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The Effect of Blade Rotation on the Efficiency and Capacity of a Grass Chopper

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A B S T R A C T

Small-scale Javanese goat farmers currently perform the chopping process manually using a sickle, a method that is time-consuming, labor-intensive, and results in non-uniform chop sizes (Syabani, 2025). This study aims to design a simple grass-chopping machine as an appropriate technology solution, determining machine specifications based on chopping capacity. The study employs a quantitative experimental method with an engineering approach, comprising stages of design, fabrication, testing, and evaluation. Testing was conducted at three capacity levels—0.58 kg/min, 0.73 kg/min, and 1.01 kg/min—yielding an average capacity of 0.77 kg/min. The results demonstrate that higher blade rotation speeds lead to greater chopping capacity, thereby confirming the alternative hypothesis. This simple grass-chopping machine can enhance the efficiency of small-scale goat farming and serves as a viable appropriate technology

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INTRODUCTION

Elephant grass is Forage serves as a fundamental component in livestock farming (Usdek,2020). Acting as a primary source of nutrients that influence growth, health, and productivity. Among the various types of forage utilized, elephant grass is a prominent choice due to its high productivity; it possesses a high fiber content and is specifically cultivated as a source of livestock feed (Putra et al., 2025). Small-scale livestock farmers often rely on traditional methods for grass chopping, using simple tools like sickles. This approach is relatively time-consuming, labor-intensive, and yields inconsistent chop sizes, which can reduce feed efficiency (Sybani et al., 2025).

The development of this appropriate technology offers an opportunity to address challenges through the implementation of a grass-chopping machine that is simple, affordable, and easy to operate effectively. This machine can increase work capacity and accelerate the chopping process (Kursi et al., 2024). Previous studies have developed grass-chopping machines utilizing high-power motors to achieve high production capacity; however, many farmers still opt for traditional methods due to high costs and the unsuitability of such machines for small-scale operations (Syabani, 2025).

Consequently, there is a need to develop a grass-chopping machine featuring a simple, economical design that utilizes an electric drill as the power source, making it easy for farmers to use. The novelty of this research lies in the design of a machine that utilizes an electric drill as the primary power source, ensuring cost-effectiveness. Furthermore, the design has been tailored to meet the specific needs of small-scale livestock farmers.

The study analyzed the relationship between blade rotation speed and shredding capacity—testing speeds of 1,240 rpm, 2,262 rpm, and 3,000 rpm—and demonstrated that increasing the rotation speed resulted in a higher shredding capacity, reaching 1.01 kg/minute at 3,000 rpm. Addressing the existing issues, this study aims to develop a simple grass-chopping machine as an appropriate technology, determine its technical specifications, analyze its chopping capacity, and examine the effect of blade rotation speed on that capacity; the ultimate goal is to provide an effective solution for small-scale livestock farmers and improve the efficiency of livestock feed preparation.

LITERATURE REVIEW

Grass Choping Machine

The grass chopping machine is a device specifically designed to accelerate the process of chopping forage for livestock, thereby enhancing the efficiency of feed preparation. Regarding its operation, material enters through an intake chute where rotating blades chop the grass; this mechanism reduces the workload compared to manual methods (Ismail et al., 2021; Arief et al., 2015; Haripadi, 2021). Previous research indicates that grass-chopping machines can increase feed production capacity and reduce the workload of livestock farmers. However, most machines developed to date utilize high-power motors, making them less suitable for small-scale farmers (Marzuki et al., 2025; Widya et al., 2024). H1: Blade rotation speed (rpm) has a positive effect on the shredder capacity (kg/min).

Appropriate Technology

Appropriate technology is technology designed with social conditions in mind and tailored to the community, making it easy to implement and serving as an economic resource. It plays a crucial role by enhancing work efficiency, reducing operational costs, and supporting livestock farmers through technology that aligns with their capabilities (Gafrun et al., 2025). Previous research indicates that the implementation of this simple grass-chopping machine as an appropriate technology would accelerate the provision of livestock feed (Nugroho, 2025; Hermawan et al., 2023). H2: Use of a simple grass-cutting machine as appropriate technology to improve the efficiency of livestock feed provision

Conceptual Framework

This study employs two variables:

1. Independent variable (x)

Blade speed (rpm)

2. Dependent variable (y)

Chopping capacity (kg/minute)

METHODOLOGY

This study employs an experimental quantitative method utilizing an engineering approach. This method is used to design, construct, and evaluate the performance of a simple grass-chopping machine, serving as a basis for appropriate technology. This approach was selected because it yields quantitative data—derived from direct testing—to inform the machine's design (Muin, n.d.; Setiawan et al., 2025; Ismail et al., 2021). The research was conducted in Jeruk Seger Village, Gedeg District—a location selected because many local residents are small-scale goat farmers who still rely on manual grass-chopping methods.

The research process encompassed a literature review, field observations, preparation of tools and materials, machine fabrication, functional testing, field testing, data analysis, and the formulation of conclusions. The designed prototype features a hollow iron frame, an electric drill as the drive motor, and a 10mm diameter shaft; it utilizes four chopping blades and a plastic bucket as the main body of the chopping chamber, with a mechanism to adjust motor rotation speed. Supporting equipment included an angle grinder, an SMAW welding machine, a hand drill, a tape measure, a square ruler, a digital tachometer, a stopwatch, and a digital scale.

The research instruments used to measure the research variables consisted of blade rotation speed (rpm), chopping time (minutes), grass weight (kg), chopping capacity (kg/minute), and the size of the chopped material. Blade rotation speed was measured using a digital tachometer, chopping time was measured using a stopwatch, and the weight of the material was measured using a digital scale. Data collection was conducted through field observations, technical documentation, and direct testing of the machine prototype. Testing was performed three times using elephant grass as the test material, with blade rotation speeds varied at 1240 rpm, 2262 rpm, and 3000 rpm. Data analysis was

conducted using quantitative descriptive analysis by calculating the shredding capacity using Equation (1).

$k = w/t$

with:

K = shredding capacity (kg/minute)

W = weight of chopped grass (kg)

t = counting time (minutes).

RESULTS

This study demonstrates that the simple grass-chopping machine—designed as an appropriate technology—can assist small-scale livestock farmers by accelerating the process of chopping elephant grass. Following the design phase, the machine underwent testing across three variations of blade rotation speeds: 1,240, 2,262, and 3,000 rpm. The variables observed included grass weight, chopping time, blade rotation speed, and chopping capacity. Test results indicate that increasing the blade rotation speed leads to an increase in the machine's chopping capacity.

Technical Specifications of the Grass Chopping Machine

The specifications of the designed machine indicate that it utilizes an electric drill motor as the primary power source, featuring a simple construction for ease of operation and maintenance. Key specifications include the frame height, the widths of the upper and lower frame sections, the overall machine dimensions, the diameters of the shaft and cylinder, and the number and length of the blades.

Chopping Capacity Test

Calculated shredding capacity:

$k = w/t$

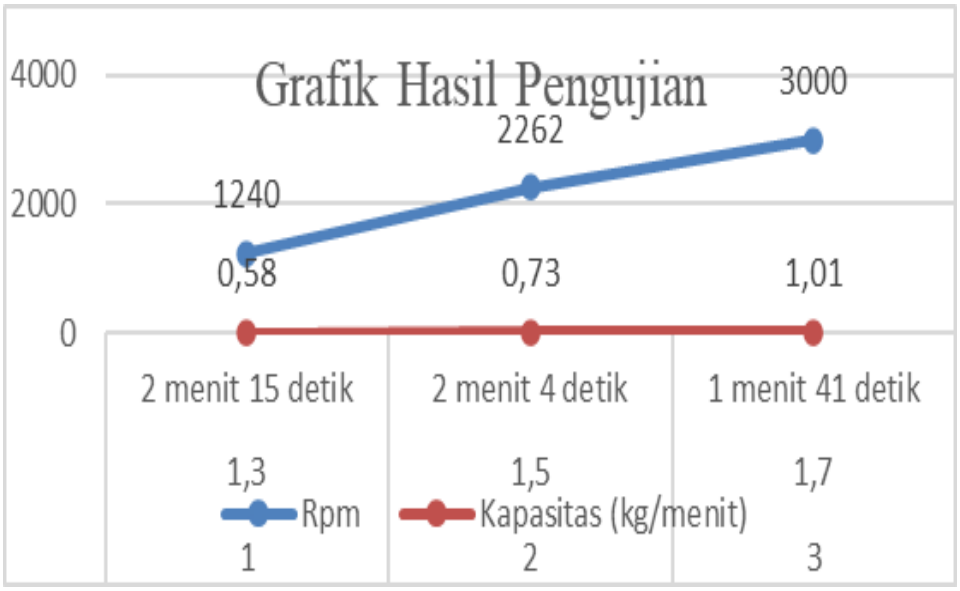
Table 1. Chopping Capacity Test

Test	Weight (kg)	Time	Blade Speed (rpm)	Capacity (kg/min)
1	1.3	2 min 15 s	1240	**0.58**
2	1.5	2 min 4 s	2262	**0.73**
3	1.7	1 min 41 s	3000	**1.01**

The chopping capacity increased from 0.58 kg/min to 1.01 kg/min as the blade rotation speed increased. The machine's average chopping capacity was 0.77 kg/min, while the average size of the chopped material was approximately 2.5 cm.

Effect of Blade Speed on Chopping Capacity

A positive influence was observed between blade rotation speed and chopping capacity. This indicates that higher blade rotation speeds accelerate the grass-cutting process, thereby increasing the machine's capacity.



DISCUSSION

The results of this study demonstrate that the simple grass-chopping machine performs effectively across the tested rotational speeds. The highest chopping capacity—1.01 kg/min—was achieved at 3,000 rpm, while the lowest capacity—0.58 kg/min—was recorded at 1,240 rpm. This confirms that increasing the blade rotation speed raises the cutting frequency, thereby accelerating the chopping process. These findings align with previous research by Marzuki et al. (2025), which indicated that increasing the blade rotation speed enhances the working capacity of the grass chopper; the results also support Widya (2024), who demonstrated that using a grass chopper—as an appropriate technology—improves efficiency in feed material preparation compared to manual methods.

Wicaksono (2022) notes that the speed of the grass-chopping mechanism is a key factor; higher rotational speeds lead to increased chopping capacity. Similarly, Ahmad (2018) confirms that chopping capacity is significantly influenced by operating speed. Collectively, these studies demonstrate that blade rotation speed is a primary determinant of the grass chopper's performance. Based on the conducted tests, Hypothesis H1 is accepted, confirming a positive effect of blade rotation speed on chopping capacity; Hypothesis H2 is also accepted. The designed simple grass chopper demonstrates improved efficiency in preparing animal feed and is a viable, appropriate technology for small-scale livestock farmers.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, it can be concluded that a simple grass-chopping machine has been successfully designed and fabricated. Serving as an appropriate technology solution, it effectively assists small-scale livestock farmers in the efficient preparation of animal feed. The machine is powered by an electric drill motor and features a simple construction, making it easy to manufacture, operate, and maintain. The test results indicate that the chopping

capacity is influenced by the blade rotation speed; three speeds were used: 1240 rpm, 2262 rpm, and 3000 rpm.

The chopping capacity was 0.58 kg/minute, and the results showed that higher blade rotation speeds yielded greater chopping capacity; thus, the research hypothesis is accepted. Overall, the developed simple grass-chopping machine enhances the efficiency of the grass-chopping process compared to using a sickle. Furthermore, it holds potential as an appropriate technology solution for small-scale livestock farmers to boost productivity in livestock feed provision (Marzuki et al., 2025; Wida et al., 2024).

Recommendations

Recommendations for future researchers include using a drive motor with higher power and employing blade materials with superior wear resistance to increase capacity and extend the service life of the blades. Furthermore, this grass chopper is recommended for adoption by small-scale livestock farmer groups as a form of appropriate technology. This is due to its simple construction and relatively low manufacturing cost, as well as its ability to enhance the efficiency of the livestock feed preparation process (Syabani et al., 2025).

FURTHER STUDY

This study has certain limitations, particularly regarding machine testing, as it was conducted using only one type of forage—namely, elephant grass. Consequently, the machine's performance could only be assessed for this specific forage type. Furthermore, the testing involved only three rotational speed variations: 1240 rpm, 2262 rpm, and 3000 rpm. As a result, the relationship between blade rotation speed and chopping capacity could not be analyzed across a broader range of speeds. Future research should aim to develop a grass-chopping machine featuring a more powerful drive system, a more stable transmission, and blades made from materials with enhanced wear resistance to improve chopping capacity (Marzuki et al., 2025).

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REFERENCES

Achmad. (2018). Performance Test And Cost Analysis Of Chopper Machines. 11(2).

Arief, S., Department Of Mechanical Engineering, Faculty Of Engineering, Hasanuddin University. (2015). Design And Construction Of An Elephant Grass Chopper. SNTTM XIV, 7–8.

Gafur, A., Fajrul, R., & Indra, A. (2025). Transfer Of Appropriate Technology To Technology Service Posts (Posyantek) Across Districts In Bengkalis Regency To Enhance Community Self-Reliance. 6, 181–187.

Haripadi. (2021). Design And Construction Of A Livestock Feed Chopper Machine. 01(02), 1–8.

Hermawan, I., Noviandri, D., & Yolanda, A. (2023). Ira Jurnal Pengabdian Kepada Masyarakat (Irajpkm): Implementation Of Appropriate Technology (Chopper Machine) For A Livestock Group In Sei Mencirim Village, Deli Serdang, North Sumatra. 1(3), 1–7.

Ismail, Marzuki (2025). Grass Chopper Machine Boosts Farmer Groups. 118-1126

Ismail, R., Thohirin, M., & Dalimunthe, M. Y. R. (2021). Design And Construction Of A Grass Chopper Machine For Livestock Feed. 1.

Muin, A. (N.D.). Research Methods.

Nugroho, B. Y. (2025). Design And Static Analysis Of A 5 HP Grass Chopper To Increase Livestock Feed Production. 4(1), 15–22.

Putra, W. T., Rahayu, M., & Nikmah, H. M. (2025). Design And Construction Of A Goat Feed And Silage Chopper Machine To Improve Feed Consumption Effectiveness. 6(4), 3823–3830.

Setiawan, D., Triyono, B., Setiawan, A., & Hidayatullah, I. (2025). Training On The Operation, Maintenance, And Handover Of A Grass Chopper Machine For The Pasirsela Forest Farmers Group. 4(1), 6307–6317.

Syabani, N. (2025). Application Of Appropriate Grass-Chopping Machine Technology To Support Local Productivity. 05(05), 141–152.

Usdek Panjaitan (2020). Design Of A Multifunctional Grass Chopper Machine Using The UDI 221 Method. 1 (4), 65-78.

Wicaksono. (2022). Design And Construction Of A 373-Watt Napier Grass Chopper Machine Using 45° Angle Blades Made Of 304 Stainless Steel.

Journal Of Mechanical Engineering: Vol. 11, No. 1, February 2022. 11(1).

Wida Listiko. (2024). Design And Construction Of A Chopper Machine (Livestock Feed Processing). Jurnal Masyarakat Merdeka: Vol. 7, (2) 2024. 165.