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## Cassava pulp as corn silage sealer under different levels and fermentation periods

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### Abstract

Corn silage serves as a common livestock feed owing to its high energy content and digestibility, yet it faces challenges from spoilage and suboptimal fermentation during production. This study examined the effects of cassava pulp inclusion (0%, 25%, 50%) as a silage sealer on corn silage across 14, 18, and 21 days of fermentation, using a 3 × 3 factorial design that combined three pulp levels with three fermentation durations under a Completely Randomized Design with randomly assigned treatments. Silage samples were analyzed for sensory qualities, pH, total soluble solids, and nutrient composition (ADL, NDF, DM & ADF), with replicates collected across different fermentation periods. Quality was assessed using a scorecard for odor, color, and structure, while recovery rates and production costs were calculated based on silage weight changes and cost per kilogram. Organoleptic tests showed high odor, excellent color, and stable structure in corn silage across treatments, with no significant effects except replication on odor. Fermentation pH stabilized within the ideal range (3.8–4.2) by 18–21 days with pulp inclusion, while total soluble solids remained steady, reflecting efficient sugar utilization. Nutritionally, dry matter increased to 37%, fiber fractions were reduced, and lignin declined, with 50% pulp at 18 days optimizing digestibility. Recovery rate exceeded 96%, peaking near 99%, and feed costs dropped by about one-third. In addition, cassava pulp inclusion from 0–50% progressively improved corn silage fermentation: pH stabilized at 3.8–4.2 by days 18–21, dry matter hit 37%, fiber (NDF, ADF) and lignin dropped for optimal digestibility at 50% pulp on day 18, recovery topped 96%, and costs fell by one-third.

**Keywords:** Nutrient composition, silage, sealer, organoleptic test

### Introduction

The study was conducted at the USTP Dairy Farm, Lupok Ani-e, Claveria, Misamis Oriental, Philippines situated at an elevation of 663 m above sea level, providing representative conditions for silage production. Fresh NK variety corn forage harvested at optimal maturity was used as the primary substrate, while cassava pulp was obtained from a local starch processing plant. Ensiling was performed in airtight polyethylene containers (750 mm × 1,300 mm × 150 µm). A digital scale, forage chopper, calibrated pH meter, portable refractometer, and fermentation sampling equipment were employed for preparation and analysis.

The experiment followed a 3 × 3 factorial arrangement under a Completely Randomized Design (CRD). Factor A consisted of cassava pulp inclusion levels (0%, 25%, 50%), while Factor B represented fermentation durations (14, 18, 21 days). Each treatment combination was replicated three times, yielding 27 experimental units. Treatments were coded as A#B#R# (e.g., A3B3R3 = 50% pulp, 21 days, replication 3). Corn fodder was harvested at the dent stage, chopped into 1–2 cm pieces, and mixed with cassava pulp according to treatment ratios. Each ensiling batch weighed 30 kg and was sealed with cassava pulp topping. Containers were stored under anaerobic conditions, and samples were collected at designated fermentation intervals.

At each fermentation period, three replicates were opened and sampled. From each bag, 1,000 g of silage was extracted for analysis. Juice samples were tested for pH and total soluble solids (% Brix). Silage samples were oven-dried to constant weight for dry matter determination. Fiber fractions (NDF, ADF, ADL) were analyzed using the sequential Van Soest detergent system,

following AOAC and ISO protocols. Silage quality was assessed through organoleptic evaluation (odor, color, structure) using scorecards adapted from Canbolat (2019)<sup>[10]</sup> and Serhat (2024)<sup>[63]</sup>. Recovery rate was calculated as (kg silage after fermentation ÷ kg forage at ensiling) × 100, while cost per kilogram of silage was determined by dividing total production costs by total kilograms produced.

Organoleptic data were analyzed using ordinal logistic regression to evaluate sensory score distributions across treatments. ANOVA was performed under the 3 × 3 factorial CRD to assess treatment effects on quantitative parameters, and Tukey's HSD test was applied for mean separation. The combined use of ANOVA and ordinal logistic regression enabled robust evaluation of both continuous and ordinal responses.

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