

## **A COMPARISON OF THE CAPACITY AND WORKING TIME OF MASHED SAGO SNACKS PRODUCTION USING CONVENTIONAL AND MECHANIZED SYSTEMS**

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### **ABSTRACT**

Sago processing based on technical aspects has not been handled systematically with the use of technology that is still very simple. The technology used is generally traditional manual and a small part is semi-mechanized. This causes a lot of sago flour to be wasted due to the inefficient extraction process, resulting in low productivity and low quality of sago flour produced. This research focuses on the processing of conventional and mechanized mashed sago snacks or cakes according to the resulting prototype design. The method used is development research. The results showed that the ratio of working time and production capacity conventionally was in the range of 29.93 gr/min - 52.74 gr/min while mechanically achieving the ratio of time and production capacity of 33.65 gr/min.

**Keywords:** sago mash, conventional, prototype, mechanization

### **INTRODUCTION**

Sago, which in Latin is called *Metroxylon* sp, is one of the various endemic plants found in Maluku. The advantage of the sago tree when compared to other types of food crops is that it has the potential to produce higher production with the characteristics of being environmentally friendly, economically and culturally acceptable, can produce on shallow peatlands and wet mineral soils without chemical-based production inputs and forms a stable agroforestry. (Natelda, 2006). Under good environmental conditions, the production process can reach 15-25 tons/hectare of dry sago flour, compared to other food-producing crops. (Stanton, 1986). So with the various multifunctions possessed by the sago plant, the habits of local people, often utilize it for their daily needs. "For example, leaves are used as roof coverings, food wrappers or storage containers with the local language term called "kamboti".

The function of sago fronds (locally termed "gaba-gaba") is also used as house building materials in the form of doors, windows, walls, ceilings and chairs and tables (furniture fittings). Where the skin of the sago tree trunk functions as a house building material while the pith or core is optimally squeezed to produce essence which in further processing is used as raw material for making traditional food. The raw essence is processed as the main food or "papeda" while the dried essence, which is processed by burning, is mostly produced as "sago plate/forna", which can be consumed directly or mashed for other traditional food processing.

The utilization and utilization of processed sago by rural communities is still low due to various obstacles. Sago cultivation that has been applied by farmers still has a subsistence background, this is related to basic food needs and has not led to a commercial system. In addition, many technical aspects have not been handled systematically and

thoroughly and the use of technology is still very simple. The technology used is generally traditional manual and a small part is semi-mechanized. This causes a lot of sago flour to be wasted due to the inefficient extraction process, resulting in low productivity and low quality of sago flour produced (Haryanto and Pangloli, 1992). In addition to the constraints mentioned, there are still socio-economic constraints, namely in terms of the availability of skilled labor involved in maintenance, harvesting, production processes, packing, marketing and others. Whereas it is known that in sago growing areas, population density is relatively rare. The availability of transportation facilities and infrastructure is an important factor in the production system. However, in reality, the sago forest is in a location with very limited facilities and infrastructure.

In some household industries, sago plant utilization and processing activities are more conventional, with processed products in the form of sago plates, shaved, bagea, mashed sago, sago cakes, papeda, and others. The direction of this research focuses on making sago mashed snacks or cakes. Where in the manufacturing process requires a mixture of several ingredients, with workmanship that requires individual labor, the processing duration is not short because it relies on human strength for the activity of mashing several ingredients together, there is no mechanization process. With consideration of the amount of production that can be constant every time per production, based on the description above, this research focuses on comparing the capacity and working time of mashed sago snacks production using conventional and mechanized systems.

## THEORETICAL FRAMEWORK

### Machining Process

The machining process is the process of producing a finished product made from metal. About 60% - 80% of all manufacturing of complete machine components is done using the machining process. (Widarto, 2008). The working principles of machine components include turning, milling and drilling. The main parameters in each lathe process are the spindle rotational speed (speed), feeding motion (feed) and depth of cut.

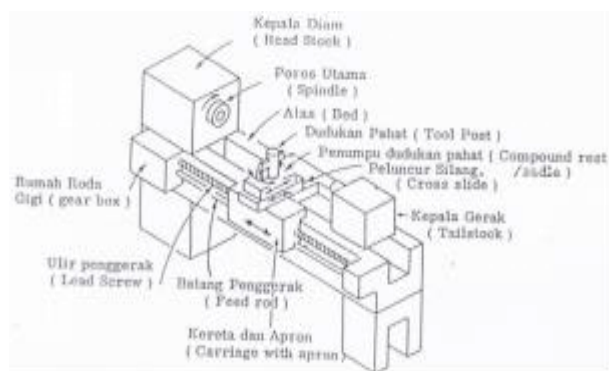


Figure Lathe Machine and components (Rochim Taufiq, 1985)

The milling machining process is a process of cutting the workpiece using cutting tools with rotating plural cutting edges, which can be flat, angled or curved or a combination of several shapes. (Widarto, 2008) Milling machines can be said to be machine tools that are used accurately to produce one or more surface work by using one or more cutting tools.

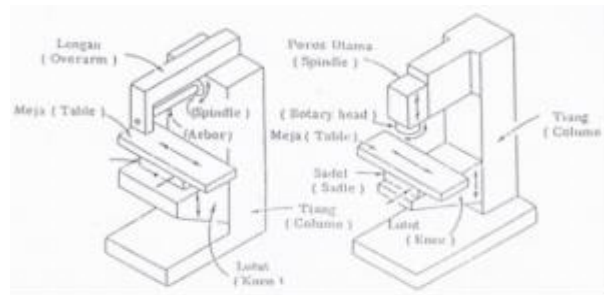
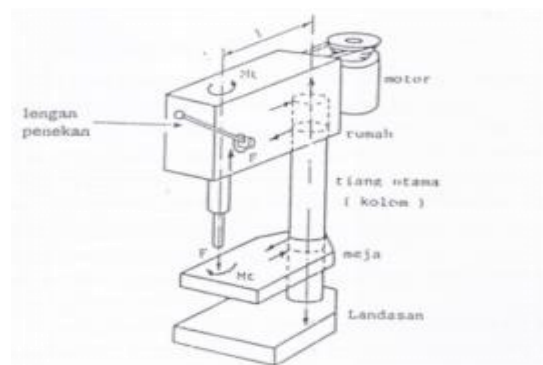


Figure Fraises Machine (Rochim Taufiq, 1985)

The gurdi process is the process of making round holes using a drill bit (twist drill), while the process of drilling (boring) through the process of expanding or enlarging the hole that can be done with a drill rod (boring bar). (Widarto, 2008).



Gurdi Machine Picture (Rochim Taufiq, 1985)

## Shield Metal Arc Welding (SMAW)

Shield Metal Arc Welding (SMAW) is a welding technique using an electric current that forms an arc and a webbed electrode. In SMAW welding, protective gas occurs when the coated electrode melts, so that in this process no inert gas pressure is needed to eliminate the influence of oxygen or air which can cause corrosion or bubbles in the welding results. The welding process occurs due to the resistance of the electric current flowing between the electrode and the welding material which causes heat to reach 3000 oC, thus making the electrode and the material to be welded melt (Sukaini, 2013).

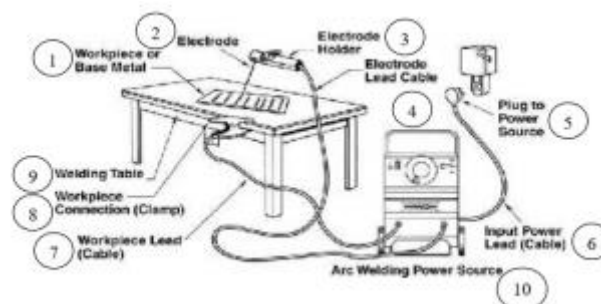


Figure SMAW Welding Equipment (Purwaka Ibrahim, 2010)

## Time Study Work Time

Determination of the working time of an operator in completing a work activity with certain skills and trained according to the normal tempo of work, defined as time measurement or time study. (Wignjosoebroto, 1993). Its achievements can be generated using the bottom-up and top-down approach stages to obtain the determination of standard time or standard time. Factors that contribute to the implementation of the process of approaching the completion of operator work time include normal time, normal work tempo, actual time and allowance time. (Wignjosoebroto, 1992). In the measurement stage of working time, measurements are used with a stopwatch or stopwatch that processes repetitively (repetitive timing) or also called the snap back method where the pointer on the stopwatch will always be returned to zero position at the end of each measured work element. (Wignjosoebroto, 2003).

## METHODS

The type of research used is research and development, to produce a prototype of mashed sago production machine based on the study and analysis of production capacity and time. The research location is at the Mechanical Engineering Workshop (prototype making), Ambon State Polytechnic, Ihamahu Village and Morella Village (3 different SME locations). The research data includes primary data, namely the amount of raw materials (weight) of processed sago mash mixture, conventional sago mash production time and mechanized sago mash production time. As comparative information is the dimensions (volume) of the work tool for making conventional sago mash models. Data collection techniques include: a). Pre-research: design of mechanized sago mash in prototype form, b).Data testing: conventional production time capacity and mechanization as a form of comparison. In the research process, sample testing will be carried out on several types of the same business with different locations conventionally and testing using the mechanization process, c). Data processing using production time analysis with the time study method and d). Data output produces a comparison of production capacity against the time of conventional and mechanized production.

## RESULTS AND DISCUSSION

The applicability of the mechanical processing of mashed sago is based on the results of the design and manufacture of the prototype of the mashed sago machine.



Picture of Sago Mashing Prototype

The results of measuring the working time and production capacity of conventional mashed sago making, came from Negeri Ihamahu and Morela Village (with 3 different SME samples). The raw materials used are sago flour, brown sugar and walnuts. While the mechanical process was carried out at the Production Laboratory, Department of Mechanical Engineering, Ambon State Polytechnic. The results of measuring time and production capacity both conventionally and mechanically, are:

**Table-1** Testing the production time of conventional sago mash method (Negeri Ihamahu).

| No. | Weight (gr) | Total Time Production (Minute) |       | Production Ratio (gr/mnt) |
|-----|-------------|--------------------------------|-------|---------------------------|
| 1   | 625         | 20' 11.28"                     | 20.19 | 30.96                     |
| 2   | 675         | 21' 08.54"                     | 21.14 | 31.93                     |
| 3   | 650         | 22' 06.40"                     | 22.11 | 29.40                     |
| 4   | 675         | 23' 55.57"                     | 23.93 | 28.21                     |
|     |             |                                |       | 30.13                     |

**Tabel-2** Pengujian waktu produksi sago tumbuk metode konvensional (Negeri Morela-1)

| No. | Weight (gr) | Total Time Production (minute) |       | Product Ratio (gr/mnt) |
|-----|-------------|--------------------------------|-------|------------------------|
| 1   | 350         | 11' 59.56"                     | 11.99 | 29.18                  |
| 2   | 325         | 10' 34.46"                     | 10.57 | 30.73                  |
| 3   | 275         | 08' 15.00"                     | 8.25  | 33.33                  |
| 4   | 300         | 07' 14.35"                     | 7.24  | 41.44                  |
| 5   | 275         | 05' 59.08"                     | 5.98  | 45.95                  |
|     |             |                                |       | 36.13                  |

**Tabel-3** Pengujian waktu produksi sago tumbuk metode konvensional (Negeri Morela-2)

| No. | Weight (gr) | Total Time Production (Minute) |       | Product Ratio (gr/mnt) |
|-----|-------------|--------------------------------|-------|------------------------|
| 1   | 303         | 12' 54.23"                     | 12.90 | 23.48                  |
| 2   | 437         | 13' 42.92"                     | 13.72 | 31.86                  |
| 3   | 402         | 13' 40.09"                     | 13.67 | 29.41                  |
| 4   | 393         | 12' 58.55"                     | 12.98 | 30.29                  |
| 5   | 412         | 12' 39.96'                     | 12.67 | 32.53                  |
| 6   | 392         | 12' 14.96'                     | 12.25 | 32.00                  |
|     |             |                                |       | 29.93                  |

**Tabel-4** Pengujian waktu produksi sagu tumbuk metode konvensional (Negeri Morela-3)

| No. | Weight (gr) | Total Time Production (Minute) |      | Product Ratio (gr/mnt) |
|-----|-------------|--------------------------------|------|------------------------|
| 1   | 385         | 06' 50.13"                     | 6.84 | 56.32                  |
| 2   | 378         | 05' 53.00"                     | 5.88 | 64.25                  |
| 3   | 277         | 07' 30.41"                     | 7.51 | 36.90                  |
| 4   | 293         | 05' 08.55"                     | 5.14 | 56.98                  |
| 5   | 412         | 07' 13.23"                     | 7.22 | 57.06                  |
| 6   | 402         | 08' 56.53"                     | 8.94 | 44.96                  |
|     |             |                                |      | 52.74                  |

**Tabel-5** Pengujian waktu produksi sagu tumbuk metode mekanis

| No. | Weight (gr) | Total Time Production (Minute) |       | Product Ratio (gr/mnt) |
|-----|-------------|--------------------------------|-------|------------------------|
| 1   | 501         | 15' 35.00"                     | 15.35 | 32.64                  |
| 2   | 532         | 15' 35.00"                     | 15.35 | 34.66                  |
|     |             |                                |       | 33.65                  |

**Tabel-6** Rekapitulasi waktu produksi sagu tumbuk

| No. | Product Source | Production Capacity (gr/mnt) |
|-----|----------------|------------------------------|
| 1   | Ihamahu        | 30.13                        |
| 2   | Morela-1       | 36.13                        |
| 3   | Morela-2       | 29.93                        |
| 4   | Morela-3       | 52.74                        |
| 5   | Mekanis        | 33.65                        |

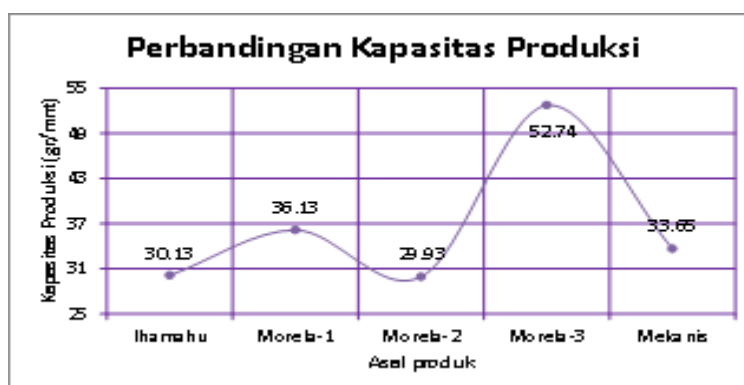


Figure Graph of production capacity comparison

Variations in the volume of processed raw material mixture for conventional sago mash production have an impact on the achievement of the resulting work time. The disparity in results looks quite far when working conventionally, this is influenced by several factors including production experience and physical abilities of workers. So that conventionally, the treatment process of each worker will have an impact on the ratio of capacity and production time. Whereas mechanically, basically, the mashed sago processing work process will remain constant, with a range of production ratio achievements that are not much different.

## CONCLUSION

The ratio of time and production capacity conventionally is in the range of 29.93 gr/min - 52.74 gr/min, while mechanized shows the achievement of the ratio of time and production capacity of 33.65 gr/min. Suggestions in the development of further research due to the relatively constant nature of mechanical production, the increase in the number of containers in the design will be linear with an increase in production capacity.

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