Experimental Study Performance of Elephant Grass Chopper Using Reel Type Blade

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Abstract. Indonesia is a country that has various types of livestock. Elephant grass is cattle food which needs to be cut into pieces (chopped) before being given so that the distribution of food to all cattle is even. The aim of this research is to determine the performance of an elephant grass chopper using a rotary reel model blade. The research method is carried out directly on a tool that has been manufactured by varying the weight of the elephant grass, namely 2 kg; 4 kg and 6 kg. The results of the research show that elephant grass can be cut or shredded completely, starting from the base to the leaves. The results of the research showed that with a grass weight of 2 kg, the shaft rotation was 107.7 rpm and the pulley rotation was 242.6 rpm with a time of 2.7 minutes, where the average width of the final chopped leaves reached 2.1 cm. In the second test, namely a mass of 4 kg, the shaft rotation was 1014 rpm and the pulley rotation was 276.2 rpm with a grass chopping time of 3.46 minutes with a leaf width of 3 cm. Tests with an elephant grass weight of 6 kg obtained a shaft rotation of 1013 rpm with a chopping time of 6.44 minutes, while the average leaf width was 3.7 cm. The results of the test data illustrate that the condition of the grass chopper is suitable for use in the elephant grass chopping process, where the chopping results can be cut well..

Keywords: Chopper, Livestock, Elephant Grass, Rotary, Rotary Reel.

1 Introduction

Cattle need to survive, produce and reproduce. High livestock production needs to be supported by sufficient and continuous availability of forage. The main source of forage is grass. One grass that has great potential and is often given to livestock is elephant grass. To get around costs and save expenses, breeders usually mix grass with additional feed. Before mixing, the grass must be chopped (chopped) first, so that the mixing process is easy to do. The grass that has been chopped is then mixed with rice bran, pieces of cassava, concentrate, a little of the herb, salt and given enough water according to the dosage. Farmers need tools so that the process of chopping or chopping grass can save time and energy, so chopping or chopping requires a short time [4],[5].

A grass chopping machine or better known as a chopper machine is a useful tool in helping humans manage livestock in terms of the availability of grass for

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livestock. Plants or grasses are chopped by machines that cut them into small pieces. These pieces are then fed through an outlet where the plant or herbs are chopped up and come out in small pieces [7]. A tool or grass chopper machine is really needed by breeders, where in general a grass chopper machine consists of several components, namely: motor that functions as a driver, transmission system, casing, frame shaft, and chopper blade.

Things that must be considered in making this grass chopper machine are how to make a machine with a strong frame, sharp blades that can be cut several times, ergonomic, the price is affordable and easy to find on the market. The machine or tool for chopping animal feed must function optimally according to its function and needs, which is the most important thing. Afriyanto year 2012 has conducted research on grass chopping machines, but this machine has a weakness, namely that there are still many leaves that have not been chopped because they are wrapped around the cylinder. This happens because there is a gap between the chopper blade and the funnel [1].

A chopper machine or what is usually called a grass chopper machine has aspects of completing the needs and situations in farming so that good machine work during the chopping process is expected to save time and energy. In this activity, the design of the tool requires a sharp knife shape for smooth cutting, efficiency, a sturdy frame, accessible sales and easy operation [8]. What is more important is that the equipment, namely the animal feed chopper machine, can operate properly according to the required requirements [6],[9]. A knife is a sharp tool that is used to cut objects into small sizes making it easier to use properly. Meanwhile, the meaning of reel itself means a roll, a reel is a rotating motion of an object whose speed varies from minimum to maximum. If these two words are combined, "Reel Type Knife" is a sharp tool for cutting objects by rotating at the desired speed. The main knife or chopper system, this grass cutter uses 4 blades installed horizontally [2],[3]. The material used for this type of knife is made of steel, each knife is 2 mm thick with a length of 15 cm and each knife is ± 17 cm so it is hoped that with 4 blades in a crossed arrangement, the quality of the material has been selected to be able to cut small sizes and produce shreds. grass in large quantities according to the needs and endurance of the operator.

Fig.1. Reel type blade in this experiment

2 Method

The research method was carried out experimentally by first manufacturing a grass cutting machine using a reel type blade. The stages of conducting the research are as follows: (1) Measuring the characteristics of elephant grass, (2) Analysis of the design of the elephant grass chopper machine which includes the chopper blade cylinder design, hoper design, frame and transmission system (3) Making a prototype of the elephant grass chopper machine, (4) functional test of the elephant grass chopper machine (5) Performance test of the grass chopper machine and (6) measurement of the length of the grass cut. The materials used in the research on making chopping tools were elephant grass, the workpieces were angle iron, shafts, plates and steel stirrups. The equipment used in this research is machine and workshop work equipment, scales, stopwatches, tachometer, belts and pulleys, bearings, electric motor.

3 Result and Discussion

Elephant grass (Pennisetum purpureum) is a type of grass that is often cultivated for animal feed in tropical and subtropical areas, including Indonesia. Following are some general characteristics of elephant grass:

1. Woody Plants: Elephant grass is included in the category of perennial grass. Even though it is called grass, it generally has strong and upright stems, and can even reach a height of more than 3 meters after a few years.
2. Leaves and Stems: Elephant grass leaves are long and wide with pointed tips. The stems are round, upright, and can be quite thick depending on the variety.
3. Fast Growth: Elephant grass is known for its rapid growth, capable of growing to significant height in a short time after being mowed or harvested.
4. Good Adaptation: Elephant grass has good tolerance to a variety of environmental conditions, including poor soil and hot tropical climate conditions. However, fertile soil and more optimal conditions will increase production.
5. Productivity: It is an important source of animal feed because of its large forage production and fairly good nutritional value.
6. Elephant grass forage contains relatively high protein compared to several other type of grass.
7. Capability in Silage: Elephant grass is also suitable for making silage because of its ability to be preserved through fermentation, so it can be used as a source of animal feed for a longer period of time, especially during the dry season.
8. Variants and Selection: There are various varieties and cultivars of elephant grass that have been developed with different characteristics, such as tolerance to pests, resistance to diseases, and higher productivity.

With these characteristics, elephant grass has become a popular choice for livestock breeders in tropical areas to meet their livestock feed needs, both in the form of fresh forage and silage, as shown in the Fig. 2.

Fig. 2. Photo of elephant grass before testing

Table 1. Grass Spesification.

Dimensions	Measurement Results
Length	93 cm
wide	3 cm
Height	170 cm
Leaf thickness	0,23 cm
Dimensions	**Measurement Results**

Source: measurement results before testing

Overall, the process of making a prototype of a sugarcane litter chopper machine is based on working drawings of the design results. The manufacturing process starts from making the hopper, making the frame, chopping cylinder, transmission system and outlet hole. By following the rules in designing a machine, especially agricultural machines, in the end the elephant grass chopper machine design can be manufactured.

Fig. 3. Manufacturing process for elephant grass chopping machine

Stationary (off farm) performance tests on elephant grass chopping machines have been carried out with elephant grass as the feed material. This performance test is to determine the ability to flow the test material, in this case elephant grass, while chopping it into small pieces. Based on the measurement results, the actual capacity of the elephant grass machine is 50.4 kg/hour. The time measured during the test starts from the time the grass enters the hopper, then continues to the chopper section and finally exits to the output section. However, the cutting length of elephant grass was still far from expectations at more than 4 cm and the cutting results were not uniform. This is because the cutting angle of the cutting knife is not uniform, the distance between the moving knife and the stationary knife is less than 1 ± 2 mm.

Fig. 4. Measurement of elephant grass after testing

To get the expected results, improvements have been made, especially to the cutting angle which has been uniformed at 3º, then improving the density between the moving knife and the stationary knife with a distance of 0.5 mm. As for measuring chopping power, rotational speed, noise level and vibration level.

Table 2. Results of measuring the performance of the grass chopper.

Testing Items	Results
Machine Capacity	50,4 kg/hour
Chopper Power	1 kW
Shaft Rotation Speed	109 Rpm

Testing Items	Results
Pulley Rotation Speed	276,6 Rpm
weight elephant grass	2 kg; 4 kg; 6 kg

The results of cutting elephant grass when viewed as a whole are the results of cutting elephant grass. So it can be seen that cutting elephant grass using a reel type elephant grass chopper produces fairly neat and uniform cuts. There are some leaves that are not chopped because the leaves are flat and usually wrapped around the chopping cylinder.

(a). Test results 2 kg

(b). Test results 4 kg

(a). Test results 6 kg

Fig. 5. Elephant grass after testing

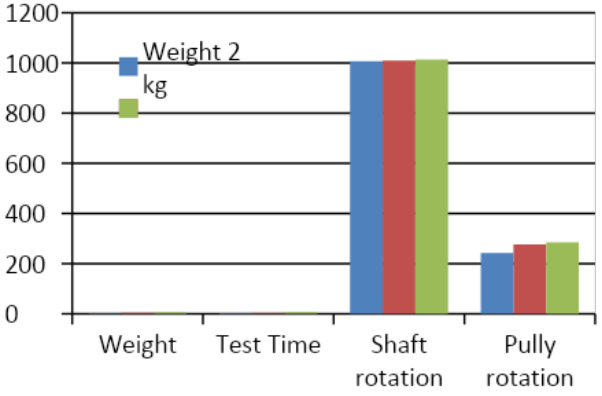

Fig. 6. Bar graph of test results for variations in elephant grass weight

4 Conclusion

The physical characteristics performance of elephant grass after measurement are; Length 93 cm, width 3 cm, height 170 cm, leaf thickness 0.23 cm with a machine capacity of 50.4 kg/hour while the chopping power on the machine is 1 Kw and the shaft rotation speed is 109.0 Rpm while the pulley rotation speed is 276.6 Rpm. The results of the test data illustrate that the condition of the grass chopper is suitable for

use in the elephant grass chopping process, where the chopping results can be cut well.

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Disclosure of Interests. It is now necessary to declare any competing interests or to specifically state that the authors have no competing interests. Please place the statement with a third level heading in 9-point font size beneath the (optional) acknowledgments[1], for example: The authors have no competing interests to declare that are relevant to the content of this article. Or: Author A has received research grants from Company W. Author B has received a speaker honorarium from Company X and owns stock in Company Y. Author C is a member of committee Z.

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