Post-harvest handling of sago and the sustainability of the processed results

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Abstract. One of the problems faced in the sago production process is the low yield of the results of processing sago pith into sago. It is estimated that around 6 million tonnes of dry starch is wasted because it cannot be recovered in processing. The low production of sago is because most of the sago processing completed by the community uses traditional methods where only minimal equipment is used. Hence, processing sago which is completed simply feels more difficult. The article aims to describe the potential of sago in Indonesia, and some efforts to raise sago production are to carry out cultivation as recommended and many issues about sago. Meanwhile, to raise the use of sago is to increase the number of sago-based food products, both traditional and conventional, with various innovations. It also promotes sago as a staple food, healthy snack, or wheat-based substitute food to the Indonesian people.

1 Introduction

Empowering sago farmers requires increasing productivity and sago starch production. The necessity is due to the need for sago, in addition to food and other foodstuffs, which continues to increase domestically and internationally [1]. Indonesia, known as the global leader in sago starch production, currently produces 585,093 tons per year. This impressive output is achieved through the utilization of a vast plantation area spanning 1,843,287 hectares, which includes 1,403,883 hectares of natural sago in Papua and West Papua. The recognition of sago's immense potential as both a food source and an industrial ingredient dates back to the 1970s. However, up until this point, the majority of plant cultivation in Indonesia has remained traditional and lacks intensive management. The productivity of sago plants remains relatively low, with yields falling below 10-15 tonnes per hectare per year. This rate is considered standard when farmers engage in general garden management practices. However, the demand for sago starch, both for food and non-food purposes, continues to rise domestically and globally [1].

Sago is a plant native to Indonesia, possibly originating from Maluku and Papua. In these places, germplasm has the highest diversity to find sago. However, until now no data has been revealed since sago was first known. Sago, a staple food for the people of eastern Indonesia such as Irian Jaya and Maluku, has the potential to be a valuable source of carbohydrates alongside rice. Despite its importance, many farmers still practice traditional methods of sago cultivation, often treating it as a secondary occupation. However, by adopting Best Management Practices and recommended technologies, sago productivity can be significantly increased to reach 25 tonnes per hectare per year. Currently, sago production stands at 210 tons, which is only 4% - 5% of the country's total production potential of 5 million tons annually. To fully optimize production, efforts are being made to explore alternative markets in the energy sector. The low productivity of sago can be attributed to both internal and external factors. Internally, sago farmers lack the necessary knowledge, attitudes, motivation, and skills required for effective cultivation. The sago sector is facing various external challenges that hinder its growth and development. One of the key issues is the insufficient number and competence of agricultural extension workers, which leads to a lack of extension activities and provision of information. Additionally, social and cultural values that prioritize other crops over sago, along with a lack of visionary values that promote sago and its products, further contribute to the sector's stagnation. Moreover, the poor performance and ineffective leadership within farmer groups exacerbate the situation.

Furthermore, the absence of support from government institutions, such as agro-soft loan support, market information, and transportation infrastructure, hampers the progress of the sago sector. The national and regional development policies that prioritize other commodities over sago also pose a challenge. Moreover, the lack of adequate facilitation and partnerships with private companies, as well as the absence of a sago processing industry as buyers, further hinders the sector's growth. Lastly, the remote location of the sago stem processing industry adds to the difficulties faced by the sector. One of the problems faced in the sago production process is the low yield of results from the processing of sago pith into sago. It is estimated that around 6 million tons of dry starch is wasted because it cannot be taken in the processing process. This low sago production is because the majority of sago processing by the community is carried out traditionally, which only uses minimal equipment, so the sago processing work is more difficult [2]. The problems faced by sago processors are low productivity, factory sanitation is still not good and the product quality is low. Low productivity is caused by, among other things, the filtering process being carried out completely manually, the sago grater having low productivity, the felling/cutting of sago stems still manually, and low yield because the dregs are not squeezed. Besides that, low sanitation can be seen from the water used for starch extraction, settling and draining tanks, and final product packaging. The quality of the product produced is still low, which can be seen from the colour of the flour which is not yet white, and the water content which is still high. This article aims to describe the potential of sago in Indonesia, and efforts to increase production by cultivation under the recommendations of the Regulation of the Minister of Agriculture of the Republic of Indonesia No. 134/Permentan/OT.140/2013 [3] and various existing sago preparations and efforts to develop sago-based products.

2 Potential of sago in Indonesia

Indonesia boasts the world's largest sago crop, with a staggering 1,843,278 hectares of sago plantations. This accounts for a significant portion of the global sago cultivation, which spans 2,942,278 hectares worldwide. Other countries such as Papua New Guinea (1.02 million ha), Malaysia (59,000 ha), Thailand (5,000 ha), the Philippines (3,000 ha), and a few others (3,000 ha) also contribute to the sago production. Sago plants can be found throughout Indonesia, from the westernmost to the easternmost regions, encompassing both large and small islands.

Among the Indonesian regions, Papua takes the lead with an impressive 160,873 hectares of sago plantations, followed by Sumatra (103,312 ha), Sulawesi (45,540 ha), the Maluku Islands (41,949 ha), Kalimantan (8,304 ha), and Java (300 ha). Furthermore, Indonesia showcases remarkable species diversity when it comes to sago cultivation. Maluku and Papua are renowned for their exceptional genetic diversity and the potential they hold for the development of superior sago varieties in the future. Among the various types of sago, three stand out due to their economic value and high carbohydrate content: Molat Sago (*Metroxylon sagus* Rottb), Tuni Sago (*Metroxylon rumphii* Mart), and Ihur Sago (*Sylvester Metroxylon* Mart). Sago plants possess a remarkable production capacity surpassing that of other plants. They typically begin producing after approximately 10 years of growth from new plantings. However, thanks to their ability to continuously generate new shoots, sago plants can sustain economic production without requiring new plantings. To date, sago starch is recognized for its exceptional yield per unit area and time. The plant's stems can accumulate sago starch, with each tree capable of storing between 200 to 220 kg. In Maluku, the production of dry sago flour can reach an impressive 345 kg per tree [4].

Compared to other carbohydrate crops, sago surpasses rice, corn, and wheat in terms of productivity. With proper management, sago has the potential to become a significant food source for Indonesia's 240 million population. Recent research indicates that certain types of sago can produce over 700 kg of dry starch per tree. Therefore, with 100 trees per hectare, it is possible to yield 70 tons of dry sago flour. Sago holds immense potential as a rice substitute due to its readiness for harvest, nutritional value, and economic significance. However, it is crucial to manage sago production under market demand. [5].

Sago is a versatile product with numerous benefits. It has been utilized for generations in various regions as a staple and additional food, with sago starch being processed into a wide range of traditional dishes. However, sago is not limited to traditional cuisine alone. It is also cultivated in a more modern manner, resulting in the production of vermicelli, sago rice, glucose syrup, cakes, bread, and salad sauce. Moreover, sago flour finds applications in non-food products such as bioethanol, dextrin, bioplastics, glue, plywood, textiles, citric acid, and lactic acid. Additionally, sago pulp serves as a valuable component in animal feed. The bark of the sago tree is processed into particle board, flooring, and briquettes/fuel. Furthermore, sago leaves have various uses, including traditional medicines, roofing, wall construction, sago stands, and handicrafts.

Climate change continues to affect agricultural production, especially rice. Droughts and floods are now frequent occurrences that result in crop failures and reduced agricultural output. As a consequence, humans are compelled to seek alternatives to rely less on limited food resources. Sago, a commodity that remains relatively unaffected by climate and natural disasters, emerges as a viable option. This plant thrives in adverse conditions and offers a high caloric value, making it an efficient source of essential nutrients. Sago starch and its processed derivatives are extensively consumed as staple food and snacks in different regions, particularly among coastal or lowland communities [5]. Sago can absorb large amounts of CO_2 so it can help overcome the threat of global warming. Apart from that, the environment where sago grows will be protected from environmental damage because sago has many saplings and does not need to be rejuvenated, so it can prevent subsidence of the peat soil surface [3].

Sago, a functional food, has the potential to contribute to food diversification and enhance local and national food security. This is because sago possesses comparable nutritional value to other staple foods like rice, corn, cassava, and potatoes. In terms of calorie content, sago is similar to rice and corn and even surpasses potatoes, breadfruit, cassava, sweet potatoes, and yams (gembili and yams). Additionally, sago contains a higher amount of carbohydrates compared to rice and other food ingredients. Although sago has a lower protein content, it can be supplemented with fish and vegetable protein through diets like papeda and/or sago

plates [6]. Sago starch also contains 3.69-5.96% dietary fibre [7] and has a low Glycemic Index (GI) value of 28, falling within the low category as it is below 55 [8]. Furthermore, sago starch consists of approximately 27% amylose and 73% amylopectin [9]. The ratio of amylose to amylopectin influences the properties of the starch itself. Higher amylose content results in a drier and less sticky starch that has a greater tendency to absorb water (hygroscopic).

Sago as a food source of carbohydrates that can be beneficial for diabetes sufferers in terms of its nutritional content and impact, is a local food resource whose use can be developed through good processing, thereby encouraging people to consume sago as a healthier source of carbohydrates [10].

3 Efforts to increase production

Efforts to increase sago production are to carry out cultivation as recommended [3]. The sago plant has not been cultivated intensively at the community/farmer level so it is feared that the sago population or germplasm will experience extinction. In several locations, apart from being harvested on a large scale, this is also accompanied by the development of cultivation by private parties, but the problem is the replacement of sago as a commodity with other crops that are considered more economical and profitable, such as oil palm. The government's policy to protect and continue to preserve sago is being pursued through the Ministry of Agriculture with a sago management and development program through the Directorate General of Plantations program starting in 2012 [3].

3.1 Growing requirements

3.1.1 Climate

Sago plants necessitate an ample supply of water throughout their growth period. The water availability ranges from 2,000 to 4,000 mm per year and is evenly distributed throughout all seasons.

3.1.2 Land

Swamp and peat land types or along river banks are ideal growing places for *Metroxylon* spp. Sago areas that receive periodic flooding or tidal influences or a good drainage system can improve the appearance of sago. The change of freshwater entering the sago planting area will bring several nutrients that the sago needs, such as potassium, phosphate, calcium, and magnesium. Sago plants can grow and develop up to a height of 700 m above sea level, but the optimal height is < 400 m above sea level. The type of soil needed is a broad spectrum, starting from soil with a clay composition of >70% with 30% organic matter and a soil pH of 5.5 – 6.5, but sago can adapt to higher acidity.

3.2 Planting material

Sago plants can be propagated by seeds (generative) but are generally propagated by saplings (vegetative). Preparation of the sago growing location includes clearing large plants, bushes, and shrubs. Other preparations include setting up a drainage system in the form of building a water canal (if the location is in a swamp or peat). The drainage system created aims to maintain the depth of groundwater in peatlands to a maximum of 50 cm from the ground

surface. Canals are also roads for production, transportation, distribution of workers, and production and harvest facilities.

Sago is planted at varying distances from 8 m to 10 m using a rectangular planting system. The spacing and planting system are adjusted to the type of sago because it is related to the size of the canopy. If possible, different types of sago are planted separately, forming planting blocks of a certain size, for example, 1 ha.

Sago is planted in a hole measuring 30 x 30 x 30 cm. Seeds that are planted should be supported by bamboo bones and placed crosswise at the front of the seed stem after being covered with soil up to the neck of the seed. The success rate of young plants in the planting area is greatly influenced by water availability. Planting should be done during the rainy season or depending on water availability. Seed leaves are trimmed (30-50 cm from the buttress) to reduce transpiration and provided with shade. The advantage of sago plants is that planting is only done once and there is no such thing as "rejuvenation" but rather the reduction or management of saplings per hill. So, sago cultivation is the most efficient farming compared to other annual/plantation crops. The success of sago cultivation is determined by the farmer's ability to control the population of saplings or sago plants in one grove. The chick population can only be controlled by pruning or reducing the number of chicks. Each clump should consist of 8-10 sago plants with different growth phases. For example, the levels of plant growth phases in one sago clump are maintained at seedling phase = 3 plants, sapling = 2-3 plants, pole = 1-2 plants, and tree = 1-2 plants. The uniqueness of the sago plant is that saplings in a clump can appear in various directions and distances from the centre of the clump.

Caring for sago is not much different from other palm plants. In general, plant maintenance includes controlling weeds (block or per plant or clump), controlling major pests, thinning saplings, and securing the development site (fire prevention).

3.3 Harvesting and processing

3.3.1 Criteria for sago palms

The main characteristics of a sago tree that is ready to harvest visually are the size of the trunk the largest height in one clump and the number of leaves on the top/crown which is 3-4 midribs and flowers have not yet appeared.

3.3.2 Sago pith processing techniques

Cutting sago trees during harvest is generally done manually (conventional) and mechanically (chainsaw). At the farmer level, such as in Papua, sago is generally processed in a simple way, causing a lot of sago starch to be wasted. On the other hand, pith processing using mechanical and semi-mechanical methods is capable of producing more starch.

3.3.3 Sago Starch Processing

3.3.3.1 As a food ingredient

Sago starch has been processed into food for a long time and has even become a traditional main food in several sago centres. Papeda or limestone is an example of the use of sago starch as the main food ingredient in Papua, Ambon, and South Sulawesi. To become dry sago starch, sago starch is dried in the sun on a winch or dried using a dryer until it reaches a water

content of less than 13% on a wet basis (bb) by the quality requirements for sago starch based on SNI 01-3729-1995 [11]. Dried sago starch will rustle when squeezed. The result of this drying is called coarse starch. The coarse starch is then pounded or ground until fine at least 80 meshes so that it becomes powdered dry sago starch better known as sago flour. People in Papua make dry sago starch, namely by drying sago starch that is still wet. One tumang (sak) or the equivalent of 50-60 kg of wet sago starch, was stirred with clean water and filtered to separate the sago starch from the remaining dregs and other foreign objects. Next, the sago starch is deposited for 3 days to remove the mucous sap and remaining sago dregs, then soaked in water for 1 hour. The waste and sago starch are exposed to the air and left to dry under the sun for 6 hours. Afterwards, the dried starch is processed by grinding it using a grinding machine, followed by sieving and packaging [11]. According to the research conducted by [12], the chemical composition of sago starch dried using a cross-flow fluidized bed dryer is not significantly different from that dried using conventional methods. Therefore, the dry sago starch produced by the dryer is of high quality. Additionally, this dryer enhances the physicochemical properties of sago starch due to its utilization of low drying temperature and short drying time. The air used to soak the waste and sago starch is dried in the sun for 6 hours. The dried starch is ground using a grinding machine, sieved and then packaged [11]. The findings of the study conducted by [12] indicate that the chemical composition of dry sago starch, which has been dried using a cross-flow fluidized bed dryer, is comparable to starch dried using traditional drying methods. Therefore, the dry sago starch produced by this dryer is of high quality. Additionally, this dryer enhances the physicochemical properties of sago starch due to its utilization of low drying temperature and short drying time.

3.3.3.2 Alternative energy materials

Sago starch has various uses. Apart from being a food ingredient, it is also a source of energy (fuel). The processing of ethanol from sago starch goes through two stages: Processing wet sago starch into bioethanol is a process starting with gelatinization, liquefaction, and saccharification followed by fermentation and distillation

4 Preserving traditional sago products that still exist today

4.1 Kapurung, sinonggi and papeda

Papeda (traditional food from Maluku and Papua), *kapurung* (traditional food from Luwu, South Sulawesi), and *sinonggi* (native food from Southeast Sulawesi) are sticky doughs that are considered nasi (rice). This particular cuisine has brought a new wave of excitement to the culinary scene in Indonesia, specifically within the sago-based food industry. It is prepared by combining starch with water until a suspension is formed. By gradually adding hot water to the sago flour and continuously stirring, the suspension achieves a consistent and sticky texture. This dish is typically served alongside complementary side dishes, including yellow sauce, yellow fish soup, and vegetables. Notably, numerous restaurants have emerged in major cities like Makassar and Jakarta, catering to the growing demand. Before 1999, Makassar had no establishments specializing in *kapurung* cuisine. However, the number of restaurants has significantly increased from just one in 1999 to 23 in 2012 [13]. *Kapurung* Restaurant, for instance, offers *kapurung* as its signature dish and provides other sago-based delicacies like *dange, cake*, and *bagea* to cater to the diverse preferences of consumers [13]. Currently, there are instant *kapurung* in cans. The results of the physical, chemical, and microbiological analysis of canned lime were water activity (aw) 0.93, total plate count (TPC), spore-forming thermophilic aerobic bacteria and thermophilic anaerobic

bacteria <10 colonies/gram, while *C. perfringens, Salmonella*, and Staphylococcus aureus were not detected (negative), the proximate analysis yielded water content of 89.4%, ash 0.90%, protein 2.15%, fat 2.98%, carbohydrates 4.57%, sodium 152 mg/100gram and calories for A 300-gram serving size is 160 calories. The results of the expiration test using the Accelerated Shelf Life Testing (ASLT) method at a temperature of 30°C obtained a shelf life of 12.63 months. Based on the Regulation of the Head of the Food and Drug Supervisory Agency - Republic of Indonesia (BPOM RI) Number 24 of 2016 concerning Requirements for Sterile Commercial Food, canned lime is declared safe for consumption by consumers [14].

4.2 Plate sago (*dange*)

Plate sago comes from Papua and Maluku and is widely consumed in the Luwu Raya area, South Sulawesi. The sago starch is sifted and put into a previously heated clay mold (forna), then covered for 15-20 minutes until cooked.

4.3 Pearl sago

Pearl sago is a processed sago starch product in the form of clear white or colourful granules (after cooking) and is consumed as a snack in the form of pudding or porridge [15]. Sago Pearls or sago grains have a round shape with a gelatinized outer layer. In its use, pearl sago has the potential to serve as a viable alternative to rice in culinary applications. Sago Pearls can be made from wet or dry sago flour. If dry sago flour is used, it needs to be wetted first before the crystallization process is carried out. However, if wet sago flour is used, the crystallization process can be carried out directly. The purpose of crystallization is to destroy sago flour that has lumped due to wetting. Crystallization can be done by kneading sago flour on a sieve with a diameter of 1 to 2 millimetres or by using a crystallizing machine. After the crystallization process is complete, the granulation process continues. The nutritional value of pearl sago can be enhanced by incorporating walnuts into the treatment, namely protein by 2.38 - 5.83%, fat by 2.43 -10.02 and minerals by 0.21 -0.55%. Based on organoleptic testing, the addition of up to 9% walnuts was still preferred by the panellists. Storage of pearl sago products in PP/alufo/PP packaging is better than LDPE packaging because it can reduce the increase in water content and fat content of the product, and decrease protein value, colour brightness, and product hardness [16].

4.4 Snacks

Snacks that still exist today are *bagea* and cake. *Bagea* is a traditional cake typical of Maluku, North Maluku, and Palopo City, South Sulawesi, Southeast Sulawesi, Indonesia. *Bagea* are usually round and pale brown. *Bagea* is a processed form of sago. Usually, *Bagea* is eaten with tea or coffee. In Ternate, *Bagea* is usually added with walnut kernels. The ingredients for making *Bagea* are powdered sugar, chopped walnuts, sago flour, vegetable oil, sifted wheat flour, finely chopped peanuts, ground cinnamon, and ground cloves. since the beginning of 2020. *Bagea* cake is a healthy snack during the COVID-19 pandemic because of the added taste of ginger as an herbal plant that can improve the body's immune system and prevent various diseases [17].

Another cake is made by heating sago flour and brown sugar water which is eaten with grated coconut. This cake is made from sago which is liked by all levels of society, both young and old, this food ingredient can be used as a side dish for elderly people, because this cake has a soft texture, making it easier for parents (elderly) to eat it. [18] stated that food

made from sago is preferred by older people. However, if you look at it from a nutritional perspective, sago is a food rich in carbohydrates but low in protein and minerals. Based on the research results of [19] the selected seaweed substitution cake formulation is a substitution of 40g seaweed and 60g sago with the characteristics of a shinier brown appearance, chewy texture, typical cake aroma, and a delicious and sweet taste. The results of the chemical, physical, and microbiological quality characteristics of the selected products show that seaweed cake has a water content of 35.35%, ash content of 1.7%, Ca 12%, crude fibre 2%, gel strength of 816.97 g/cm^2.

5 Developing Sago product

Nowadays consumers are increasingly smart in choosing healthy and cheap food. Sago is a gluten-free food ingredient. Although not as much as wheat or buckwheat flour, sago flour is naturally gluten-free and is a suitable replacement for wheat flour for those who have celiac disease or follow a wheat-free diet. Sago flour contains antioxidants and anti-carbohydrates including reduced blood sugar levels, decreased appetite, and better digestion. The nutritional content per 100 grams of sago flour is 332 calories, protein < 1 gram. Fat < 1 gram, carbohydrates 83 grams, fibre < 1 gram, and zinc 11% of the Nutritional Adequacy Rate (AKG). Sago flour is also used to make bread, biscuits, and crackers. Sago flour can be used to make dishes such as alat, a type of pancake popular in Malaysia. Apart from that, commercially, sago flour is used as a thickener in various foods [20]. Sago flour is a type of gluten-free flour that can be used to make many foods that use sago flour as the main ingredient, among others :

5.1 Sago quiche

Sago quiche filled with cheese and spinach. Quiche is a type of pie that originates from France. The quiche crust can be made from sago flour to make it healthier because it is gluten-free.

5.2 Cinnamon cookies

Cinnamon cookies, which are a variant of dry cake, generally use low protein flour so that the cake texture is crispy. However, you can get similar crispy dry cake results by using sago flour.

5.3 Sago cheese kastengel

Sago cheese kastengel can be made using sago flour to reduce gluten consumption. The texture of kastengel with sago flour is quite crunchy and melts in the mouth.

5.4 Panna cotta

Sago is generally made into a traditional snack. However, it can make modern snacks such as panna cotta with sago as the main ingredient. Panna cotta is an Italian dessert that is thickened and identical to gelatin. The sticky character of sago flour can replace gelatin in making panna cotta.

5.5 Cireng

Sago can be a mainstay ingredient for making West Javanese snacks. Cireng, cimol, cilok, cilor, and various other snacks use sago. Cireng cooked by frying is also easy to make because it only requires a few simple ingredients.

5.6 Milk bread

Milk bread, which is often called torn bread or soft white bread made from milk, usually uses high protein wheat flour which also has a high gluten content. If you are reducing gluten consumption, you can still make milk bread by replacing the wheat with a mixture of sago flour and three other gluten-free flour.

5.7 Boba

Home-style boba can also be made from boba or tapioca seeds using sago flour. Many drink menus can be creative with boba. One of them is milk tea brown sugar boba

5.8 Sago noodle

Sago noodles or gleser noodles - also called glosor noodles or leor noodles - and their preparations are popular during the month of Ramadan in the Bogor, Cianjur, and Sukabumi areas. Glaser noodles have the appearance of a rubber band soaked in kerosene: bloomy, pliable, and springy. Glazed noodles don't crumble easily in hot soup. This is possible because it is made from sago flour (*Metroxylon sago* Rottb.), which in Maluku or Papua is usually processed into papeda or limestone, aka sago porridge, enjoyed with fish sauce. The levels of digestible starch in sago noodles reach 7.55 -9.45 mg/g noodles, Pancasan sago noodles have higher levels of digestible starch than other sago noodles, namely 9.45 mg/g noodles. Sago noodles are classified as a type of food with a low glycemic index (28) with a low GI. It is hoped that this food can be utilized by DM sufferers [8].

6 Efforts to sustain sago processing

The sustainability of the sago flour processing business is greatly influenced by both social capital and economic capital. Various aspects of social capital, such as cooperation or collaboration, the implementation of written rules, and the job responsibilities of sago processors, along with the support from the government, play a significant role in ensuring the business's sustainability. On the other hand, economic capital also plays a crucial role in supporting the continuity of the sago flour processing business. Factors like the quality of production, maintenance and supervision of machines, and the performance of the workforce contribute to the business's long-term success [21].

Climate change poses a significant threat to sustainable food production, and numerous measures have been taken to mitigate the potential risk of food shortages in the future. The primary focus of discussions and research has been on developing new plant varieties that can adapt to changing environmental conditions, thereby ensuring continued production. Introducing drought and heat-resistant crops has been one such effort to counter the decline in food production. Additionally, advancements in crop cultivation techniques have been made to enhance the suitability of changing environments for crop growth. These endeavours primarily aim to preserve the dietary preferences of people in specific regions and countries. However, ensuring food availability can also be achieved by altering people's food habits,

thereby relying on food sources that are less susceptible to the impacts of climate change. In Indonesia, for instance, rice serves as the main staple food and a crucial livelihood resource for the majority of the population. However, rice production heavily relies on favourable climatic conditions, including adequate rainfall, suitable temperatures, and air quality. On the other hand, resources like cassava and sago, although not considered major staple foods, play a significant role and their production remains relatively unaffected by climate change [22].

The Kendari City Government has committed to exploring local food resources in Southeast Sulawesi, including the sago plant which is a raw material for traditional food, through support for the development of Micro, Small, and Medium Enterprises (MSMEs). The strategy for developing the sago home industry in Southeast Sulawesi Province can be carried out by maintaining traditions as typical food, improving marketing, using appropriate technology in processing sago, improving product quality, and supporting government capital [23].

Sago is a commodity that is relatively unaffected by climate or natural disasters. Furthermore, sago exhibits remarkable efficacy in delivering vital calories. Sago flour and its derived products are extensively consumed as primary sustenance and delectable treats by numerous individuals, particularly those residing in coastal regions or low-lying areas. The various studies that have been carried out should be utilized in processing sago-based foods. It also promotes sago as a staple food, healthy snack, or wheat-based substitute food to the Indonesian people.

The utilization of sago by local communities has demonstrated its versatility, offering potential for the expansion of home industries and subsequently benefiting farmers economically. Sago serves as a crucial ingredient in the food industry, and its demand is projected to rise in the coming years. There are 63 products made from sago, spread across 21 of 33 provinces in Indonesia, which provide many benefits, and of course, have high food potential to be further developed so that they can be more widely accepted, particularly in the realm of processing endeavors within the food industry domain. [24].

7 Conclusion

One of the problems faced in the sago production process is the low yield of the results of processing sago pith into sago. It is estimated that around 6 million tonnes of dry starch is wasted because it cannot be recovered in processing. The low production of sago is because most of the community is responsible for conducting the processing of sago carried out using traditional methods where only minimal equipment is used, so processing sago which is done only feels more difficult. Efforts to increase sago production are to carry out cultivation as recommended. Meanwhile, to enhance the utilization of sago, one must augment the quantity of processed sago-based products, both traditional and conventional, with various innovations. It also promotes sago as a staple food, healthy snack, or wheat-based substitute food to the Indonesian people.

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