

A Design of a Grain Bagging Tool Using Sphiral Spring Type Conveyor

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Abstract: With the development of human knowledge, technologies are created that make all aspects of life easier and faster. Agriculture is no exception, which is the basic activity of human life. Various work aids have been designed and made to make it easier and faster to do work. At this time the process of bagging grain in the mills is done manually, namely by using a shovel, done both. To speed up the bagging process and save on the use of employees, currently a grain bagging device uses a type spiral spring conveyor with an electric motor drive. This tool is portable and can be operated alone so that it can speed up and save the use of labor. The test results showed that the manual bagging rice process, which was carried out by two people, took 59.8 seconds to bag one sack of 26.4 kg of grain while using a spiral spring conveyor took 28.6 seconds for a bag containing an average of 31.2 kg.

1 INTRODUCTION

Agriculture is a basic human job in an effort to meet the needs of life. Rice is the staple food of people in Asia. Due to population growth and decreasing agricultural land, the Indonesian government currently imports a lot of rice to meet domestic needs. In an effort to accelerate the production process and improve the quality of rice, innovations in agricultural equipment must be carried out (pertanian,2022;polbangtanyoma). To process agricultural grain into rice, many processes are carried out. The process includes harvesting, transportation, drying, bagging and milling. Therefore, the government wants to increase the quantity and quality of rice produced by farmers. To produce high-quality rice requires many steps that must be taken by farmers apart from maintenance from planting rice to harvesting. In the drying process, which requires the grain to be completely dry, the resulting grain is not brittle at the time of milling. Farmers are usually overwhelmed when inserting grain to sacks to be sent to the grinding

machine. Therefore, it is necessary to design a tool inserting grain into sacks.

The grain bagging device is designed to make it easier to inserting the grain into the sack before it is taken to the milling machine. At this time the farmers still use the manual method by using a shovel to inserting the grain into the sack which takes a lot of time and energy.

So far, the author has observed that the process of bagging grain into sacks is done manually using only a shovel which is very cumbersome and not ergonomic. This process is usually done by 2 people. This process can be seen in Figure .1 (youtube,2022)



Figure 1: Bagging grain manually.

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The design of an ergonomically designed tool for loading grain into sacks has been introduced by (A. H. Pratama and H. Setiawan,2020). This “Abakan Gadak” bagging tool can reduce muscle fatigue. The tools introduced are still fully manual without a touch of the machine so that it requires a lot of energy in the bagging process. Abakan Gadak has a capacity of 25 kg in 59.12 seconds. The design model introduced can be seen in Figure .2



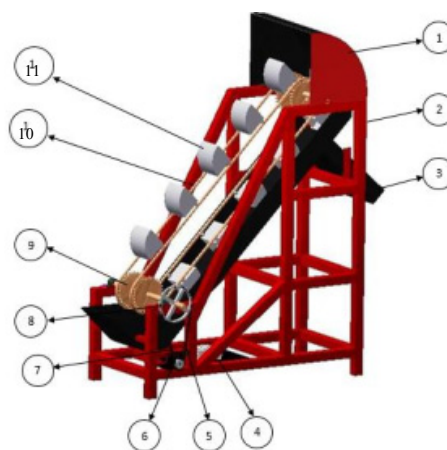
Figure 2: Ergonomic manual rice bagging process.

Other designs for collecting and bagging grain using the conveyor method have also been introduced by (Rinanto, 2021; Prayitno, 2019). Rinanto designed a bagging device using a screw conveyor model. While Prayitno uses a plate belt model. The engine capacity is 20 kg in 49 seconds. The design model can be seen in Figure 3.



Figure 3: Belt conveyor type grain bagging device.

Another design for the bucket elevator type of grain bagging equipment, has also been made by (Dani Irawan,2017). The result of the design is a prototype with a capacity of 208 lt/minute (theoretical). The design model made is as shown in Figure 4.



- | | |
|-----------------------|-------------|
| 1. Top cover | 7. V-belt |
| 2. Frame | 8. Pulley |
| 3. Dispensing chimney | 9. Sprocket |
| 4. Adapter | 10. Chain |
| 5. Switch | 11. Bucket |
| 6. Electric motor | |

Figure 4: The prototype of the bucket bagging model.

2 MATERIAL AND METHODE

The grain bagging tool that are made today are basically used to make it easier for farmers to bag grain into sacks, so that they can make the farmer's job easier to do. This tool uses a spiral spring conveyor to pull the grain towards the guide before it is dropped into the prepared sacks. By turning the spring spiral to the right clockwise using the supplied electric motor. Like picture 5.



Figure 5: Spiral spring.

The spiral spring conveyor consists of a spiral spring that is inserted into the hose and mounted on the shaft of an electric motor. When the shaft is rotated, the spiral spring will rotate and pull the material in the spiral spring.

This grain bag tool in the form of a spiral spring conveyor serves to insert grain into sacks, which consists of a spiral spring as a grain transfer unit, this grain transfer tool is moved by an electric motor. In the process of transferring the grain, the grain will be sucked in through a flexible hose which contains a spiral spring which is rotated by an electric motor so

that the grain will move upwards.

The flow diagram of the process of designing or making grain transfer equipment can be seen in Figure 6.

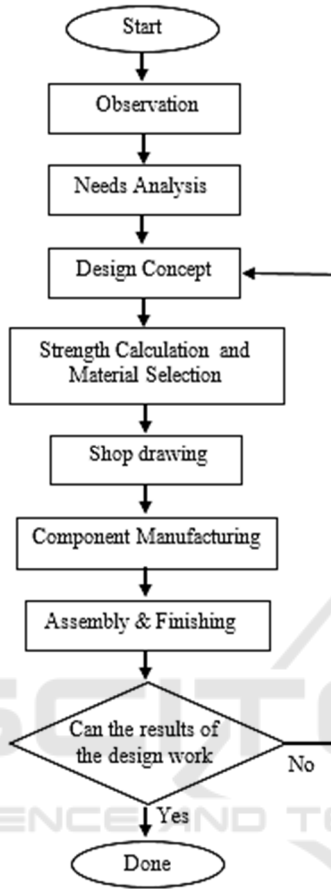
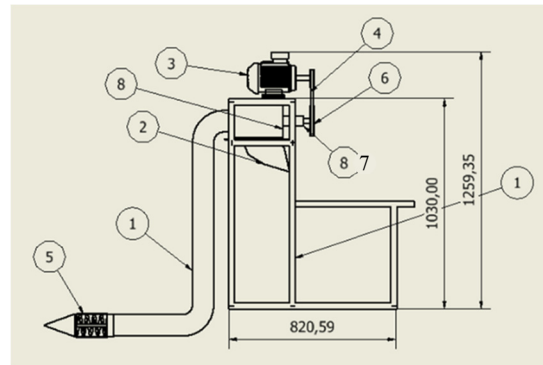


Figure 6: Flowchart of making conveyor spiral spring.

3 RESULTS AND DISCUSSION

The process of bagging the grain is currently done manually, carried out in two as shown in Figure 1, this process causes fatigue, because it is done by bending. Based on these observations, the author designed a tool that can ease the burden on workers and speed up the work process without causing pain in the waist. Figure 7 shows a grain bagging device using a spiral spring conveyor.

Based on the results of the tests that have been carried out for bagging 1 sack of grain to the conventional grain bagging process and using a spiral spring conveyor, significant results were obtained on bagging speed and comfort.



Caption:

- 1. Frame
- 2. Funnel out
- 3. Electric motor
- 4. V Belt
- 5. Place of entry of rice
- 6. Pulley
- 7. Axle holder box
- 8. Axle screw holder

Figure 7: Spiral spring conveyor.

The conventional grain bagging process for one sack of grain takes 59.8 seconds to bag one sack of grain weighing 26.4 kg. Table 1 shows the time it takes to bag 1 sack of grain, the testing process is carried out 5 times.

Table 1: Manual bagging process.

Bagging process No.	Weight of bagged grain (kg)	Time (seconds)	explanation
1	26	60	-
2	25	57	low back pain
3	28	66	low back pain
4	27	59	fatigue
5	26	57	pain in the waist

The data on the grain bagging process using a spiral spring conveyor can be seen in table 2.

Table 2: Bagging process with spiral spring conveyor.

Bagging process No.	Weight of bagged grain (kg)	Time (seconds)	explanation
1	27	30	no complaints
2	32	29	no complaints
3	31	27	no complaints
4	34	28	no complaints
5	32	29	no complaints

To make it easier to compare one by one, from the results table a graph of the comparison of the weight and time needed to bag the grain in one sack can be made. Figure 8 shows the comparison of the weight of the grain each time a bag is inserted into the sack from the expectation to include as much as 30 kg.

Figure 8 shows the volume obtained during the manual bagging process. Based on the results of tests carried out 5 times, the average weight is 26.4 kg.

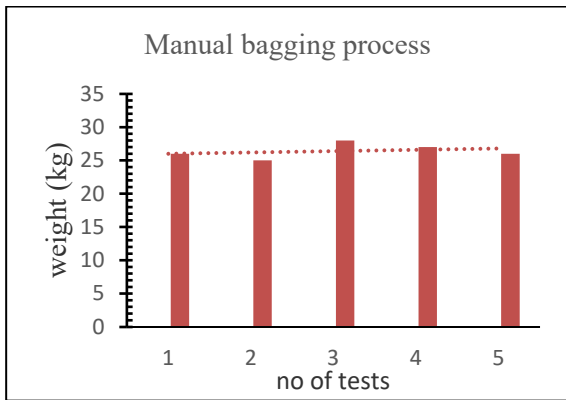


Figure 8: Manual bagging process.

Figure 9 shows the weight obtained after weighing the filling using a spiral spring conveyor. The test results show the average mass of filled grain is 31.2 kg

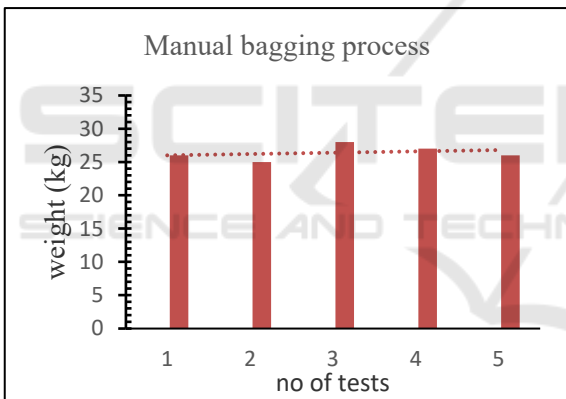


Figure 9: Conveyor spring spiral bagging process.

By comparing the manual bagging process with bagging using a spiral spring conveyor, the graph of the average weight filled into the sack can be seen in Figure 10.

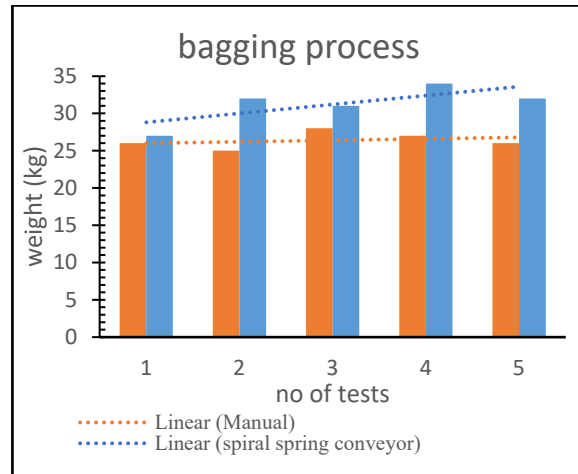


Figure 10: Weight comparison of the bagging process.

Based on the test results, it was found that the weight that was filled into the manually filled sacks was always less than the weight obtained which was filled using a spiral spring conveyor. This is because the workers are tired so they think the sacks are full.

Based on the results of testing the time required to bag 1 sack of grain manually as shown in the data in tables 1 and 2, a graph can be made as shown in Figure 11.

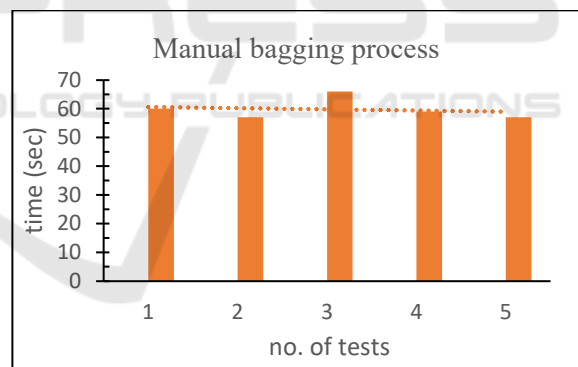


Figure 11: The time it takes to deliver 1 sack of grain.

While the time needed to bag 1 sack of grain using a spiral spring type conveyor can be graphed as shown in Figure 12

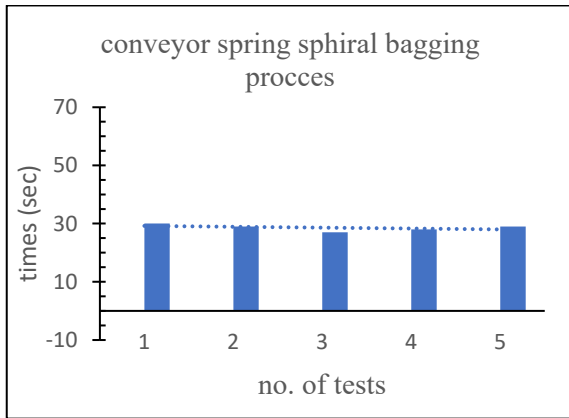


Figure 12: The time it takes to deliver 1 sack of grain.

Comparison of the time required to bagging 1 sack of grain between the bagging process manually and bagging using a spiral spring conveyor, a comparison graph is obtained as shown in Figure 13.

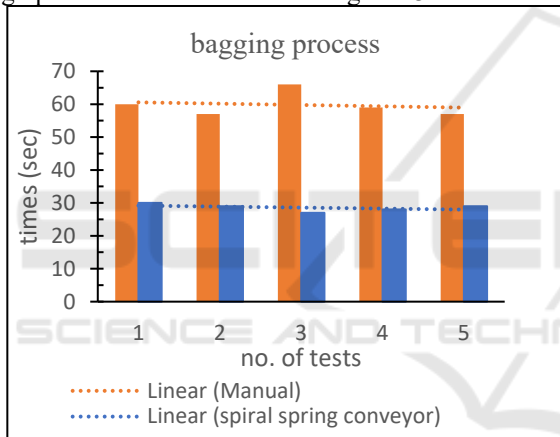


Figure 13: Comparison of the time it takes to deliver 1 sack of grain.

From Figures 10 and 13 it can be seen that the comparison of the speed of the manual bagging process with bagging using a spiral spring conveyor. Based on the weight in one sack, it was found that the mass of grain with the bagging process using a spiral spring conveyor was more than the mass using the conventional method. The average mass obtained from the manual bagging process is 26.4 kg, while using a spiral spring conveyor is 31.2 kg. This means that there is an average increase of 4.8 kg or an increase of 18.2 percent.

Based on the time required to bag 1 sack of grain manually is 59.8 seconds, compared to using a spiral spring conveyor is 28.6 seconds. So there is a time savings of 51.5 percent.

4 CONCLUSIONS

Based on the design results, the dimensions of the grain bagging device using a spiral spring conveyor are 820.59 mm long, 600 mm wide and 1259.35 mm high.

The bagging process using a spiral spring conveyor has an increase in speed of 51.5 percent so it has a very good performance.

The weight gained by bagging using a spiral spring conveyor also increased by 18.3 percent.

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