demonstrate that SSF effectively enhances the nutritional value of *Leucaena* leaves through microbial metabolism. The highest improvements were observed at 70% moisture, which yielded the maximum crude protein (26.56%) by Day 7 and the lowest crude fiber (15.56%) by Day 5. Physically, 60% moisture encouraged the most homogenous colonization, whereas 70% moisture led to more compact growth. By the seventh day, all fermented samples exhibited a visible shift from thin white mycelia to a dense, dark amber texture.

Conclusion: In conclusion, *Rhizopus oligosporus* shows significant potential for upgrading *Leucaena leucocephala* via SSF by simultaneously increasing protein and reducing fiber. Maintaining a 70% moisture level for five days optimizes the balance for maximum digestibility.

Keywords: *Leucaena leucocephala*, *Rhizopus oligosporus*, solid-state fermentation, protein enrichment, fiber degradation

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