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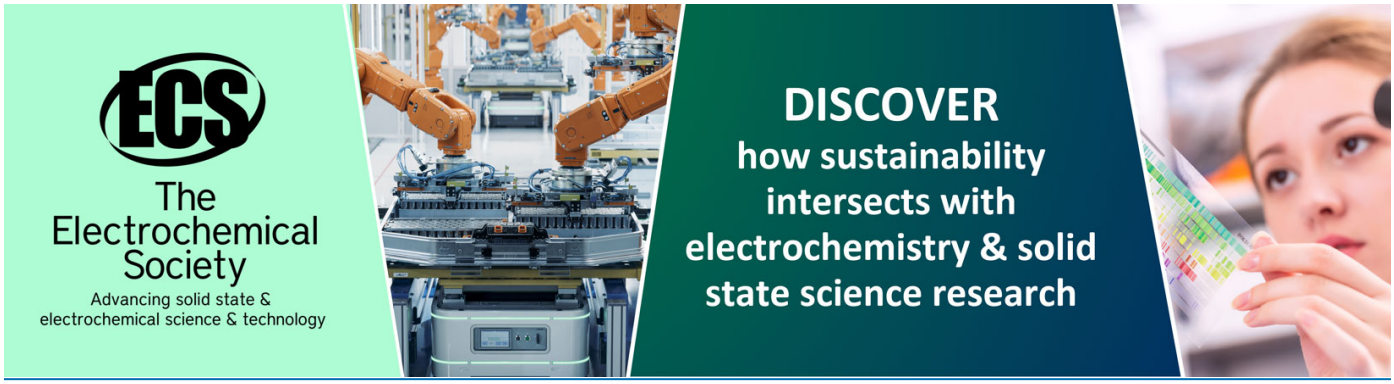

Identification of the distribution and characteristics of local sago from Kendari, Southeast Sulawesi

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Abstract. In eastern Indonesia, particularly Southeast Sulawesi, sago is an important commodity as a carbohydrate-producing plant. Carbohydrate output can reach 15-24 tons ha-1 annually, surpassing rice, corn, and wheat. Southeast Sulawesi, notably the Kendari mainland, relied on sago starch until rice became the predominant carbohydrate source. Sago starch, like other basic starches, has no taste. Sago does not contain fat or protein, so it must be eaten alongside other local foods that do. Sago palms grown naturally produce 2–5 tons of dry starch per hectare. With 500 sago clumps per acre of varied ages, 100 trees might be harvested annually. . Well-maintained farms can generate 150 kg of starch palm and 15 tons ha^{-1}. Currently, only 5,912 ha are planted with sago, from the total area in 1985 was 13,000 ha. Sago development requires characterizing and identifying Kendari Southeast Sulawesi's local sago. The results showed that there were three dominant types of local sago in Kendari, namely sago molat, sago tuni and sago borowila, originating from the main sago production centres in Kendari such as in Tobimeita, Abeli and Pohara.

1. Introduction

In eastern Indonesia, particularly Southeast Sulawesi, the sago palm is a staple meal and valuable commodity [1]. Southeast Sulawesi and has high productivity as a carbohydrate-producing plant. The potential for carbohydrates produced can reach 15-24 tons ha^{-1} yearly, which is higher than the production potential of other carbohydrate-producing plants such as rice, corn, and wheat [2]. Before rice became the main source of carbohydrates, sago starch was the main source of food for the people who live in Southeast Sulawesi, especially in the Kendari mainland area. Like other basic starches, sago starch itself has no taste and is usually flavoured with other food ingredients.

The stem and flour of the sago palm have multiple applications [3]. Sago is used as a raw material in many different industries, including the production of ethanol [4], bio-plastic materials [5], liquid sugar [6], food flavouring [7], the medical business [8], and animal feed additives [9]. In addition to providing a source of income and sustenance, the sago industry also helps to alleviate poverty in rural areas. With a potential annual dry sago production of between 5.1% and 8.11% million tons, Indonesia's sago potential has reached one million hectares. More than 90% of Indonesia's sago area is located in Papua. Although sago has many applications, it is becoming increasingly difficult to cultivate since traditional sago fields are being converted to other crops [10], as well as human settlements [11-12]. Sago agriculture is still extractive; farmers harvest harvesters without replanting, contributing to the shrinking

sago land area. If this circumstance persists, the sago plant may go extinct. It is important to classify and identify the range of indigenous sago from Kendari, Southeast Sulawesi, as sago palm conservation and cultivation are both on the agenda.

2. Methods

This research was conducted in the Kendari Peninsula as the largest sago producing area in Southeast Sulawesi. This research is exploratory research on smallholder sago plantations in the main sago-producing centres in Southeast Sulawesi. The characteristics of sago plants to be described are first determined by the blocks of sago land with the following conditions: (1) sago plantations are monoculture and grow in groups, (2) environmental conditions are relatively homogeneous, (3) sago plantations grow regularly and do not grow much. experience death, (4). Sago is free from pests and diseases, (5) is at least 10 years old, and (6) has a minimum planting area of one hectare. The data obtained from the observations were analysed by descriptive statistics, then based on the observed variables, superior sago clones were determined from the Kendari Peninsula, Southeast Sulawesi Province. Observations were made at least 10 trees for each planting block. The variables observed included: stem (height, diameter and thickness of the bark), leaves (shape, colour, length, spines and leaf midrib type), pith (hardness level, flour content, pith colour), sago colour and number of tillers (less, moderate or high). Then also the age of ready to harvest and the production of sago flour per stem. From the data collected, superior clones will be determined with criteria based on harvest age, sago production and number of tillers. Sago plants are classified as promising superior crops if the harvest age is not more than 11 years, the stem population per clump is more than 15 stems, the pith starch content of at least 18% (wet weight percent), and the wet sago production of at least 200 kg per stem.

3. Results and Discussion

3.1. Condition of sago planting in the Kendari Peninsula

For the most part, sago plants in Southeast Sulawesi thrive in either arid or rain-fed environments that are periodically flooded, as well as in swampy or continuously flooded areas. It is challenging to cultivate sago plants successfully. The community and sago growers have yet to make any effort to replant; instead, they focus solely on extractive harvesting. The total area of Southeast Sulawesi's sago plantations dropped precipitously from its original 13,706 hectares to about 5,912 hectares as a result of this pattern of exploitation.

Table 1. The area of sago plantations in the Kendari Peninsula, Southeast Sulawesi

District	Sago Acreage (ha)			Total
	Sago Productive	Young Sago	Unproductive	
Konawe	1,794	890	57	2,741
South Konawe	718	840	44	.602
Kendari	42	60	-	102
Kolaka	654	134	29	817
North Kolaka	622	1	27	650
Total	3,830	1,925	157	5,912

The shrinkage of the area of sago plantations is also caused by the conversion of land functions from sago plantations to other crops such as rice fields, settlements and other designations. Of the sago plantation area which currently reaches 5,912 hectares [13], about 65.00% of them (3,830 ha) are productive sago, 32.50% of the area (1,925 ha) is unproductive sago and the remaining 2.66% or 157 ha is unproductive sago palm (Table 1). In general, the types of sago found in Southeast Sulawesi are

divided into two types, namely spiny sago and non-spiny sago. Types of sago that are included in the prickly sago group include (1) sago tuni (runggu manu) and sago rattan (rui). Meanwhile, sago that is not thorny includes (1) sago molat (roe) and sago borowila.

3.2. Identification and characteristics of sago in sago production centres

The identification and characteristics of several important characteristics of sago plantations and their production in several main sago producing centres in the Kendari Peninsula are as shown in Table 2.

Table 2. Characteristics of sago plants and their production in several sago-producing centres in the Kendari Peninsula

No	Criteria		Location				
			Landono	Tobimeita	Abeli	Pohara	Poli-polia
1	Trunk	Height (m)	9.62	10.23	10.12	9.65.	9.54
		Diameter (cm)	59.75	59.95	56.25	57.25	51.15
		Stem Thickness (cm)	3.12	3.15	3.16	3.25	3.25
2	Leaf	Colour	Green	Green	Green	Green	Green
		Torn	No Torn	No Torn	No Torn	No Torn	No Torn
3	Pit	Hardness level	Soft	Soft	Soft	Soft	Soft
		Starch content (%)	19.45	21.00	19.85	19.15	18.25
		Colour	White	White	White	White	White
4	Trunk Number	Number	15.15	14.95	16.00	15.75	15.95
5	Harvest Age	Year	10.25	10.45	10.45	10.48	10.52
6	Starch Production	Kg per Plant	150.25	227.65	212.32	207.65	153.35

3.3. Selected Superior Sago Clone

Determination of superior sago clones was carried out based on the criteria of (1) harvest age, (2) sago starch content, (3) sago production per tree and (4) number of tillers per clump. Several characters of selected local superior sago clones are shown in Table 3.

Table 3. Characteristics of growth and production of sago in several sago-producing centres in the Kendari Peninsula

No	Criteria	Location				
		Landono	Tobimeita	Abeli	Pohara	Poli-polia
1	Harvest Age	10.45	11.00	10.67	10.33	10.25
2	Starch content	19.15	19.95	20.15	19.25	19.00
3	Production per trunk	152.50	227.65	211.75	207.15	152.36
4	Trunk number	15.15	15.07	15.45	15.37	15.58

Based on several growth and production characteristics as shown in Table 3, it appears that sago plantations in Tobimeita, Abeli and Pohara are superior to sago production potentials from Landono and Poli-polia. Thus, Tobimeita, Abeli and Pohara sago can be classified as selected local superior sago. The sago germplasm from the three regions (Tobimeita, Abeli and Pohara) has the potential to be used as a source of seeds and sago propagation because it has advantages based on growth and production characteristics.

3.4. Cultivation and Production Improvement

Planting conservation and increasing sago production in Southeast Sulawesi can be improved through rehabilitation patterns in sago plantations which have only been harvested extractive and improvement of sago cultivation patterns from forest patterns to cultivation or semi-cultivation patterns.

4. Conclusions

The results showed that the pattern of sago cultivation in the Kendari Peninsula was generally still extractive and this was possible because the existing sago plantations were generally still in the form of sago forest and not sago cultivation. It is feared that the extractive and exploitative pattern of sago cultivation will threaten its sustainability, so it needs to be preserved with local superior sago clones. Several local superior clones that can be used to rehabilitate sago plants include those from the Tobimeita, Abeli and Pohara areas.

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