Abstracts of International Sago Symposium (25th Annual Meeting of Sago Palm Studies) Local Initiatives in Sago Development for Food Security and Human Resilience: Transforming Knowledge to Action

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Venue: Aryaduta Hotel, Makassar, South Sulawesi, Indonesia

Organizers: The Society of Sago Palm Studies, Sago Study Team, Hasanuddin University, CoT (Center of Technology) and C-BEST JICA Project UNHAS, Faculty of Forestry, Hasanuddin University

Opening Ceremony:

Yusran, Chairman of committee, Dean of Fac. of Forestry, UNHAS

Hiroshi Ehara, President of The Society of Sago Palm Studies, Nagoya University

Muh Ramli, Director of Center of Technology (CoT) Hasanuddin University

Syahrul Yasin Limpo, Governor of South Sulawesi

Dwia Ariestina Pulubuhu, Rector, Hasanuddin University

Keynote speaker: Dr. Muhammad Dimyati, Director General of Strengthening for Research and Development, DIKTI

Session I "Transforming Knowledge to Action: Sago Techno Park Concept"

Sago Techno park proposal for sago development in Tana Luwu

Katsuya Osozawa (Sago Researcher/JICA Expert C-BEST Project Unhas), Makarennu (Head of Sago Study Team Unhas)

View and opinion from local governments in Tana Luwu

M. Judas Amir, MH. (Mayor of Palopo), A. Mudzakkar, MH. (Regent of Luwu), Indah Putri Indriani, M.Si. (Regent of Luwu Utara), Ir. M. Thoriq Husler (Regent of Luwu Timur)

Potency of Sago as Superior Commodity of South Sulawesi

Agus Arifin Nu'mang, MS. (Vice Governor of South Sulawesi Province)

Sago Research Networking

Bintoro Djoefrie (Head of Sago Community in Indonesia), Hiroshi Ehara (The Society of Sago Palm Studies, Japan), Barahima Abbas (Papua State University), Marsus Suti (Rector of Andi Djemma University), Yulius B. Pasolon (Haluleo University)

Session II "Sago forest roles for food security and human resilience"

The Power of Sago starch: Koichi Tsuji (President, Tsuji Safety Food Co.Ltd, Japan)

National Programs of Ministry of Environment and Forestry to Support Sago Development in Indonesia: Sri Tantri Arumdhati, (Ministry of Environment and Forestry)

Sago for Disaster Prevention: Rowena P. Varela (Vice President for Research and Exention, Caraga State University, Philippines)

Session III "Long Journey of Sago Research in the World"

Characteristics of Sago Palm as a Starch Crop in the Tropics: Yoshinori Yamamoto (JICA expert, Myanmar)

Cultural Diversity and Socio-Economic Sustainability of Sago Forest Communities: Yukio Toyoda (Rikkyo University, Japan)

Effect of Micro Powdering Treatment for Sago Hampas Liquefaction and Saccharification: Takashi Mishima (Mie University, Japan)

Economic Aspects in the Production and Distribution of Sago Palm Resources: Cases in Indonesia: Tomohiro Uchiyama (Tokyo University of Agriculture, Japan)

Germination physiology of Sago Plant: Rinaldi Sjahril (Hasanuddin University)

Poster presentation

Decomposition of Sago Starch by Heat-Dry Treatment: Takato Miyazaki (Mie University)

The Idea of Long Lasting Demand for Sago Palm: Saki Ehara (Nagoya University)

Estimating the Starch Yield under the Climate Change from Potential Habitat of Sago Palm using MaxEnt in Sulawesi, Indonesia: Akemi Itaya (Mie University)

The Difference Factors of Sago Farm Household Production in Luwu Utara District, South Sulawesi, Indonesia: Andi Patiware Metaragakusumaa (Ehime University)

Summary and Recommendations: Agnes Rampisela (Hasanuddin University)

Closing Speech: Masaki Tani (Head of Office, Consular Office of Japan at Makassar, Republic of Indonesia)

From Academic Research to Network Activities of Sago Palm

Hiroshi Ehara

International Cooperation Center for Agricultural Education, Nagoya University, Furo-cho, Chikusa-ku, Nagoya, 464-8601, Japan. e-mail: ehara@agr.nagoya-u.ac.jp

The Society of Sago Palm Studies was established in Japan in 1992. The objectives of this society are to contribute for: 1) exchange of the information on sago palm and sago-based culture in the world as well as communications among the researchers and communities; 2) the development of research programs on sago palm production and specific utilization. The great importance of un-/under-exploited plant resource has been stressed by learned persons at every opportunity. Some of them have focused their special attention to sago palm as invaluable resources of starchy stuff, having concern about the vison of food security for all. Some others have emphasized the incomparable usefulness of this plant for the agricultural development of low-lying swampy areas of the tropics, since sago palm can grow in swampy, alluvial and peaty soils where almost no other crops can grow without drainage or soil improvement. The issues for the sago palm development, including production and utilization, are extensive and profound in nature, being interrelated with each other. Therefore, an interdisciplinary approach to the effective implementation of research and development program will be prerequisite. Cooperative and collective activities of relevant disciplines would be strongly required to harmonize and synchronize them. Toward this end, we have held our annual meeting every summer and published the academic journal “SAGO PALM” for 23 years. The international sago symposium was held in Japan in 1985, 2001 and 2015. We have supported to hold the 9th International Sago Symposium in the Philippines in 2008. Furthermore, we took part in the establishment of SNAP (the Sago Network for Asia and Pacific; Chair: FAO, Vice Chair: Indonesia, Malaysia) and participated in the expert consultation meeting on the development of a regional sago network at FAO Regional Office for Asia and the Pacific in Bangkok in March 2013.

Key words: Academic research, Food security for all, Interdisciplinary approach, Network activity, Sago palm

Transforming Knowledge to Action: Sago Techno Park in Tana Luwu

Katsuya Osozawa

Ehime University Japan

Introduction. Mankind, especially at farmers level still not able to cultivate sago palm. Why the cultivation is difficult? The answer is simple, it is because the sago plant is large, much bigger than human body. The origin of all cultivated plants started 10000 years ago. Cereals, potato and vegetables, all are cultivated during the Paleolithic to the Neolithic era. And, those cultivated plants, were adjusted kinds to the size of human body size. The cultivation of a large plant, not possible to be done by one person, teamwork is needed. It is, a university-industry and government collaboration areas, and also a team-work across generations. On the other hand, there are also the benefits of large size. Large sago palm with large leaves create clumps and forming a sago forest. In other words, it creates a green, comparable to the tropical rainforest, which protect the environment, conserve biodiversity, and has capacity for disaster prevention function. Now, we try to utilize the merit of large size, to create forest while developing the cultivation technique and knowledge to support the local development.

New Social model. The development of eastern part of Indonesia mostly depend on the cultivation skill of agriculture, forestry and fisheries. Utilizing sago palm we can create a model of society forest co-existence, a new social model which was not exist until now.

This new social model attempted in South Sulawesi is targeted to be a model for the development in other region in eastern part of Indonesia, where sago palm exist. John Perlin in "forest and civilization", describe our history that during these 5, 000 years the human race developed a civilization by utilizing forest, and by eat up the forest started destroy the civilization. In other words, Europe and the United States were not created a "civilization that coexists with the forest". If, in Tana Luwu, by using sago palm we can create a new social model that never been anyone realized until now, we can lead the future of human history.

Vision of Techno Park Tana Luwu. Based on the agreement of three (3) regencies and one city (Kab.Luwu, Kab.Luwu Utara, Kab.Luwu Timur, and Palopo City) in the seminar of the sago palm, this concept of Sago Techno Park in Tana Luwu is developed. The core concept are: (1) Cultivation of sago plant. In order to cultivate sago plant, it is important to do research in how to produce superior sago seedlings and estimation of starch production and others. These kind of information are provided by high quality research result from all over the world, especially from Sago Palm Society. (2) Increasing of local socio economic condition. Active participation of local community is the key but the support from Japan small and medium enterprises is also considered. To be able to compete other countries such as Singapore and Malaysia, high quality product is important. Challenge here is how to build a local community based high quality small enterprises which can produce high quality product. (3) Promotion of locally produced safe and healthy food. Sago is famous for its pure contents of carbohydrate. Japan listed it as safe and healthy food for allergic patients and also explores other healing capacities.

Merit of local development based on sago. Development of Sago Techno-park will provide chance for local government and local farmers to design a development framework based on local resources and will provide opportunity to gain support from researchers and research institute both in local, national and international level, such as Sago Society. In the other hand, local industry will also developed and if necessary collaboration with small scale industries from other countries in order to achieved high skill and human resource development will be established. Knowledge and skill in sago cultivation will resulted larger forest area and local community will learn how to utilize the capacity of sago forest in environmental protection and biodiversity to deal with disaster prevention. We hope that all knowledge, experience and research result in this Sago Techno-park will spread and be introduced to the world and we believe that in the near future this model will contribute to the policy of Indonesia National Government

Characteristics of Sago Palm as a Starch Crop in the Tropics

Yoshinori Yamamoto

Former Faculty of Agriculture, Kochi University, Nankoku-shi, Kochi-ken, 783-8502, Japan.
*e-mail: yamayosi@kochi-u.ac.jp

Sago palm (*Metroxylon sagu* Rottb.) is indigenous to the lowlands of Southeast Asia and Melanesia, located between latitude 10°N and 10°S, up to an altitude of 700 m (Flach 1986). Sago palm accumulates a lot of starch in its trunk (pith) and has been utilized as a staple food by local people for long time, and in recent years, much attention has been paid to sago palm due to the high starch productivity. Sago palm is the only crop which can grow on the marginal land such as peat soil, flooding area during rainy season, etc. under low input conditions. Accumulating starch in the trunk for long years means that sago palm is more tolerable to meteorological conditions caused by climate change compared to cereal, root and tuber crops. The starch yield of sago palm shows the highest at around flowering stage and its range varies from nearly 0 to 1000kg per palm with the average of around 300kg. The starch yield is influenced by many factors, but the great difference among varieties (folk varieties) are reported. The varietal differences are mainly based on the trunk (pith) biomass differences, but not by the starch percentage. The biomass differences among the folk varieties are caused by the differences of leaf area per palm. The starch productivity of sago palm per unit area may be higher than those of the main cereal, root and tuber crops, if the management would perform well. The starch characteristics are similar with those of root and tuber crops except the amylose content and retrogradation which are similar with those of cereals. The nutrition of sago starch is very similar with that of cassava. From these characteristics of sago palm, I concluded that sago palm should be considered a high potential starch resource crop in the Tropics especially in progress of global climate change.
Key words: Climate change, Growth, Productivity, Sago palm, Starch

Cultural Diversity and Socio-Economic Sustainability of Sago Forest Communities

Yukio Toyoda

College of Tourism, Rikkyo University, Kitano, Niiza-shi, Saitama-ken, 352-8558, Japan
*e-mail: ytoyoda@rikkyo.ac.jp

Sago palm (*Metroxylon sagu* Rottb.) grows in the lowlands of Southeast Asia and Melanesia, and sago is the staple food in some areas of Indonesia, Malaysia and Papua New Guinea. In the surrounding areas, sago is used only as supplementary food to the other food, such as rice, taro and yam, or only used in the period of famine, or it is not consumed any more. In the area where sago is the staple food, there are several characteristics about sago usage. First, the time of labor input of getting sago is shorter than the other crops, such as rice. In this sense, getting sago starch is an efficient way of getting staple food. Second, since most of the ingredients of sago starch is carbohydrate, the other nutrition, especially protein, must be taken for meals together with sago starch. Protein is consumed mostly in the form of fish, since the sago grows in swampy areas. Third, the industrialization of sago starch is possible only with certain conditions. One condition is that we must have a good access to the sago forest. Quite often, sago forest is located in swampy areas, and in many cases it is located sparsely and not collectively.

It is hard to construct roads to get there, and therefore, bringing out the product from the forest is not easy. Another characteristic of sago growing area is that the people use sago not only as food, but also for various purposes, such as for constructing materials. It is often used as thatching materials even in the places where sago is not consumed as food. Therefore, when we construct large scale of sago plantations, it is necessary to consider that sago forest gives various kinds of benefits to the local people.

Key words: Industrialization, Constructing Materials, Labor input, Plantation, Starch

Effect of Micro Powdering Treatment for Sago Hampas Liquefaction and Saccharification

Takashi Mishima[1]*, Budi Santoso[1,2], Kotatsu Sakakura[1], Hitoshi Naito[3], Masaharu Ohmi[4], Yoshihiko Nishimura[1], Tomohiro Uchiyama[5], Akemi Itaya[1], Makoto Hisamatsu[1], Hiroshi Ehara[6]

[1] Mie University Tsu, 514-8507, Japan, [2] Papua University, Manokwari, West Papua 98314, Indonesia, [3] Kurashiki University of Science and The Arts, Kurashiki, 712-8505, Japan, [4] Tokyo University of Agriculture and Technology, Fuchu, 183-8538, Japan, [5] Tokyo University of Agriculture, Setagaya, 156-8502, Japan, [6] Nagoya University, Nagoya, 464-8601, Japan. * e-mail: mishima@bio.mie-u.ac.jp

The objectives of this study are to recover the starch from Sago hampas using micro milling process, and to understand the effects of the milling process for the physicochemical properties on sago starch.

Resent year, some researcher proposed how to use sago hampas using bioconversion technique. Because sago hampas have much starch in there. The starch in the hampas fixed with strong fiber, the Rasper cannot release them. So, we applied milling process to release fixed starch in the hampas.

We compared dry and wet milling process for the hampas. We thought the milling process give physical effect for starch and fiber in the hampas. We observed the shape using polarizing microscope and SEM after the milling processes. And we measured crystallinity using X-ray diffraction meter, size distribution using laser scattering after that. The dry milling sago starch showed strong damage, and wet milling showed small damage. And the dry processing needed longer processing time and coolant to keep the mill machine than the wet milling.

The enzymic liquefaction and saccharification are important method for bioconversion from starch to glucose syrup. We tried to make it using wet milling sago hampas and we got some information from this processing.

Key words: Liquefaction, Micro milling process, Saccharification, Sago hampas

Economic Aspects in the Production and Distribution of Sago Palm Resources: Cases in Indonesia

Tomohiro Uchiyama[1*], Yoshihiko Nishimura[2], Yulisu B. Pasolon[3], Hiroshi Ehara[4]

[1]Tokyo University of Agriculture, Setagaya, 156-8502, Japan, [2]Mie University Tsu, 514-8507, Japan,

[3]*Haluleo University,* [4]*Nagoya University, Nagoya, 464-8601, Japan.* * e-mail: tu205722@nodai.ac.jp

The objectives of this study are to reveal actual conditions of sago production and distribution in Indonesia, by a series of case studies in Southeast Sulawesi and Java from socio-economic viewpoints. The findings are as follows.

First, in Southeast Sulawesi, sago starch is distributed locally, and provides substantial profit to processors. As the demands are stable and rising, it is possible to improve the income by increasing efficiency of sago starch extracting process.

Second, there are some production of sago starch in Bogor area in the Central Java, where is far from sago growing areas. There is some possibility that the case in Bogor can survive because it is the only one business in the area. However, it is indicated that sago extracting industry may be able to develop, by relocating extracting process nationwide, in the same way as Malaysia.

Third, currently barks, leaves and residues of sago palms are used as biomass, such as firewood, building materials and composts. By pursuing the multi-use direction, sago palm may be able to provide additional income to producers.

As this study reveals, the cost structure of sago and starch production differs according to the region in Indonesia. To make clear the actual situation and key factors for sago industry, the further study, such as quantitative surveys, are required.

Key words: Cost and profit structure, Distribution, Locations

Decomposition of Sago Starch by Heat-Dry Treatment

Takato Miyazaki[1]* and Takashi Mishima[2]**

[1]*Faculty of Bioresources, Mie University, 1577 Kurimamachiya-cho, Tsu, Mie, 514-8507, Japan*

[2]*Graduate School of Regional Innovation Studies, Mie University, 1577 Kurimamachiya-cho, Tsu, Mie, 514-8507, Japan.* *e-mail: 513151@m.mie-u.ac.jp, **e-mail: mishima@bio.mie-u.ac.jp

Starch heat treatment is known as processing method of the food material. Properties of starch with heat-dry treatment (HDT) wheat, potato flour and so on, have been investigated. For example, British Gum is known as one of the oldest HDT starch. It is almost completely soluble in water, does not separate from solution on standing and has a low reducing value (A.Thompson *et al.* 1958). Sago starch is one of the resource for various uses in Southeast Asia. For example, sago starch is used for Papeda, noodle, cookie, and so on. And we have interested about HDT sago starch.

Then, decomposition of HDT sago starch was investigated. Sago starch treated by dry-heat for 0.5, 1, 2 hours at 200 °C and degraded them with isoamylase for 24 hours, were subjected to SEC. On this study, we classified long chain fraction group (Fraction 1) that is composed of M.W.≥ 15,000, middle chain fraction group (Fraction 2) that is composed of 5,000 ≤M.W.≤ 15,000 and short chain fraction group (Fraction 3) that is composed of M.W.≤ 5,000.

Results of HDT sago starch showed that long chain fraction decreased and decomposed as treatment time was longer. And HDT sago starch decomposed by isoamylase was showed fraction 1 decreased with treatment time, and Fraction 3 slightly decreased with treatment time, too. But Fraction 2 increased. Fraction 1 was inferred to

be decomposed and move other fractions. And Fraction 3 may polymerize with other fractions, and may become higher molecular weight.
Key words: Decomposition, Heat-dry treatment, Sago starch, SEC

The Idea of Long Lasting Demand for Sago Palm

Saki Ehara

Media Professional Studies, Graduate School of Languages and Cultures, Nagoya University, Furo-cho, Chikusa-ku, Nagoya, 464-8601, Japan. e-mail: ehara.saki@c.mbox.nagoya-u.ac.jp

Sago Palm has great possibilities, not only for traditional way of staple food or sweet stuff, but also for other occasions as well. As many people know, even in Japan, sago starch is used for anti-allergic food material and a cosmetic brand recently started to use sago starch (sago pearl) for cosmetic item, a “massage bar”. Therefore, we can notice that sago palm is in further demand. To respond to market demand, the appropriate strategy how to ensure stable quantity of sago starch will be needed. Moreover, it is necessary to the expansion of reliable demand and at the same time it should be sustainable. For the sustainable growth in the demand, first of all, the branding should be focused on. In case of sago palm in South Sulawesi, it would be recognized as “*regional brand*”. Then, to make the PR (public relations) for sago palm, the IMC (integrated marketing communication) is the key point. Seeing the current situation of the Indonesian media-use, which is overwhelmingly effective PR activities by TV. On the other hand, in Indonesia, the growth of internet penetration rate is soaring in the last few years, and it is proven that the use of SNS is nearly 90%. In addition, it is said that Indonesia's internet population will overtake Japan within a few years. If aggressive tactics of PR for sago palm can be considered based on these facts, it will be able to maintain long lasting demand of sago starch.
Key words: Branding, IMC, Long lasting demand, PR, Sago palm

Estimating the Starch Yield under the Climate Change from Potential Habitat of Sago Palm using MaxEnt in Sulawesi, Indonesia

Sri Een Hartatik[1], Akemi Itaya[1*], Hiroshi Ehara[2], Makoto Hisamatsu[1], Takashi Mishima[1], Tomohiro Uchiyama[3], Hitoshi Naito[4], Masaharu Ohmi[5], Yoshihiko Nishimura[1], Chay Asdak[6], Dicky Muslim[6]

[1]Mie University, Tsu, 514-8507, Japan, [2]Nagoya University, Nagoya, 464-8601, Japan, [3]Tokyo University of Agriculture, Setagaya, 156-8502, Japan, [4]Kurashiki University of Science and The Arts, Kurashiki, 712-8505, Japan, [5]Tokyo University of Agriculture and Technology, Fuchu, 183-8538, Japan,
[6]Padjadjaran University, Bandung, 40132, Indonesia. * e-mail: itaya@bio.mie-u.ac.jp

Sago palm is an important crop to cope with global food security and energy problem. Due to the increasing of rice consumption, sago palm production and consumption is decreasing. Investigating the distribution of sago palm is important to ensure the sustainable use of the palm. The purpose of this study was to predict the future distribution and harvesting of Sago palm affected by the climate change using the MaxEnt model and it was compared with the current prediction that was predicted in our previous study. We showed only small area (129,800ha) was suitable for sago palm in our previous study. It was 4 times of semi cultivated stands (30,000ha). The maximum temperature of the warmest month had the highest contribution for probability in that study. MIROC5-RCP85 expected to rise to 35.2 ^{o}C in current from 32.8 ^{o}C in 2070. Sago palm distribution might be affected by the climate change. In this study, the suitable area for sago palm growing is expected to expand in the south west part of Sulawesi in the future, which was 893,600ha in 2050 and 1,392,700ha in 2070 (possibility > 0.7). Although a balance with other land use have to be considered, it is profitable to increase in starch production. Under good conditions, the yield of sago palm varies from at least 15 ton to possibly 25 ton of dry starch/ha. Based on 20 ton/ha, the dry starch production in 2070 will be 10 times higher than the current condition.

Key words: Climate change, Ecological niche model, Habitat, Starch yield

The Difference Factors of Sago Farm Household Production in Luwu Utara District, South Sulawesi, Indonesia

Andi Patiware Metaragakusuma[1*], Marlisa Ayu Trisia[1], Osozawa Katsuya[2], Hu Bai[2]

[1]The United Graduate School of Agricultural Sciences, Ehime University, 3-5-7 Tarumi, Matsuyama, Ehime 790-8566, Japan, [2]Department of Resources and Environmental Policy, Faculty of Agriculture, Ehime University, 3-5-7 Tarumi, Matsuyama, Ehime 790-8566, Japan

Abstract

Associated with the sago potency in South Sulawesi Province, the role of SFH is become more important because of majority sago processors is dominated and run by them. However, there is a limited number of studies focused on the sago farm household (SFH) in Indonesia particularly in South Sulawesi Province. This study is aimed to identify whether there is a difference between sago farm household with high production (SFH1) and low production (SFH2). A total 54 of valid questionnaire were collected from SFH in Malangke Barat Sub District, one of the sub districts in Luwu Utara District, during July and August 2015. The obtained data were analyzed by using statistical independent t-test analysis, the test to determine statistical differences between the means of two groups. Based on the test (significant at the 1% level), SFH1 can be identified with higher working hours, higher income, and better motivation than SFH2. SFH1 allocates 5.34 hours/day, while SFH2 only allocates 2.46 hours/day for sago processing. SFH1 can earn money 8.69 million IDR /month, while SFH2 only can earn money 2.19 million IDR/month from sago. Furthermore, SFH1 believes that sago is profitable and promising, while SFH2 only involves in sago production to support their economic life without any further desires. Undeniably, a motivation training and supporting from related stakeholders to encourage the SFH should be conducted for achieving better livelihood.

Keywords: Difference factors, motivation, sago farm household, sago production