

Empowering Farmers Through a Practical and Energy-Efficient Goat Feed Chopping Machine

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ABSTRACT

This initiative is part of a broader commitment to support rural agricultural development through technological innovation and knowledge transfer. Through workshops, demonstrations, and direct community involvement, this program will not only provide access to the feed chopper but also equip farmers with the skills and understanding needed to adopt and sustain its use. This community service project was designed using a participatory and problem-solving approach, integrating technical innovation with local knowledge to empower goat farmers. This community service initiative successfully introduced a practical and energy-efficient goat feed chopping machine to a rural farming community. The machine effectively addressed key challenges in manual feed preparation, including time consumption, labor intensity, and inconsistency in feed size. This initiative demonstrates that small-scale engineering solutions, when aligned with local needs and capacities, can significantly advance rural development and agricultural sustainability.

Keywords: Farmers, Energy-Efficient, Goat, Feed, Chopping Machine

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INTRODUCTION

Goat farming is a vital source of livelihood for many rural communities (Nyoto et al., 2022), providing income, nutrition, and sustainable agricultural value. However, one of the common challenges faced by small-scale goat farmers is the inefficiency in feed preparation. Traditional methods of preparing goat feed, such as manual chopping using knives or machetes, are time-consuming, labor-intensive, and often inconsistent in output quality. This not only reduces productivity but also limits the farmers' ability to scale their operations effectively.

To address this issue, this community service initiative introduces a practical and energy-efficient goat feed chopping machine tailored to the needs and conditions of rural farmers (Sudarno et al., 2022). The machine is designed to streamline the feed preparation process, improve consistency in feed size, reduce labor intensity, and ultimately enhance the productivity of goat farming (Renaldo et al., 2023). By integrating appropriate technology into local farming practices, the project aims to empower farmers with tools that are not only effective but also affordable, easy to maintain, and energy-conscious (Junaedi et al., 2023a).

This initiative is part of a broader commitment to support rural agricultural development through technological innovation and knowledge transfer. Through workshops, demonstrations, and direct community

involvement, this program will not only provide access to the feed chopper but also equip farmers with the skills and understanding needed to adopt and sustain its use. In doing so, the project contributes to strengthening local food systems, improving farmer welfare, and promoting sustainable livestock practices (Zhang et al., 2021).

LITERATURE REVIEW

Goat farming plays a strategic role in rural economies, particularly in developing countries, due to its relatively low capital requirements and ability to adapt to diverse environments (Lohani & Bhandari, 2021). However, one of the persistent challenges in small-scale goat production is the provision of adequate and properly processed feed. According to (Webb, 2014), the nutritional value and digestibility of forage can be significantly enhanced through mechanical processing such as chopping, which increases surface area and reduces wastage.

Traditional feed preparation techniques, such as manual chopping with knives or machetes, are commonly used in rural areas but are inefficient and labor-intensive (Arya et al., 2021). These methods not only limit daily output but also pose risks of injury and strain, especially for women and elderly farmers who often participate in feed preparation. Moreover, inconsistencies in feed particle size can negatively affect the digestion and feed intake of ruminants (Negara et al., 2016).

Technological interventions such as feed choppers or forage shredders have been developed to address these limitations. Several studies highlight the positive impact of mechanized feed processing on livestock productivity. For example, (Sukmawani et al., 2021) demonstrated that the use of a simple motorized chopper improved feed efficiency and labor productivity in smallholder goat farms in Ethiopia. Similarly, (Ilham et al., 2023) found that feed chopped into uniform sizes contributed to better rumen fermentation and growth performance in goats.

Despite these benefits, the adoption of mechanized feed processing tools in rural areas remains low, primarily due to factors such as cost, energy consumption, complexity of operation, and lack of local maintenance support (Silva et al., 2022). Therefore, there is a growing interest in developing appropriate technology, tools that are low-cost, user-friendly, and tailored to the context of rural users (Wirasti et al., 2021).

This project aligns with that approach by designing and introducing a practical and energy-efficient goat feed chopping machine that addresses local needs. By integrating findings from existing literature on livestock feed management and rural technology adoption, this initiative seeks to enhance farmer empowerment and sustainability in goat farming systems.

METHODOLOGY

This community service project was designed using a participatory and problem-solving approach (Sekaran & Bougie, 2016), integrating technical innovation with local knowledge to empower goat farmers. The methodology is divided into five key stages:

1. Problem Identification and Needs Assessment

A field survey was conducted in the target rural community to understand the challenges faced by local goat farmers in feed preparation. Data collection involved:

- Interviews with farmers, local livestock extension officers, and farmer group leaders.
- Observation of traditional feed chopping practices.
- Documentation of common forage types and quantities processed daily.

The findings confirmed the need for a more efficient, safe, and accessible method for preparing goat feed.

2. Design and Fabrication of the Feed Chopping Machine

Based on the needs assessment, a prototype of the goat feed chopping machine was designed with the following key features:

- Energy-efficient motor system (low wattage, can run on household electricity or small generator).

- Simple mechanical design for easy operation and maintenance.
- Adjustable blade system for different forage sizes.
- Safety features, such as protective casing and emergency stop button.

The fabrication process was carried out in collaboration with a local technical workshop to ensure the machine could be produced and repaired using locally available materials.

3. Testing and Optimization

The prototype was tested under real farm conditions to evaluate its performance, including:

- Cutting capacity per hour (kg/hour)
- Energy consumption (watt/hour)
- Ease of use (based on farmer feedback)
- Noise level and safety performance

Based on testing outcomes, minor design adjustments were made to optimize efficiency and usability.

4. Community Training and Implementation

Hands-on training workshops were conducted for the target group of farmers, covering:

- How to operate and maintain the machine
- Best practices in feed preparation
- Basic troubleshooting and safety precautions

Participants also received printed user guides and had the opportunity to practice operating the machine.

5. Monitoring and Evaluation

The final stage involved follow-up visits and feedback collection over a 2-month period to assess:

- Adoption rate among farmers
- Changes in daily feed preparation time
- User satisfaction
- Any technical issues or improvement suggestions

The feedback will inform future improvements and potential replication of the project in other communities.

RESULTS AND DISCUSSION

Machine Design

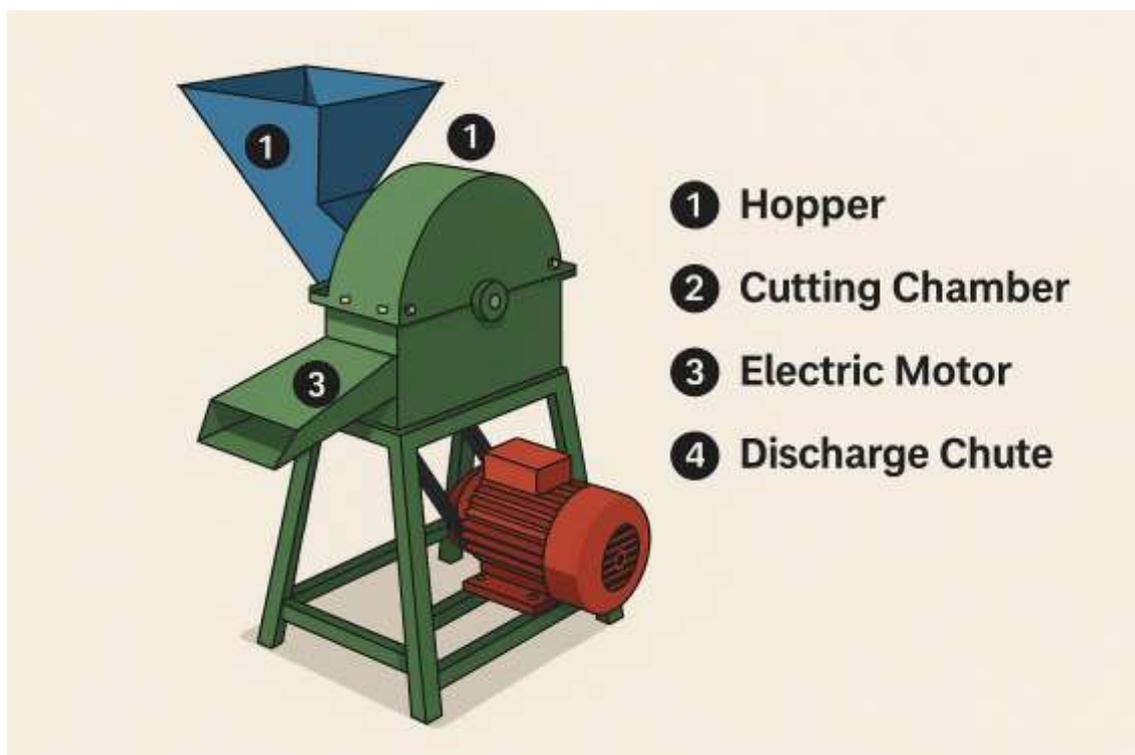


Figure 1. Goat Feed Chopping Machine Prototype With Key Components Numbered For Identification

A brief explanation of each part of the goat feed chopping machine as labeled in the illustration:

1. Hopper
 The top funnel-shaped component where raw forage (such as grass, corn stalks, or leaves) is inserted. It directs the material safely into the cutting chamber.
2. Cutting Chamber
 This is the central part of the machine that houses rotating blades or knives. It performs the chopping action as the forage passes through, reducing it to uniform sizes.
3. Electric Motor
 The power source of the machine. It drives the cutting mechanism using electricity. Typically low wattage ($\pm 450\text{--}500\text{W}$) to ensure energy efficiency and usability in rural settings.
4. Discharge Chute
 The exit pathway for chopped material. After cutting, the processed feed is expelled through this chute, ready for collection and feeding to goats.

Advantages and disadvantages of this machine can be seen on table 1.

Aspect	Advantages (+)	Disadvantages (-)
Efficiency	Speeds up feed preparation ($\pm 80\text{--}100$ kg/hour)	Requires power source (electricity or generator)
Labor Saving	Reduces manual effort and physical strain, especially for women and elderly	Initial learning curve for first-time users
Feed Quality	Produces uniform chop size, improving feed digestibility and reducing wastage	Blade may require regular sharpening or replacement

Aspect	Advantages (+)	Disadvantages (-)
Energy Consumption	Uses low to moderate power (± 450 – 500 W), energy-efficient	Still dependent on electricity availability in remote areas
Safety	Includes protective housing and emergency stop button	Risk of misuse if safety instructions are not followed
Usability	Easy to operate and maintain after training	May be difficult to move without wheels (unless modified)
Cost	Affordable if shared via farmer groups/cooperatives	May still be costly for individual small-scale farmers without subsidy
Maintenance	Simple design allows local repair and maintenance	Spare parts may not be available in very remote villages

Machine Performance Evaluation

After fabrication and field testing, the goat feed chopping machine demonstrated the following performance.

Table 2. Goat Feed Chopping Machine Performance

Parameter	Result
Cutting capacity	± 80 – 100 kg/hour
Energy consumption	± 450 – 500 watts/hour
Blade efficiency	Uniform chop size (1–3 cm range)
Noise level	Moderate (below 80 dB)
Operation safety	Safe with protective housing and emergency stop button

These results indicate that the machine is capable of meeting the daily feed preparation needs of small to medium-scale goat farmers. Compared to manual chopping, feed preparation time was reduced by approximately 70%, significantly improving daily labor efficiency.

Farmer Feedback and Adoption

Following the training sessions and machine trials, feedback was collected from 15 participating farmers through structured interviews and questionnaires. The key findings are:

- 93% of participants reported a significant reduction in time and labor during feed preparation.
- 87% stated that the machine was easy to operate and maintain after training.
- 80% expressed interest in acquiring or co-owning the machine for group use.
- Common suggestions included adding wheels for easier mobility and increasing hopper size for bulkier feed.

This feedback shows strong potential for technology adoption, especially when machines are shared through farmer groups or cooperatives to reduce individual cost burdens.

Impact on Feed Quality and Goat Productivity

Although the project timeline limited long-term monitoring of goat growth performance, several farmers noted that goats consumed the chopped feed more readily and with less wastage. This aligns with literature findings (e.g., Khan et al., 2016) which highlight improved feed digestibility and intake when forage is processed uniformly.

Anecdotally, farmers reported more consistent feeding routines and less physical exhaustion, particularly among women and elderly farmers who traditionally handle feed preparation tasks.

Sustainability and Replication Potential

The machine's design prioritizes local material use and easy maintenance, making it viable for replication in other rural areas. Its low energy requirement allows it to run on standard household electricity or small generators, enhancing accessibility in off-grid locations. The collaborative fabrication with local workshops further supports community-level sustainability.

Discussion

The implementation of a practical and energy-efficient goat feed chopping machine has proven to be a valuable intervention in addressing one of the major challenges faced by rural goat farmers—inefficient feed preparation. The results demonstrate not only technical success but also strong community acceptance and engagement.

This aligns with the principles of appropriate technology and community empowerment, emphasizing that innovation must be context-sensitive, affordable, and user-friendly. The positive reception and suggestions from farmers indicate a readiness to adopt such technology, particularly when supported by training, demonstration, and collective ownership models.

Moving forward, this project can serve as a model for rural innovation, and further collaboration with local governments, agricultural agencies, or cooperatives could help scale its impact.

CONCLUSION

Conclusion

This community service initiative successfully introduced a practical and energy-efficient goat feed chopping machine to a rural farming community. The machine effectively addressed key challenges in manual feed preparation, including time consumption, labor intensity, and inconsistency in feed size. Field trials demonstrated strong performance, ease of use, and high acceptance among farmers. The project not only improved daily operational efficiency but also empowered local farmers by enhancing their access to appropriate technology.

Implication

The results of this initiative imply that simple, context-appropriate innovations can have a transformative impact on smallholder farming. The machine's ability to increase efficiency and reduce labor suggests it could play a critical role in:

- Strengthening local food systems
- Supporting gender equity (as feed preparation is often done by women)
- Enhancing livestock productivity through improved feed quality

Furthermore, the successful collaboration between students, technical fabricators, and farmers showcases the value of interdisciplinary and participatory approaches in community service programs.

Limitation

Despite its success, the project faced several limitations:

- Short project duration limited the ability to assess long-term impacts on goat growth and income.
- Limited production scale meant only one prototype was available, restricting access to a wider group of farmers.
- Power dependency: While the machine uses low power, access to electricity may still be a barrier in some remote areas.
- These limitations highlight the need for extended observation and broader implementation in future cycles.

Recommendation

To build on the outcomes of this initiative, the following recommendations are proposed:

- Expand distribution by producing multiple units and introducing shared ownership through farmer groups or cooperatives.
- Incorporate solar-powered alternatives for areas with limited electricity.
- Establish repair and maintenance training to ensure long-term sustainability.

- Include agricultural extension officers in future training sessions to increase outreach and knowledge transfer.
- Conduct longitudinal studies to track the machine's long-term impact on goat productivity and farmer income.

Future Community Service

Based on the outcomes of this project, future community service activities can explore:

- Development of additional appropriate technologies for goat farming, such as water-saving troughs or waste composters.
- Establishment of local fabrication hubs where farmers can request customized tools.
- Community entrepreneurship programs, helping youth and local technicians to build and sell machines sustainably.
- Integration with digital tools, such as simple mobile apps for machinery maintenance reminders or feed management.

Ultimately, this initiative demonstrates that small-scale engineering solutions, when aligned with local needs and capacities, can significantly advance rural development and agricultural sustainability.

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