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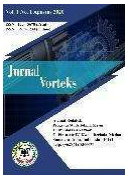

INFLUENCE OF BLADE DISTANCE ON ONION CUTTING MACHINES

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Abstrac

Using a cutting machine helps improve efficiency and the quality of the cuts.This study aims to find out how different blade spacing in an onion cutting machine affects the quality of the slices, consistency of the results, production capacity, and the level of onion damage. The parameters observed include slice thickness, consistency of the cuts, production capacity (kg/hour), and the percentage of damaged onions. The results show that a blade spacing of 0,5 mm produces the thinnest and most consistent slices, but it also increases the machine's workload and the damage to the onions. These findings can serve as a reference for designing onion cutting machines for both home and industrial use.

Kata Kunci: *bawang merah, mesin pemotong, jarak pisau, kapasitas produksi, kualitas potongan*

Penggunaan mesin pemotong membantu meningkatkan efisiensi dan kualitas potongan. Penelitian ini bertujuan untuk mengetahui bagaimana perbedaan jarak bilah pada mesin pemotong bawang memengaruhi kualitas irisan, konsistensi hasil, kapasitas produksi, dan tingkat kerusakan bawang. Parameter yang diamati meliputi ketebalan irisan, konsistensi potongan, kapasitas produksi (kg/jam), dan persentase bawang yang rusak. Hasil penelitian menunjukkan bahwa jarak bilah pisau 0,5 mm menghasilkan irisan paling tipis dan paling konsisten, tetapi juga meningkatkan beban kerja mesin dan meningkatkan kerusakan bawang. Temuan ini dapat menjadi referensi untuk merancang mesin pemotong bawang, baik untuk keperluan rumah tangga maupun industri.

INTRODUCTION

The high demand for shallots has led to the need for technological innovation in post-harvest processing to increase product efficiency and quality (Hindarti, 2014). The onion cutting process is a critical step that affects the quality of the final product. This is a serious issue, especially in the fried onion industry, which requires uniform slicing to ensure even cooking and consistent crispiness.(Billah et al., 2024).

Onion cutting machines have been designed with a variety of mechanisms, from cylindrical rotary blade systems to disc-type blades. The most important factors affecting cutting quality are blade sharpness, rotational

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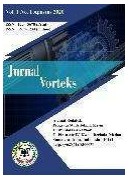

speed, pressure, and blade pitch (Faruqi et al., 2025). Blade pitch variation is one of the most important parameters determining cutting thickness and uniformity, as well as influencing cutting capacity. However, studies on the effect of blade pitch on onion cutting quality are still limited.

Based on the explanation above, this study was conducted to examine the effect of varying blade distances (0.5 mm, 0.7 mm, 0.9 mm) on an onion cutting machine on the quality of the sliced onion, production capacity, and the level of onion damage. This study is expected to provide recommendations for optimal blade distances that can be applied to both household and small and medium industries (IKM). (Setiawan, 2021).

2. Method

The research was conducted in a mechanical engineering laboratory with three variations in blade distance measured using a mm scale. The slicing machine used a three-blade vertical rotary knife, with 5 kg of shallots per sample, three times. Primary data were obtained directly from the research site (Mau et al., 2024)

2.1. Onion slicing machine

The image of the onion slicing machine that will be made is shown in Figure 1.

Description of onion slicing machine parts:

1. Hopper
2. Blade holder
3. Bearing
4. Pulley and v-belt
5. outlet
6. Motor
7. Frame work

Figure 1. Onion Slicing Machine

Table 1. Dimensions and Specifications

Component	Technical Specifications
Tool Name	Onion Cutting Machine.
Function	Slicing/chopping agricultural materials such as shallots.
System Cutting	Horizontal rotating disc with 3 symmetrical straight blades.
Hopper	The top hopper is where the shallots are placed. It measures 18 cm long, 17.5 cm wide, and 15.5 cm high, with a 130° tilt angle. It's made of stainless steel.
Eye Seat Knife	The blade holder serves as a mounting point for the rotating blade used to slice onions. The circular shape has a diameter of 30 cm, a 3 cm diameter hole, a thickness of 12 mm, and a length of 12 cm. The blade is made of stainless steel. The blade is made of 0.3 mm thick stainless steel plate, and is 13 cm long and 3.5 cm wide.
Number of Blades	3 pieces (stainless steel)
Distance Between Blades	7 cm
Bearing	Bearings keep the engine rotating on its axis. They are made of chromium steel.
Pulleys and V-Belts	The pulley and V-belt transmit the electric motor's rotation to the blades. They are made of rubber.
Outlet	The outlet is where the shallots exit after being sliced. It measures 32 cm long, 17.5 cm wide, and 27.5 cm high, with a 105° angle. Made of stainless steel.
motor	An electric motor converts electrical energy into mechanical energy. Power 1 hp, speed 1440 rpm.
Production Capacity	48–73 kg/hour

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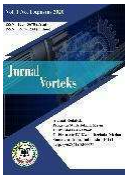

Component	Technical Specifications
Tool Dimensions	Height ± 110 cm; width ± 50 cm; length ± 60 cm
frame	The frame supports all the components of the slicing machine. Made of angle iron measuring 29.5 cm long, 40.5 cm wide, 63 cm high.

2.2 Testing procedures

1. Preparation of tools and materials to be used
2. Test 500 grams of onion slices for each speed variation.
3. Iris time measurement and capacity estimation (kg/hour)
4. Visual evaluation of slice quality (uniformity of size, degree of damage)

The test material used was 5 kg of shallots.Testing was conducted with three blade spacing variations: 0.5 cm, 0.7 cm, and 0.9 cm. The quality of the slices was assessed visually, observing the uniformity of the cut size. Productivity was calculated in kg/hour based on the time required to slice 1 kg of onions.All stages of the research are arranged systematically and structured to ensure the validity, reliability and accuracy of the results.

The machine's working mechanism is as follows: an electric motor drives a pulley connected by a V-belt. When the motor is operating, the rotation of the motor shaft is transmitted to the main shaft where the knife disc is mounted. As the disc rotates, the knife also rotates, thereby slicing the onions fed through the upper hopper. The sliced onions are then released through the outlet, which acts as the onion outlet.

3. Results and Discussion

Figure 2 shows the onion slicing machine blade used for testing. Figure (a) shows the physical shape of the cutting machine blade, while Figure (b) shows the shallots that will be used in the test.

a) Blade b) Bawang Merah

Figure 2. Test materials

In this study, to obtain data on the quality of the sliced onion results and the duration of the shallot cutting process, several test devices and materials were used. The device used was an onion slicing machine, while the test materials consisted of 1.5 kg of shallots as the research sample. The slicing machine served as an aid in systematic data collection, analysis, and interpretation. The onion slicing procedure was carried out in several stages, as described below:

1. Preparation of innggridients
   a. 1,5 kg of shallots
   b. Clean the outer skin of the onion.
2. Measuring the blade distance
3. Testing the onion slicing machine
4. Checking the quality of the onion pieces

Based on data obtained from the shallot slicing process using a cutting machine, it can be concluded that this machine is very helpful in speeding up and simplifying the slicing process. The quality of the cut results is greatly influenced by the rotation speed of the machine and the sharpness of the blade used. Therefore, optimal cutting results depend heavily on the condition and sharpness of the slicing blade.(Bermano & Irawan, 2021).

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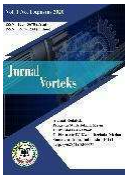

The test results and onion cuts using this machine can be seen in Table 2.

Table 2. Test result data

No	Blade distance	sample	Initial weight	Final weight	time	capacity
1	0,5 mm	500 gr	500 gr	420 gr	76 sec	48 kg/hour
2	0,7 mm	500 gr	500 gr	420 gr	56 sec	65 kg/hour
3	0,9 mm	500 gr	500 gr	420 gr	50 sec	73 kg/hour

a) b) c)

Figure 3. Sample testing results 1

It can be seen in Figure 3, namely the results of the sample 1 test where; a) is the distance of the blade, b) is the test material with an initial weight of 500 gr and c) is the result of the slices from the onion cutting machine (420 gr). In Figure 3, the results of the cuts with a capacity of 500 gr of shallots required 76 seconds, resulting in a capacity of 48 kg/hour when cutting with a maximum cutting quality of 85%.

a) b) c)

figure 4. Sample testing results 2

It can be seen in Figure 4, namely the results of the sample 2 test where; a) is the distance of the blade, b) is the test material with an initial weight of 502 gr and c) is the result of the slices from the onion cutting machine (420 gr). In Figure 4, the results of the cuts with a capacity of 500 gr of shallots took 56 seconds. The test on the 2nd sample was faster than the previous test, resulting in a capacity of 65 kg/hour when cutting with a maximum cutting quality of 85%.

a) b) c)

Figure 5. Sample testing results 3

It can be seen in Figure 5, namely the results of the sample 3 test where; a) is the distance of the blade, b) is the test material with an initial weight of 504 grams and c) is the result of the slices from the onion cutting machine (420 grams). In Figure 5, the results of the cuts with a capacity of 500 grams of shallots require 50 seconds. The test on the 3rd sample is the fastest test among the previous tests, resulting in a capacity of 73 kg / hour when cutting with a maximum cutting quality of 85%.

Figure 6 shows a graph of the relationship between slicing capacity and blade pitch. The graph shows that slicing capacity increases with increasing blade pitch, from 48

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kg/h at 0.5 mm and 65 kg/h at 0.7 mm to 73 kg/h at 0.9 mm

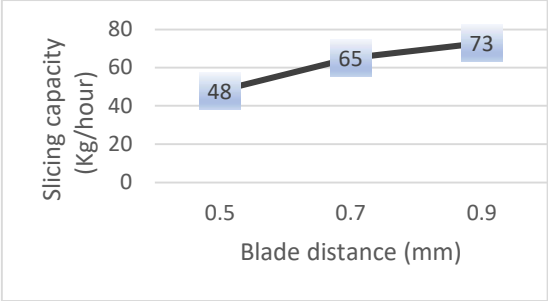

Figure 6. Graph of the relationship between slicing capacity and blade distance

The graphic shown in Figure 6 illustrates that each different blade spacing greatly affects the cutting capacity quality. A blade pitch of 0.5 mm can produce a cutting capacity of 48 kg/hour of onions, and a blade pitch of 0.7 mm increases the cutting capacity to 65 kg/hour. A blade pitch of 0.9 mm produces a cutting capacity of 73 kg/hour.

From the overall test results, it was concluded that the greater the distance between the blades, the greater the impact on the slicing capacity and the level of uniformity of the slices. The slices produced by each blade were quite uniform, with a thickness of 0.8 mm to 1.1 mm.

4. Conclusion

Based on the results of research on the effect of blade distance on onion cutting machines, the following conclusions can be drawn:

A. The larger the blade pitch, the higher the machine's production capacity. At a pitch of 0.5 mm, the production capacity is only capable of producing up to ±48 kg/hour, increasing to ±65 kg/hour at a pitch of 0.7 mm, and reaching a maximum capacity of ±73 kg/hour at a pitch of 0.9 mm.
B. The quality of the sliced results was relatively uniform across the various blade spacing variations. The thickness of the onion slices ranged from 0.8 mm to 1.1 mm, so it can be concluded that the results were quite consistent even with the different blade spacing variations.
C. Cutting efficiency increases with increasing blade pitch. The time required to slice an onion sample decreases with a wider blade pitch, thus supporting increased productivity without significantly reducing cut quality.

Overall, this study shows that a wider blade spacing (0.9 mm) provides optimal performance in terms of capacity and efficiency, while maintaining acceptable slice quality. These findings can serve as a reference in the design and development of onion cutting machines for both household and small and medium-sized industries (IKM).

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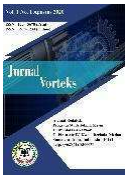

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