

# Effect of Feeding Size of Cassava Leaf by Chopper Machine on Milk Production of Goat at Kemirikebo Village

Ferriawan Yudhanto<sup>1\*</sup>, Putri Rachmawati<sup>1</sup>, and Citravia Agustin<sup>2</sup>

<sup>1</sup>Department of Automotive Engineering Technology, Universitas Muhammadiyah Yogyakarta, Jl. Brawijaya, Kasihan, Bantul, DIY 55183, Indonesia

<sup>2</sup>Department of Animal Husbandry, Akademi Peternakan Brahmputra, Jl. Ki Ageng Pemanahan, DIY 55162, Indonesia

**Abstract.** A chopper machine that functions as a feeding chopper is often used in agriculture and animal husbandry. The design of this machine is different from a commercial chopper. It is used with a set length of chopped sizes variation in 4 sizes, 1, 3, 5, and 7 cm. Chopped sizes based on the farmer's requirement to meet standard feeding sizes will impact livestock production. Smaller sizes of feeding, mainly forage (basal feeding) which is easier to digest, will increase feeding efficiency. This research aims to inform farmers about the importance of knowing the forage size for goats that will increase livestock productivity. The 3-5 cm chopped cassava leaf's optimum size raises milk production from 700 to 1000 ml/day/goat (raising to 42%). This is because the size of the chopped forage makes it easier for the microbial in the goat's rumen to be digested.

## 1 Introduction

Ruminant breeding in Indonesia is predominantly small-scale with goats/sheep [1]. The goat farming system in Indonesia is still traditional, especially feeding management. Feeding is the main stuff for livestock which is used for survival, reproduction, and production of products (children, meat, and milk) [2]. Feeding consumption correlates with the level of digestibility in livestock [3]. Smaller size of the feeding, especially forages (basal feed), will give better digestibility that will increase feeding efficiency. The ability to digest is deeply influenced by the performance and the physical condition of the feeding material processed [4].

One of the ruminant breed sources of dairy goats is found in Yogyakarta, Turi District precisely in Kemirikebo Village. This village has a livestock group called KPP Pangestu that has 1.200 dairy goats including 600 broodstock which belong to PE goats and Sapera goats. They can produce milk as much as 400 liters/day. The PE (*Peranakan Etawa*) goats were cross-bred between Etawa and Etawa while the Sapera goat was cross-bred

---

\* Corresponding author: [ferriawan@umy.ac.id](mailto:ferriawan@umy.ac.id)

between Saanen and PE [5]. Cross-breeding among goats with different genetics will produce quality performance and high milk production [6].

The main feeding of dairy goats as ruminants is forage. Concentrate is also given to add nutrition, so the livestock can produce milk quickly [7]. The farmers will mix forage (fiber source) and concentrate (energy source) [8]. This is because complete feeding mixing will be more effective if the forage is of the appropriate size (2-5 cm). As a selected feeding, goats will prefer feeding that has a standard size, as previous studies stated that a particle size of 3 cm dry forage given to local goats can provide efficiency consumption and palatability [4].

The previous study by Yudha and Nugroho [9] designed a chopper machine for cassava machines following the plan, task discussion, concept design, detailed design, analysis of the mechanism, and selection of the capacity power engine. The power engine uses an electrical motor with 0.25 HP, 1400 rpm. The instrument uses three pulleys and two V-belts, resulting in an output of 210 rpm. This chopper machine gives 80 Kg/hour of cassava slice.

The harvest of the cassava leaves was carried out by traditional method using a sickle or machete. This method is less effective because this process takes more time and effort. When compared to sickles or other sharpened tools which are considered unsafe, automatic chopping machines that are available in various sizes and safe to use are urgently needed to help farmers produce fodder that is standard in size. Designing and constructing chopper machines for feeding livestock is the most appropriate way to solve the problem [10].

## **2 Material and Methodology**

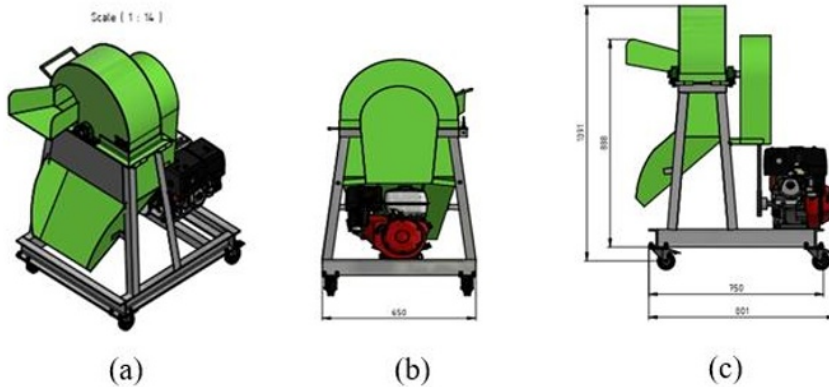
This activity was carried out at the KPP Pangestu, Kemirikebo Village, Turi, Sleman, Yogyakarta. The material implementation used dairy goats, Etawa and Sopera, forages, and a chopping machine. The method of implementing research activities includes coordination and observation.

- a) The coordination stage was carried out with the goat farmers of KPP Pangestu and members of the livestock group who participated.
- b) The observation stages were carried out to find the problems in KPP Pangestu and formulate the problem-solving needed to improve milk production.
- c) The counseling was carried out as problem-solving delivered by design for the feeding chopper machine.

## **3 Result and Discussion**

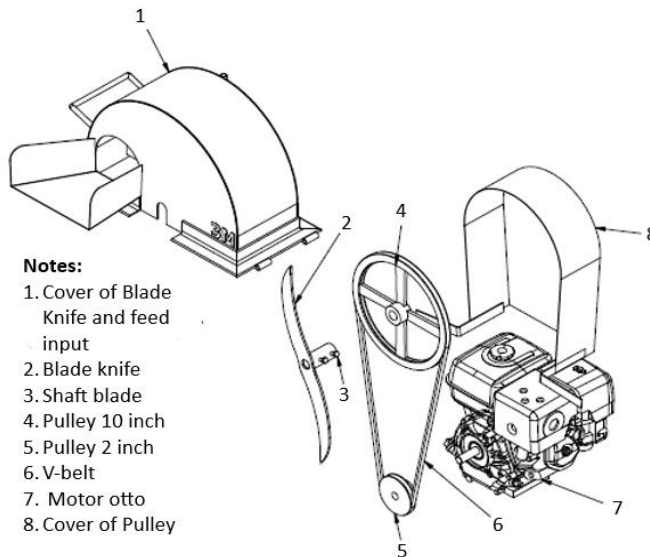
### **3.1 Design and Manufacturing of Forage Chopper Machine**

Planning for the forage of the chopper machine started with designing the tools using inventor software with the original scale. The automatic feeding chopper construction design is shown in Fig. 1. The machine part is divided into four parts; the first one is the cover, the machine frame, and the drive, and the last part is the cutter system.



**Fig. 1.** Feeding chopper construction design in 3D, view; (a) whole, (b) front, (c) back.

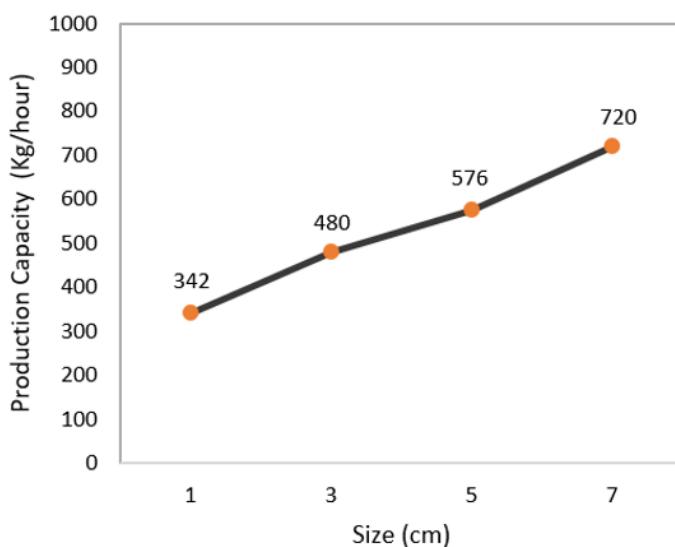
Fig 2. shows the design of the chopper machine using a drive system with a rotational speed by Otto motor with 6 HP (Horse Power) with a power output of 4.5 kilowatts at 3600 rpm. This drive connects the chopper blade by two pulleys. The lower pulley, 2 inches (5.08 cm), and upper pulley, 10 inches (25.4), are joined by a V-belt (Fig. 2). A V-belt has been linked to two pulleys through 19.7 inches (50 cm) in diameter. This combination produces a ratio of 1:5, resulting in the rotation speed output being 720 rpm.



**Fig. 2.** Design to use chopper machine safely (Patent number S00202301987).

This machine has several components, such as a gasoline motor as the drive then there is a frame to support all parts, and the shaft as a holder for the chopper blades; the most important is the casing so that the chopped result doesn't spread anywhere, as well as a protector to the chopper for safety. The cover from the belt on the back of the machine uses a galvanized plate with 1.2 mm thickness, 15 cm width, and 1-meter length. A plate can cover the top and bottom pulleys which are connected by a V-belt to remain safe and secure. This chopper can adjust the desired chopped feeding size, making it more

accessible for farmers to choose the forage type. In previous studies, the result of the design of the chopper machine was to produce a small capacity [11]. The result of this design could be more flexible for the farmers who need more ability, and they have to upgrade it. The large chopping capacity of this machine was the ratio of the chopping time. There are four variations of chopping size: 1, 3, 5, and 7 cm. The data are shown in Fig 3. Each size has a production capacity. The 1 cm chopped cassava leaves were produced at 320 Kg/hour. Then the bigger size of the 3, 5 to 7 cm cassava pieces was made at 480, 576, and 720 Kg/hour capacity, respectively. The capacity increases with the rise in the size of the cassava leaves chopped. The gasoline consumption of copper machines is approximately 1 liter/hour. A chopper machine has designed the sizes of the forages. It puts forward excellent and straightforward results, which are helpful for farmers (Fig 4).



**Fig. 3.** The comparison capacity (Kg/hour) and chopped feeding size (cm).

### 3.2 Forage Size Results and Milk Production

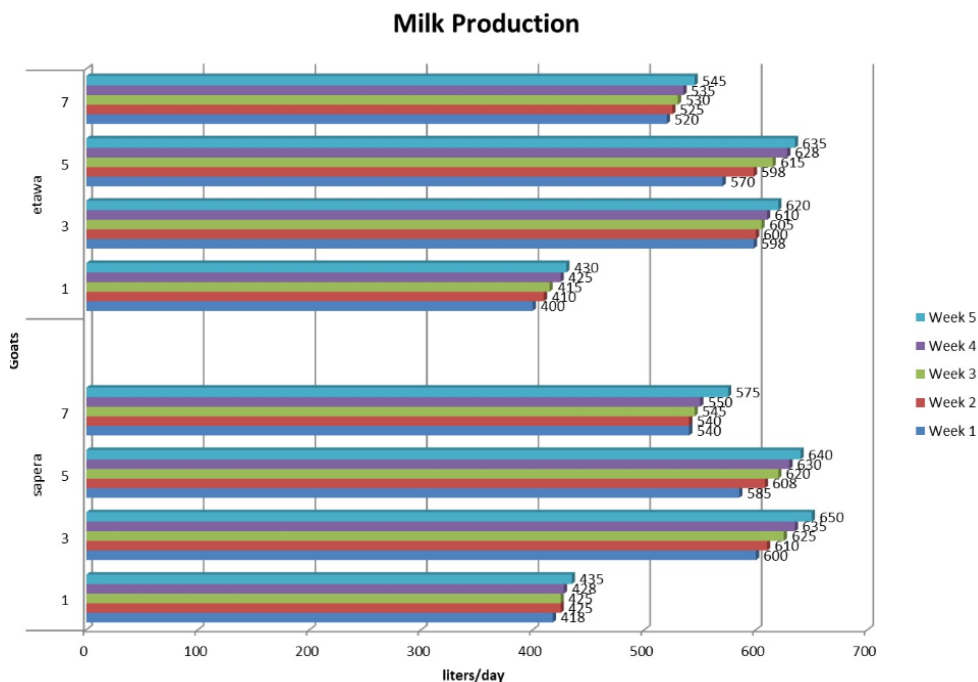
Fig. 4 shows feeding cassava leaves before and after chopping. The percentage forage for ruminants is 10% of the animal's body weight, higher than the concentrate percentage [12]. The previous research showed that a ratio of 75% forages and 25% concentrate were given to produce good milk production of goat [13]. The particle size of concentrates affects not only milk production but also the consumption efficiency, palatability, and digestibility of local goats [4]. High crude fiber content in forages impacts digestibility causing livestock productivity to decrease. Therefore, adding concentrates is still needed to stimulate microbial growth.



**Fig. 4.** Feeding chopped cassava to goats.

The goats prefer to select, and sort plant parts that are highly digestible. Therefore, reducing sizes for feeding by chopping or grinding could increase forage intake [14]. Before the chopping machine was applied, the milk production in KPP Pangestu produced 0.70 liters/day/goat of dairy, which means milk made was less than 1 liter/day/goat. Therefore, the optimal size of cassava forage for goats was obtained by the research in 5 weeks at KPP Pangestu to investigate the effect of forage size on the Sapera and Etawa goats. The chopped cassava leaves dry easily when harvested in a wet condition. It will reduce the cyanide (HCN) in the cassava leaves which is a poisonous agent for life stock contained [15]. Cassava leaves contain high crude protein up to 20%, on dry matter, it is higher than Elephant grass which is 8.90 %. Moreover, previous research reported that elephant grass supplemented with cassava leaf silage had up to 5% significant effect ( $P < 0.05$ ) on feeding intake and body weight gain in goats. It was an increase in average daily weight gain of 50 g/head/day.

KPP Pangestu has 1200 dairy goats, including 600 broodstock. They can produce milk at least 400 liters/day. Goats in KPP Pangestu are Etawa goats and Sapera goats. Etawa goats were cross-bred with *Peranakan Etawa* (PE) goats while the Sapera is a cross-bred between the Saanen goat and PE. This research was to observe the comparison of milk production of the Sapera and the Etawa goat.



**Fig. 5.** Milk production of Sapera and Etawa goats.

Before using a chopper machine for feeding the goat, the milk production was 400 liters/day. The data in **Fig. 5** show that the feeding size particle is 1, 3, 5, and 7 cm. Observations were made on lactating dairy goats for five weeks after applying the chopper machine. The milk production was optimum by 3 and 5 cm (Sapera and Etawa) in sizes compared to the 1 and 7 cm sizes. Forage feeding that is too short or too long cannot be adequately digested by microbes in the rumen. The 3 and 5-cm sizes are optimum for microbial in the rumen, so they impact on increasing the milk production to  $\pm 600$  liters/day.

## 4 Conclusion

The chopper machine construction can set the feeding for goats from 1 to 10 cm in length. Slicing cassava leaves using a chopper machine set on size by 3 and 5 cm increased 42% the milk production of dairy goats (Etawa and Sapera) compared to the raw cassava leaves before chopping. The increased milk production occurs in the first week to the fifth week.

## Acknowledgment

Thank you to LPM Universitas Muhammadiyah Yogyakarta for grant Number: 573/A.3-III/LPM/XII/2022, so that this activity can be carried out properly.

## References

1. K. Muatip, T. Widiyastuti, N. N. Hidayat, H. Purwaningsih, and E. Purwanto. *Anim. Prod.* **19**, 2, 135–142 (2017).
2. Nurlaha, L. Abdullah, and D. Diapari. *J. Ilmu Pertan. Ind.* **20**, 1, 18–25, (2015)

3. P. K. Tahuk and G. F. Bira. *Livest. Anim. Res.* **20**, 2. 130 (2022)
4. R. Iswarin, F. Fani, and A. W. Pambudi. *Anim. Prod.* **18**, 1. 8 (2016)
5. L. Escareño, H. Salinas-Gonzalez, M. Wurzinger, L. Iñiguez, J. Sölkner, and C. Meza-Herrera. *Trop. Anim. Health Prod.* **45**, 1. 17–34 (2012)
6. S. Rusdiana, L. Praharani, and S. Sumanto. *J. Penelit. dan Pengemb. Pertan.* **34**, 2. 79. (2016)
7. P. S. Erickson and K. F. Kalscheur. *Nutrition and Feeding of Dairy Cattle*, in *Book of the Animal Agriculture*. 157–180 (2020)
8. P. Ginting, S. Wartazoa. **19**, 2. 64–75 (2009)
9. Yudha, V, and N. Nugroho. *Quantum Tek.: J. Tek. Mesin Terapan* **2**,1 (2020)
10. S. A. Balayo, R. M. Paca, A. L. Salmazan, and Y. A. B. Mangorsi. *Int. J. Humanit. Soc. Sci.* **9**, 2. 100–113 (2017)
11. I. Mashudi, M. Fakhruddin, A. Hardjito, and H. Wicaksono. *ATASEC*. 195–202 (2022)
12. A. Serment, P. Schmidely, S. Giger-Reverdin, P. Chapoutot, and D. Sauvant. *J. Dairy Sci.* **94**, 8. 3960–3972 (2011)
13. Adriani, A. Latif, S. Fachri, and I. Sulaksana. *J. Ilm. Ilmu-ilmu Pet Univ. Jambi.* **XVII**, 1. 15–21 (2014)
14. C. D. Lu. *J Dairy Sci* .**0302**,87. (2016)
15. Marjuki, H. E. Sulisty, D. W. Rini, I. Artharini, Soebarinoto, and R. Howeler, *Livest. Res. Rural Dev.***20**, 6. (2008)