2nd ASEAN Sago Symposium Programme Book

Advances in Sago Research and Development

29-31 October 2012

DeTAR PUTRA

UNIVERSITI MALAYSIA SARAWAK

Contents

Welcoming Address from the Chief Minister of Sarawak.

PEHIN SRI HAJI ABDUL TAIB MAHMUD

S.B.S., D.K. (JOHOR), D.K. (PAHANG), D.P., P.S.M., S.P.D.K., S.U.M.W., S.S.D.K., S.S.A.P., D.G.S.M., D.P.P.N., S.S.S.A., S.P.M.T., KT. W.E. (THAILAND), KEPN (INDONESIA), S.P.M.B. (BRUNEI), K.O.U. (KOREA), AO (AUSTRALIA), P.C.D.

السلام عليكم و رحمة الله و بركاته and Salam sejahtera to all participants of the 2nd ASEAN Sago Symposium 2012.

It gives me great pleasure to welcome all distinguished guests and participants of the 2nd ASEAN Sago Symposium. I would also like to congratulate Universiti Malaysia Sarawak (UNIMAS), Centre of Excellence for Sago Research (CoESAR), CRAUN Research Sdn Bhd, Malaysia, Bogor Agricultural Institute (IPB), Indonesia, and FAO Regional Office for Asia and the Pacific (FAO-RAP), Thailand, for organizing this symposium for the second time in Kuching, Sarawak.

Sago starch is one of the important commodities for Sarawak with an annual export about of 70,000t. However, the low price of the starch and lengthy period of maturity impedes meaningful development in the sago industries. In order for sago starch to be competitive, it has to be modified into a product that is able to command a higher price and the agronomy and plantation best practices on sago palm need to be looked into more seriously. This is to ensure the constant supply of sago starch raw material for the development sago industries. Realizing the potentials, here in Sarawak, the state government set up CRAUN Research Sdn Bhd to undertake the R & D on sago plantation and downstream processing of sago starch and its byproduct. Not to forget, the Faculty of Resource Science and Technology, UNIMAS, is also actively involved and committed with the establishment of the Centre of Excellence for Sago Research (CoESAR) to spurs the research and development on sago and its byproduct. I believed that there is a great future for sago to be developed further and advanced with the current trend on sago research and its derivatives. This symposium will be an appropriate forum and platform for such discussions. It is aimed at highlighting the research and developments on sago palm and other related fields.

Thus, I trust that this two days gathering will see much dissemination and free exchange of ideas and knowledge, as well as fruitful discussions among participants, contributing to a better understanding and realization on the advances in sago research and development.

I wish you all every success in your deliberations, and I hope your stay in Kuching, and Sarawak, Bumi Kenyalang will be a pleasant and memorable one.

YAB Pehin Sri Haji Abdul Taib Mahmud

Welcoming Note from the Vice Chancellor

السلام عليكم و رحمة الله و بركاته and Salam sejahtera to all participants of the 2nd ASEAN Sago Symposium (ASAS) 2012.

It gives me great pleasure and a privilege on behalf of Universiti Malaysia Sarawak (UNIMAS) to welcome all the distinguished guests and participants of the 2nd ASEAN Sago Symposium (ASAS) 2012.

Firstly, I would like to thank the Organizing Committee for their efforts in bringing together experts from industries and researchers from various fields in sago research and its derivatives to share their findings and expertise and hope the exchange of ideas will lead to establishment of research and partnerships.

Sago palm is a starch producer which contributes to the economics of the Asean countries, particularly so for Malaysia and Indonesia. It has been used by the locals for hundreds of years as food, and now is the subject of intense studies as the main option for starch source of the future. There is a huge potential for the advancement of scientific knowledge through various fields of sago research and development such as agronomy and agriculture sciences, microbiology and molecular biology, waste management and starch utilization, biotechnology, economy and social studies, sago starch chemistry and others. UNIMAS and other relevant agencies and institutions either government or private sectors could play a major role to utilize the R & D on sago resources in a sustainable manner that would benefit the whole nation in general and in particular the local communities.

I believe that this symposium is an excellent platform for researchers to interact and share ideas and research findings while fostering long linkage. Nowadays, universities, research institutions and the private sectors are working together mutually to ensure all the effort and infrastructures provided for research by the government are materialized. Many scientific breakthroughs can be achieved through innovative research which ultimately will be beneficial to the country.

Finally, I trust that the three days gathering will see much dissemination and free exchange of ideas and knowledge, as well as fruitful discussions amongst participants, contributing to a better understanding and appreciation on the advances in sago research and development.

Professor Datuk Dr Khairuddin Ab. Hamid

Greetings from the Chairman

On behalf of the organizing committee, I would like to extend a warm welcome to all participants to the 2nd ASEAN Sago Symposium (ASAS) 2012.

I am encouraged by the positive response received from the participants coming from diverse areas representing tertiary education, industries, plantation and research institutions in Malaysia, and also from foreign organisations and research centres throughout the Asia Pacific region. The theme "*Advances in Sago Research and Development*" is indeed most appropriate especially in looking at the advancement that have been made in sago research and the by-products resulting from such projects with consequential impact towards our community.

The symposium will address significant issues in relation to sago research and development in particular the areas of agronomy, agriculture, economy, social, biotechnology, chemistry, genetic and molecular biology, product development and other related field. A total of 120 participants among which 32 oral and 40 poster presenters and 52 general attendee with a mix of theoretical and practical approaches providing a huge forum for the sharing and dissemination of knowledge on the advancement of sago research and its derivatives.

The success of the 2nd ASAS 2012 is made possible by untiring and dedicated efforts from the secretariat and members of the various subcommittees comprising staff from Universiti Malaysia Sarawak (UNIMAS) and Centre of Excellence for Sago Research (CoESAR), as the main organizers, and the strong support from CRAUN Research Sdn Bhd, Bogor Agricultural Institute (IPB), Indonesia, and FAO Regional Office for Asia and the Pacific (FAO-RAP), Thailand, as the co-organizers. My sincere gratitude and appreciation is extended to all committee members.

Finally, I wish all the participants a good and fruitful deliberation throughout the symposium. Please take in the hospitality that Sarawak has to offer and THANK YOU for making this symposium a great success through your participation and commitments.

Associate Professor Dr Hairul Azman Roslan

List of Invited Speakers

Keynote Speakers

Mr. Hiroyuki Konuma,
FAO Regional Office for Asia and the Pacific, Bangkok, Thailand
Recognizing the Economic and Social Value of the Sago Palm – A Neglected Food Security Crop

Hiroyuki Konuma, a Japanese national, holds a Master of Science Degree (M.Sc.) in Agricultural Science from Tsukuba University in Japan. He has been with FAO for over 30 years. He started his carrier in Syria with JICA(JOCV) in 1977. He joined FAO in 1980 as an Associate Expert in animal husbandry in Yemen, and moved to Somalia as the Head of UNHCR Field office in Jalalaqsi in 1983, engaged in a refugee agricultural settlement programme.

He returned to FAO in 1985, based at the FAO Regional Office for Africa in Ghana for 4 years, and was transferred to FAO headquarters in Rome in 1989 working as a Project Operations Officer. Seven years later, he was appointed the FAO Representative in Bangladesh (1996) and served there till his transfer to the FAO Regional Office for Asia and the Pacific in Bangkok in 1999.

Based in Bangkok, he has been assigned progressively senior positions as the Chief of the Operations Branch, Chief of the Policy Assistance Branch and Deputy Regional Representative. He was appointed Assistant Director-General and FAO Regional Representative for Asia and the Pacific in March 2010.

Prof Dr Dulce Maria Flores
University of Philippines, Mindanao, Philippine

GREENING ASIA: The Sago Invasion.

Basically, greening is defined as "restoring vitality and freshness" and therefore, for environmentalists it means a process of restoring environmental wellness. If it means greening the environment through the use of a plant or planting in large scale, then this life form must be able to do all the following to be able to "green and restore" the environment. These are the attributes of the sago palm which make it a very "hard-to-surpass" candidate for the so called greening programs.

- It has higher rate of starch synthesis than any other starch source. Its photosynthetic prowess is so, such that it can convert CO_2 into starch, store it in its trunk, to as high as 200 kg (optimal) in about 8 years. At a minimum of 1000 growing plants per hectare and at this rate per tree (25 kg starch per year), the sago palm stand can sequester at least 36.67 tons of CO_2 per hectare per year.
- It can survive in hostile environments where many other plants will not: like water logged soil or areas of prolonged and regular flooding; marginal soils such as peat swamps and river banks; it can withstand strong typhoon winds and even a little salinity. It used to be discredited and abhorred for its ability to block waterways and resistance like the weeds, but now much appreciated for its bank-stabilizing capacity through its sturdy roots trapping silt load and industrial pollutants
- It survives forest fires. The bark is a very good insulator to the apical and basal buds such that regeneration can still occur. In spite of all these extreme environments, sago has a longer life span than oil palm and rubber. It does not require weeding and drainage compared to rice and corn. No other plant can wait for one or two years in place, for the starch to be harvested, as harvesting for sago is not obligatory, as compared to rice and corn.
- In the recent devastation of crops and staple due to flooding caused by atmospheric hydrological changes, a failure of harvest is eminent. Only sago will satisfy the requisite criterion of surmounting unpredictable events related to environmental change.

All the above attributes (from WR Stanton, 1991) have often been repeated and appreciated in each and all sago symposia we have attended. And yet there are still millions of fellow Asians, especially true in the Philippines, who have not known the unique edge of sago over other crops. We are only a few who are lucky enough to have been led to open our eyes to this unsung resource. Many thanks to the forerunners of sago research in the likes of W.R. Stanton, M. Flach, D.L. Schuilling, F.S. Jong, N. Haska and our Japanese friends led by Mr. Nagato. And to the countless researchers, equally accomplished scientists, and the toilers and believers who have continuously added to the collective information about this magnificent plant year after year. Each of you here have contributed something to bring sago to the fore up to this very minute. Let us all join forces in doing what ought to be done. Let us bring sago to the consciousness of every Asian who has not known of its grandeur, where on the contrary and instead, have regarded sago as a "poor man's staple". Let us plant sago where there are idle lands waiting to be tapped. One strategy would be to boost investments in such green technologies as ethanol and lactic acid fermentation and thereby increase the demand for sago starch. This will surely convince everyone to conserve existing wild stands and expand some more. Let the cycle begin!

Plenary Speakers

Prof Dr Yoshinori Yamamoto
Kochi University Japan

Changes in Leaf and Trunk Characters of Sago Palm (*Metroxylon sagu* Rottb.) with Age, with Special Reference to Varietal Difference

The research was carried out to clarify the changes of leaf and trunk characters with age (from sucker emergence to harvesting stage), using two different types of folk varieties grown around Lake Sentani, Papua Province, Indonesia, i.e., Para (high yielding and late maturing variety) and Rondo (low yielding and early maturing variety). The number of leaves per palm changed from 10-20 leaves in both varieties. The leaf length, number of leaflets and longest leaflet length increased with age from the rosette to the trunk formation stage and then remained unchanged until flower bud formation stage with little varietal difference. On the other hand, the changing patterns with age of the longest leaflet width, thickness and SPAD (chlorophyll indicator) values are considerably different between the varieties. The values of these characters were remarkably higher in Para than Rondo from the early growth stage. The trunk weight of Para at harvesting stage was 5-6 times higher than that of Rondo due to the larger diameter, higher trunk elongation rate and the longer trunk growth duration. The starch yield of Para at harvesting stage, 860-980kg per palm, was 5-6 times higher than that of Rondo, at 160-180kg. The varietal difference in starch yield might be brought by the varietal differences of leaf characters such as leaflet width and thickness and chlorophyll content, and higher sink capacity, i.e., trunk volume as well as the growth duration.

Prof. Dr. H. Mochamad Hasjim Bintoro Djoefrie
Bogor Agricultural University, Bogor, Indonesia

Development Prospect of Sago Plantation at Backward Area

Indonesia has so many small islands that spread throughout the archipelago. Most of the small islands are remote area. Beside the small area, Indonesia has backward area. Society in those islands is poor. Some causes of backward areas are maybe geography, natural resources, human resources, infrastructure, social conflict and development policy. In order to, that Region can be developed, so that should be economic development based on local resources. Many sago grow in remote areas and sago can be used as a staple food, liquid sugar or bio-ethanol. Smallest islands, in certain seasons do not get the supply of food and energy because the wave height, so the islands are vulnerable to pirates and piracy. Presence industry on remote islands would make the region independent of food and energy. With the factory will improve the welfare of local residents, so that it will attract people to build telecommunications towers. Bioethanol can be used to patrol navy, so in addition to increasing prosperity, security area will be ensured.

Assoc Prof Dr Hairul Azman Roslan
Universiti Malaysia Sarawak (UNIMAS), MALAYSIA

Sago research in UNIMAS Sarawak: Gene prospecting from sago genome.

Sarawak has been blessed with soil that is ideal for planting of sago palm. UNIMAS, being in the state of Sarawak, has been involved in the sago palm research ever since its inception *20 years* ago. Sago research in UNIMAS has always been a priority at the Faculty of Resource Science and Technology and to further consolidate this importance, a *Centre of Excellence for Sago Research* (CoESAR) was established in 2009. CoESAR aims to be the main reference point for researches in sago palm in the ASEAN region. Researches in UNIMAS are diverse, we have research groups that are involved in agronomy and soil science, looking at sago starch, fermentation process, practical uses of sago waste to produce products and molecular biology group looking at the sago genome. The molecular biology group in UNIMAS are investigating several questions pertaining to the palm such as in the trunk formation of palms, deciphering the starch biosynthesis pathway and genetic controls of the flowering process. Through the analysis of ribonucleic acid (RNA) we were able to isolate genes that are expressed from different tissues and developmental stages of sago palm growth. Although the work is preliminary in nature, we have recently discovered many genes of interest. One of the interests of our research group is the ability of sago palm to adapt to biotic and abiotic stresses. Initial work indicated a concoction of defense genes are expressed responding to biotic and abiotic stimulus. The expression of these genes is probably the key to the ability of sago palm to withstand stresses and thrived in conditions where other plant could not. Most recently we have embarked on transcriptomics work through the use of Next Generation Sequencing and hopeful that the project can divulge more information for the community.

Professor Emeritus Dr. Ayaaki Ishizaki
Kyushu University JAPAN.

What new technology is needed to complete the sago industry?

The population of the world now exceeds 7 billion, and a consequence of this large population is a high demand for food and other resources that support human life. The majority of food is supplied in the form of carbohydrates, and approximately 250 kg of carbohydrates is required per year per capita. Therefore, 2.8 billion tons of carbohydrates is required to support the total world population, and an increase in the production of carbohydrates will be essential to support human life. The use of sago as a carbohydrate source may be able to prevent a human food crisis. However to establish the sago industry, many obstacles must be overcome, including problems with processing, economy, waste management and pollution. It will be necessary to develop a total processing procedure for the sago industry. This presentation will focus on several important new technologies that can be used to establish the sago industry. From an economics viewpoint, the diversification of the starches used is important. Sago starch has been used as a carbohydrate source in food since ancient times in rural tropical areas, including the Malaysian peninsula. Currently, sago starch is consumed in the form of processed foods such as sago pearls and sago flour. Sago flour has also been used in the fermentation industry. In Malaysia, sago starch has been used in glutamic acid fermentation, and

Sarawak sago has been used as the primary raw material for the production of glutamic acid. Another bottleneck in sago processing is the environmental problems and pollution caused by wastewater and waste materials such as pith and bark. New technology for the treatment of high-BOD wastewater has been developed by Toyo Koatsu Co. Ltd., and Supercritical Technology Research Corporation, Hiroshima Japan, which may overcome the obstacles regarding wastewater. For pith, the production of ethanol for use as a fuel using the amylo method is feasible. Bark can be transformed into high-quality carbon material by the technology developed by EEN (Earth Environment Network) Co. Ltd., Tokyo Japan. These processes involve hot pyrolysis method and the products allow the waste bark to be used for soil conditioner and fertilizer and may be used as solid fuel to produce electricity.

Assoc Prof Dr Abdul Manan Dos Mohamed
Universiti Kuala Lumpur (UniKL MICET), Melaka MALAYSIA

Importance of Sago Starch Quality: Development of Sago Starch Standard and Diversification of Value-added Sago Starch

Sago starch exhibits excellent physicochemical properties, thus offers numerous possible commercial applications and is suitable for industrial modifications. This includes the production of speciality maltodextrin, highly value-added modified starch and pharmaceutical grade starches. However, the properties of sago starch vary according to palm varieties, the growth stages of palm, soil variation and the location of starch within the palm itself. In addition to palm stages and soil differences, processing methods and post-harvest handling also contribute to differences in starch properties. Studies on physicochemical properties of sago starch extracted from palm at various commercial growth stages showed that there are some variations in the proportion of granule size, granule distribution and pasting profile at base and mid heights of the palms. Varietal differences lead to white and pink flour product. Poor log quality and inefficient processing methods produce inferior starch quality as expressed as a function of colour lightness and viscosity drop. The expression of pinkish colour of starch when gelatinized limits downstream processing activities involving highly value added product. Thus, sago starch remains to be used in low value product that requires less stringent colour and viscosity requirement, such as noodles and snack food. Colour and viscosity are the primary parameters of starch, differentiating industrial grade and food grade as stated in Malaysian Standards, MS 468 and MS 470, respectively. Hunter value of 'L' higher than 90 for starch powder and viscosity of gelatinised starch (6% of dry weight) exceeding 600 B.U. enable the starch to be categorized as Food Grade sago starch. Revised version (2012) of MS 468 and MS 470 has included microbial limit and starch content of sago starch. Although whiteness (lightness) of starch is achieved in dry powder form as specified in MS 470, when gelatinized, a pinkish liquid is produced, leading to an inferior final product specification. As such, there is a need to remove such impurities comprising of polyphenolic substances, thereby creating a new sago starch quality, named as refined sago starch as specified in MS2410 (2012). The new standard specifies not only colour and viscosity of sago starch but limits the amount of total phenolic content to be below 10 ppm, ensuring the desired colour of starch when gelatinized and differentiate two categories of starch granule size range, fine and large granules. The former ensures the colour of starch when gelatinised and the later ensures the homogeneity of starch granule size range, thus ensuring acceptable physicochemical property ranges, as required in the production of final product. This talk will address the processing technologies for the production of refined sago starch required for downstream activities and value addition of the starch produced.

Prof Dr Kopli Bujang
Universiti Malaysia Sarawak (UNIMAS), MALAYSIA

A Holistic Approach to Maximise Productivities of the Sago Industry.

The use of sago starch, either as food or as research materials for the production of chemicals and recently as the source of bioenergy has been intensely discussed or deliberated over the past ten years, fed by research grants from national and international sources. Maximising the development of the frequently overlooked sago industry demands a proper framework between the ASEAN countries for such needs to be satisfactory fulfilled. High quality planting materials cultivated on soils with proper water management and superior planting regime need to be practiced to jump-start the development of new sago plantations. Without these, intensive use of any sago products, either the palm biomass or the starch end product will not be commercially viable since only well managed sago plantations can ensure continuous and abundant supply of the raw materials. Malaysia and Indonesia, two of the largest sago starch producers in the world, should consolidate their research and effort on modernisation of the sago plantation in order to sustain the supply of raw materials for the rising sago industries. Discernible efforts have been exhibited by LCDA of Sarawak through CRAUN Research Sdn. Bhd. of Sarawak in systematic cultivation of about 12,000ha of sago palms on peat soils in Mukah and Dalat with considerable success. However, results from studies on the deep peat section still need to be fully ratified. This is because previous and current observation reveals that growth of the sago palms become unsatisfactory as it aged beyond 4 years, in spite of proper water and crop management which include regular pruning and fertilization (ACR, 2012). Similar efforts have been reported in Riau, Indonesia with the commercial cultivation of 12,000ha of sago palms in late 1996. Sago palms can be cultivated on peat but adequate maintenance must be executed to optimize growth and productivity (Jong, 2009). Rehabilitation attempt to enhance growth of sago palms has also been reported by modifying the planting distances and construction of canals in the plantation (Bintoro *et al*., 2009). The canals served as an effective water management scheme and improved plant growth while providing an effective but simple method to transport harvested logs to the sago mill. Modernisation of the mostly dilapidated sago mills is imperative to ensure maximum extraction of starch from sago pith to reduce wastage and concomitantly minimising its polluting effects to our waterways. In Sarawak, most sago mills require only 30 to 40mins to produce dried and packed food grade sago starch. Efficient rasping of the pith and starch extraction procedure ensures that only 2-3% residual starch, with almost similar percentage of fibre are disposed as sago effluent, which rigorously minimised the BOD loading into the environment. In all these cases, financial constraint plays a critical role to ensure systematic development of the sago plantation (Jong, 2009; Bintoro, 2009). As such, products from this industry need to be developed and marketed in order to provide a regular and constant cash flow to the sago farmers. Modification of starch into sugars is an established, simple and swift process, which can serve to beef-up the normally cash tight development of the sago plantations. Sago starch has been enzymatically hydrolysed into sugar 100% recovery and the syrup purified using powdered activated charcoal to remove all impurities and colour (Bujang *et al*., 2000). Sago sugar is as sweet as 50% glucose standard, contains mostly glucose (94%), with maltose and other impurities, both at 3% each (Bujang, 2011). Scaling up the process up to 50kg did not reduce the sugar recovery significantly. Drying of the purified sago syrup is best performed using an oven (minimum 60^{o}C), producing high (100%) recovery albeit after several days. Sago starch therefore has a potential to be the

alternative raw material to complement the frequent shortages of sugar supplied by processing imported sugar cane in this country. Apart from starch, by-products from the starch extraction process such as effluent, fibres and bark can be utilised with some treatments and modifications to provide side incomes. At approximately 18L/sec (Bujang *et al*., 1996), utilisation of the sago effluent is critical to minimise water degradation. Hydrolysis of the fibres to produce sugars has been reported with about 40% success (Janggu and Bujang, 2009). This is in tandem with achieving the zero waste concepts to this industry. Previous works have reported on culturing of alga for production of single-cell protein (SCP) in treated sago effluent with some success. Utilising such waste not only will reduce the cost of large-scale production of SCP but will inadvertently minimise the effects on water quality of the neighbouring rivers. The current price of sago starch is now at an all times high, at RM1,800/ton (USD590/ton), and Sarawak exported more than 50,776 tons in 2011 (DoS, 2012), procuring an income of RM91.04 million (USD30.04 millions). Assemblage of both upstream and downstream processing works by the various institutions of the ASEAN nation is imperative to enhance development of research which will eventually propagate new interests on the sago industry as a whole.

Opening Ceremony of 2nd ASEAN Sago Symposium
29 October 2012 (Monday)

0930 - Arrival of Distinguished Guest

0935 - Arrival of YBhg. Prof Datuk Dr Khairuddin Ab Hamid
Vice Chancellor, UNIMAS.

0940 - Arrival of YBhg. Datu Dr Hatta Solhi
Chairman, UNIMAS Board of Directors.

0945 - Arrival of YAB Pehin Sri Haji Abdul Taib Mahmud
Chief Minister of Sarawak.

0950 - Doa recitation.

0955 - Montage

1000 - Welcoming Note by the Chairman of *2nd ASEAN Sago Symposium* 2012.

1005 - Welcoming Address by YBhg Prof. Datuk Dr Khairuddin Ab Hamid,
Vice Chancellor, UNIMAS

1015 - Opening Address by YAB Pehin Sri Haji Abdul Taib Mahmud,
Chief Minister of Sarawak.

1030 - Official Launching of 2nd ASEAN Sago Symposium by YAB Pehin Sri Haji Abdul Taib Mahmud, Chief Minister of Sarawak.

1035 - Souvenir presentation to YAB Pehin Sri Haji Abdul Taib Mahmud,
Chief Minister of Sarawak.

1045 - Refreshment

Scientific Program for 2nd ASAS 2012
29 – 31 October 2012

Day 1 (29 October, Monday)

0830 - 0930 Registration of participants

0930 - 1045 Official Opening Ceremony of 2nd ASEAN Sago Symposium 2012 by the Honorable Chief Minister of Sarawak, Pehin Sri Haji Abdul Taib Mahmud

1045 - 1115 Coffee break and Poster Session

1115 - 1230 **KEYNOTE Speaker 1:** Mr. Hiroyuki Konuma, (FAO Regional Office for Asia and the Pacific (FAOAP), Bangkok, Thailand).

Recognizing the Economic and Social Value of the Sago Palm – A Neglected Food Security Crop.

(Venue: Zamrud)
Chairperson: Mr Yusup Hj Sobeng (CRAUN Research Sdn Bhd)

1230 - 1400 Lunch

1400 – 1600 **Scientific Session A, B, C & D**

Time	PLENARY SESSION	
1400	**PLENARY Speaker 1:** Prof Dr Yoshinori Yamamoto, Kochi University, Japan. **Changes in Leaf and Trunk Characters of Sago Palm (*Metroxylon sagu* Rottb.) with Age, with Special Reference to Varietal Difference.** *(Venue: Zamrud)* *Chairperson: Assoc Prof Dr Mohd Hasnain Md Hussain (UNIMAS)*	
	CONCURRENT SESSION	
	Scientific Session A (Venue: Zamrud) *Chairperson: Assoc Prof Dr Awang Ahmad Sallehin Awang Husaini (UNIMAS)*	**Scientific Session B (Venue: Serindit)** *Chairperson: Mrs Dayang Salwani Awang Adeni (UNIMAS)*
1430	Paper 1 **Development of Sago-based Value Added Products.** Dr Rosa Rolle, [FAO Regional Office for Asia and the Pacific (FAORAP), Bangkok, Thailand].	Paper 2 **Bioconversion of Sago Pith Residues into Fermentable Sugars using Crude Cellulases from Local Fungal Isolate.** Prof. Dr. Suraini Abd. Aziz, [Universiti Putra Malaysia (UPM), Selangor, Malaysia].

1445	Paper 3 **Morphological and Anatomical Characters of Sago Palm Starch- Observation by Scanning Electron Microscope .** Prof. Dr. Nitta Youji, [Ibaraki University, Japan].	Paper 4 **Sago Palm Conservation Network and Village Sufficiency Economy.** Mr.Pisit Charnsnoh, [Yadfon Foundation, Thailand]
Time	**PLENARY SESSION**	
1500	**PLENARY Speaker 2:** Prof Dr H.M.H. Bintoro, Institut Pertanian Bogor (IPB) Indonesia. **Development Prospect of Sago Plantation at Under Developed Area.** *(Venue: Zamrud)* *Chairperson: Prof Dr Kopli Bujang (UNIMAS)*	
	CONCURRENT SESSION	
	Scientific Session C (Venue: Zamrud) *Chairperson: Assoc Prof Dr Awang Ahmad Sallehin Awang Husaini (UNIMAS)*	**Scientific Session D (Venue: Serindit)** *Chairperson: Mrs Dayang Salwani Awang Adeni (UNIMAS)*
1530	Paper 5 **Biomass Allocation and Root Distribution of Sago Palms in Small Holding Farms and Plantation at Mukah, Sarawak.** Prof. Dr Isa Ipor, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].	Paper 6 **Potential of Sago Mill Effluent for Biomethane Production.** Assoc. Prof. Dr. Maizirwan Mel, [International Islamic University Malaysia, (IIUM), Malaysia].
1545	Paper 7 **Monitoring of Nutrient Uptake and Fertilizer Placement in Sago Palm (*Metroxylon sagu*) using Isotopic Tracer Technique** Mr. Roland Yong, [CRAUN Research Sdn. Bhd., Malaysia].	Paper 8 **Repeated Batch Fermentation for Ethanol Production in Glucose from Sago Starch.** Assoc Prof Cirilo Nolasco Hipolito, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].

1600: **End of Scientific Sessions Day 1**

1600 -1700 : High tea for the 2nd ASEAN Sago Symposium 2012

Day 2 (30 October, Tuesday)

0845 – 0930 : **KEYNOTE Speaker 2:** Prof Dr Dulce Maria Flores (University of the Philippines, Mindanao, Philippine).
GREENING ASIA: The Sago Invasion

(Venue: Zamrud)
Chairperson: Assoc Prof Dr Hairul Azman Roslan (UNIMAS)

0930 – 1230: Scientific Session E, F, G & H

Time	PLENARY SESSION	
0930	**PLENARY Speaker 3:** Professor Emeritus Dr Ayaaki Ishizaki, Kyushu University, Japan. **What New Technology is Needed to Complete the Sago Industry?** *(Venue: Zamrud)* *Chairperson: Dr Rosa Rolle (FAORAP)*	
	CONCURRENT SESSION	
	Scientific Session E (Venue: Zamrud) *Chairperson: Dr Mohd Effendi Wasli (UNIMAS)*	**Scientific Session F (Venue: Serindit)** *Chairperson: Assoc Prof Pang Suh Cem (UNIMAS)*
1000	Paper 9 **Analysis of Effects of the Sucker-control in the Sago Palm (*Metroxylon sagu* Rottb.) Cultivation.** Mr Keita Nabeya, [Tohoku University, Japan]	Paper 10 **Application of Sago Starch in Cosmetic Formulations.** Assoc Prof Dr Prapaporn Boonme, [Prince of Songkla University, Thailand].
1015	Paper 11 **Dna Methylation Profiling of Sago Palm (*Metroxylon sagu* Roettb)** Assoc Prof Annabelle Novero, [University of the Philippines Mindanao, Philippines].	Paper 12 **Various Local Foods from Sago in Indonesia.** Mrs Gayatri K Rana, [Ministry of Agriculture Republic of Indonesia].
1030	Paper 13 **Use of Mycorrhiza in Lateral Root Initiation of Sago Palm (*Metroxylon sagu* Rottb.) Plantlets *in vitro.*** Ms Siti Sahmsiah Bt Sahmat, [Universiti Teknologi Mara (UiTM), Kota Samarahan, Malaysia].	Paper 14 **Socio-economic Potency of Sago in Paser Regency, East Kalimantan Province, Indonesia.** Dr Krishna Purnawan Candra, [Mulawarman University, Indonesia].

1045 – 1115: Coffee break & Poster Session

Time	PLENARY SESSION	
1115	**PLENARY Speaker 4:** Assoc Prof Dr Hairul Azman Roslan, Universiti Malaysia Sarawak, (UNIMAS) Malaysia. **Sago Research in UNIMAS Sarawak: Gene Prospecting from Sago Genome.** *(Venue: Zamrud)* *Chairperson: Prof. Dr. Nadirman Haska (IPB)*	
	CONCURRENT SESSION	
	Scientific Session G (Venue: Zamrud) *Chairperson: Assoc Prof Dr Zainab Ngaini (UNIMAS)*	**Scientific Session H (Venue: Serindit)** *Chairperson: Assoc Prof Dr Cirilo Nolasco Hipolito (UNIMAS)*
1145	Paper 15 **PCR Cloning by Genome Walking of a Complete Gibberellins Biosynthetic Gene, ga20-oxidase from *Metroxylon sagu*** Mr Bala Jamel, [CRAUN Research Sdn. Bhd., Malaysia]	Paper 16 **Optimization of Fermentation Medium for Amylase Production by *Aspergillus flavus* under Solid State Fermentation (SSF).** Ms Siti Ratna Mustafa, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].
1200	Paper 17 **Growth Performance of the transplanted sago palm (*Metroxylon sagu* Rottb.) Suckers With Different Earliness of Trunk Formation.** Dr Albertus Fajar Irawan, [PT National Sago Prima, Indonesia].	Paper 18 **The Stakeholder Analysis to Scaling-up Sago Business: Case Study in Indonesia.** Dr Eddy Chiljon Papilaya, [Sekolah Tinggi Pertanian Kewirausahaan Banau Halmahera Barat Maluku Utara Indonesia].
1215	Paper 19 **Identification of Differentially Expressed Genes of Trunking and Non-trunking Sago Palm by Representational Difference Analysis of cDNA.** Ms Siti Izyan Liyana Bt Kamarol, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].	Paper 20 **Sago Fibre Clay, a New Ceramic Medium for Ceramic Artwork.** Ms Wan Samiati Andriana Wan Mohammad Daud, [Universiti Teknologi Mara (UiTM), Kota Samarahan, Malaysia].

1230 – 1400: Lunch

1400 -1500: Scientific Session I, J, K & L

Time	PLENARY SESSION	
1400	**PLENARY Speaker 5:** Assoc Prof Dr Abdul Manan Dos Mohamed, Universiti Kuala Lumpur (UniKL-MICET), Melaka Malaysia. **Importance of Sago Starch Quality: Development of Sago Starch Standard and Diversification of Value-added Sago Starch.** *(Venue: Zamrud)* *Chairperson: Prof Dr Bintoro (IPB)*	
	CONCURRENT SESSION	
	Scientific Session I (Venue: Zamrud) *Chairperson: Assoc Prof Dr Edmund Sim Ui Hang (UNIMAS)*	**Scientific Session J (Venue: Serindit)** *Chairperson: Dr Lee Kui Soon (UNIMAS)*
1430	Paper 21 **The Economics of Sago Plantation: Comparison on Peat and Alluvial Soil.** Mr Zahri Perhi, [CRAUN Research Sdn. Bhd., Malaysia].	Paper 22 **Sago Starch Based Biocomposite Reinforced with Kenaf Fibres.** Ms Nur Humairah Bt Abdul Razak, [International Islamic University Malaysia (IIUM), Malaysia].
1445	Paper 23 **The Utilization of the Large Sucker as Sago Planting Materials.** Prof Dr Nadirman Haska, [Biotech Center of the Agency for the Assessment and Application of Technology, Indonesia].	Paper 24 **Used Motor Oil Biosorption by Immobilized *Bionectria* sp. on Sago 'Hampas'.** Mr Mohd Farith Kota, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].
1500	Paper 25 **Proteomics of Trunking and Non-trunking Sago Palm (*Metroxylon sagu* Rottb.).** Assoc Prof Dr Hasnain Md Hussain, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].	Paper 26 **Nutritional Content of Sago Worm *Rhynchophorus ferrugineus* Powder.** Ms Norazlin Abdullah, [Universiti Teknologi Mara (UiTM), Kota Samarahan, Malaysia].

1515 – 1545: Coffee break & Poster Session

Time	PLENARY SESSION	
1545	**PLENARY Speaker 6:** Prof Dr Kopli Bujang, Universiti Malaysia Sarawak (UNIMAS), Malaysia. **A Holistic Approach to Maximise Productivities of the Sago Industry.** *(Venue: Zamrud)* *Chairperson: Mrs. Gayatri K Rana (FAORAP)*	
	CONCURRENT SESSION	
	Scientific Session K (Venue: Zamrud) *Chairperson: Dr Sim Soon Liang (UNIMAS)*	**Scientific Session L (Venue: Serindit)** *Chairperson: Dr Micky Vincent (UNIMAS)*
1615	Paper 27 **Repeated-batch Fermentation by *Candida tropicalis* ATTCa** Ms Nurul Faseeha Binti Zulkiffli, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].	Paper 28 **Biogas Generation Potential via Anaerobic Treatment of Sago Mill Effluent.** Ms Nurleyna Yunus, [CRAUN Research Sdn. Bhd, Malaysia].
1630	Paper 29 **Incorporation of Fatty Acid Derivatives onto Sago Network for Oil Absorption.** Mr Muhamad Farid bin Mohammed Noh, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].	Paper 30 **Removal of Starch from Starch Solutions by Tangential Flow Filtration.** Ms Samantha Siong Ling Chee, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].
1645	Paper 31 **Heterologous Expression of Alcohol Dehydrogenase Gene** Ms Mastura Bt Sani, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].	Paper 32 **Comparative Study of Kojic acid Production from Sago Hampas using Different Strains of *Aspergillus flavus* via Solid State Fermentation.** Mr Alvin Miai Spencer, [Universiti Malaysia Sarawak (UNIMAS), Malaysia].

1700: **End of Scientific Sessions Day 2**

1700: Closing Ceremony of the 2nd ASAS 2012

Day 3 (31 October, Wednesday)

Optional:

0930-1230: **Visit to Sarawak Cultural Village, Santubong , Kuching**

Abstract of Oral Papers

Paper 1

Development of Sago-based Value Added Products.

Rosa S. Rolle[1*] , Hiroyuki Konuma[2] & Somsak Boromthanarat[3]

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The development of sago-based food products offers considerable potential for food security and livelihoods development in sago producing areas. Developing new products based on sago starch, improving traditionally the development of sago-based food products offers considerable potential for food security and livelihoods development in sago producing areas. Developing new products based on sago starch, improving traditionally produced value added sago based products and marketing those products to a wider consumer base, could contribute greatly to generating income and employment opportunities for individuals living in sago starch producing areas. Substitution of wheat flour with sago starch in a standard cookie formulation was studied in Southern Thailand. Findings revealed that wheat flour can be substituted by sago starch up to a level of 40 percent in producing cookies that find good consumer acceptance. These findings highlight the potential of sago starch to replace wheat flour in other types of local confectionery and food products. This paper discusses the findings of a study on the formulation of cookies that incorporate sago starch as an ingredient, and will highlight some of the key challenges to be addressed in advancing the development of sago based value added products.

Paper 2

Bioconversion of Sago Pith Residues into Fermentable Sugars using Crude Cellulases from Local Fungal Isolate.

Suraini Abd-Aziz*, Siren Linggang, Lai-Yee Phang & Mohd Helmi Wasoh

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Utilization of sago pith residues for fermentable sugars production using crude cellulases from local fungal isolates namely *Trichoderma asperellum* UPM1 and *Aspergillus fumigatus* UPM2 either individual or in combination were studied. In this present study, the effect of enzyme concentration, substrate concentration, pH and temperature on hydrolysis process was evaluated to determine the appropriate conditions for enzymatic hydrolysis of sago pith residues. In view of the results obtained, high conversion of sago pith residues could be achieved by treating 5% (w/v) of sago pith residues with 23.4 I.U of crude cellulases from

consumed by many people living in Papua and Maluku islands, and some areas in Sumatera, Kalimantan, and Sulawesi Islands of Indonesia. Due to nationwide intensive rice production program, and introduction to imported wheat four, nowadays people very much dependent on rice and wheat flour in their diet of carbohydrate sources. Therefore, the role of corn, cassava, sweet potatoes, and sago as staple food was gradually vanishes. Meanwhile Indonesia is being intensively developing efforts to diversify food consumption, and promote local foods for healthy active and productive life, in order to strengthen Indonesia food security. Sustainable utilization of wild stand and semi wild stand sago palm (*Metroxylon sagu* Rottb), are being promoted as carbohydrate source other than rice. Papeda, sinonggi, kapurung, bagea, sagu lempeng, mutiara, are only some of local food made of sago pith.

Paper 13

Use of mycorrhiza in lateral root initiation of sago palm (*Metroxylon sagu* Rottb.) plantlets *in vitro.*

Siti Sahmsiah Binti Sahmat[1], **Margaret Chan Kit Yok[1*]** &Dr. Zaliha Christine Abdullah[2]
[1]Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA, Campus Samarahan, Sarawak;
[2]CRAUN Research Sdn Bhd, Kuching, Sarawak, MALAYSIA
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The successful micropropagation to increase planting materials of sago palm (*Metroxylon sagu* Rottb) has been hindered by the slow nursery growth of the plantlets. Indigenous mycorrhiza belonging to the Glomus genus isolated from wild sago palm has been successful produced in culture media using aeroponic technique. This paper reports the outcome of a study conducted to investigate the introduction of cultured spores on growth of tissue cultured plantlets at three root growth stages *in vitro*. It was observed that the mycorrhiza spores accelerated the initiation of lateral roots at all growth stages.

Paper 14

Socio-economic Potency of Sago in Paser Regency, East Kalimantan Province, Indonesia

Krishna Purnawan Candra [1*] & Abdul Sahid [2]
[1]Dept.Agricultural Product Technology, Fac.Agriculture of Mulawarman University, Jl.Pasir Balengkong, Kampus Gunung Kelua, Samarinda 75119 Indonesia; [2]Dept.Agroecotechnology, Fac.Agriculture of Mulawarman University, Jl.Pasir Balengkong, Kampus Gunung Kelua, Samarinda 75119 INDONESIA
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Five regencies in East Kalimantan (Paser, Penajam Paser Utara, Kutai Kartanegara, Kutai Timur, and Kutai Barat) of those surveyed showed great potential of sago plantation, in terms of growing native plant species and land suitability. Harvesting time of sago plants in this area is around 10-12 years, with productivity of 250-300 kg of sun dried sago per tree. About 50 ha of sago plants, consists of 30 ha and 20 ha of forest sago and semi-cultivated sago plants were found in surveyed locations in the five districts. Sago plants owners and sago craftsmen provide

a very good response to the offer of sago cultivation program, because sago starch processing have been entrenched and they believe that their income will increase when starch sago processing is upscaled while sago starch markets are wide open. Obstacles in sago business development are there is simple equipment and methods used for the starch sago production, and there is no policy program to develop sago business from local government. Development strategy of Sago business, in East of Kalimantan can be conducted with the government participation in (i) develop of sago starch processing scale of the sago craftsmen, including programme of advice and assistance related to the activity, (ii) attract investors to build partnership with local sago owners and craftsmen, (iii) construct infrastructure and design programs that support the development of the sago plants as crop cultivation.

Paper 15

PCR Cloning by Genome Walking of a Complete Gibberellins Biosynthetic Gene, ga20-oxidase from *Metroxylon sagu*

Bala Jamel[1*], Mohammad Hasnain Hussien[2] & Mohammad Azib Salleh[2]

[1]*CRAUN Research Sdn. Bhd. Kuching, Sarawak;* [2]*Faculty of Resource Science and Technology, University Malaysia Sarawak, Kota Samarahan, Sarawak, MALAYSIA*

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This study demonstrates the utilization of Genome Walking technique for the isolation of the gene that regulates gibberellins production in sago palm. Gibberellins are plant hormones that are involved in controlling stem elongation, maturity and flowering in plant species. One of the genes in the gibberellins biosynthetic pathway that encode for GA20-oxidase has been successfully isolated and sequenced. Prior to this, based on published conserved amino acid sequences of the plant GA20-oxidase cDNA clones, oligonucleotide primers were constructed and then used to amplify a genomic template obtained from sago palm. Two PCR products sized at 200 and 500 bp were obtained. Sequence alignment showed, both fragments are homologous with GA20-oxidase gene obtained from other plant species. Our effort to amplify the entire gene region using standard PCR procedure was unsuccessful. Due to this, a Genome Walking technique was tested and three PCR products sized at 1000, 750 and 500 bp were produced. The nucleotide sequence for these fragments was determined. Sequence alignment indicated that, these entire fragments carry nucleotide sequences that are homologous with GA20-oxidase gene. The total genomic size obtained was 1822 bp. However, Blast analysis indicated that, the region that encodes for this gene is confined to 1322 bp region.

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Terima Kasih / Thank You

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This is to certify

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participate at the

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'Advances in Sago Research and Development'

29th - 31th October 2012

DeTAR PUTRA, Universiti Malaysia Sarawak (UNIMAS)

Kota Samarahan, Sarawak

Malaysia

Assoc. Prof. Dr. Hairul Azman Roslan

Chairman

2nd ASEAN Sago Symposium 2012

UNIMAS Moving forward CoeSAR Center Of Excellence For Sago Research

SOCIO-ECONOMIC POTENCY OF SAGO IN PASER REGENCY, EAST KALIMANTAN PROVINCE, INDONESIA

Krishna Purnawan Candra
Abdul Sahid
Fac.Agriculture
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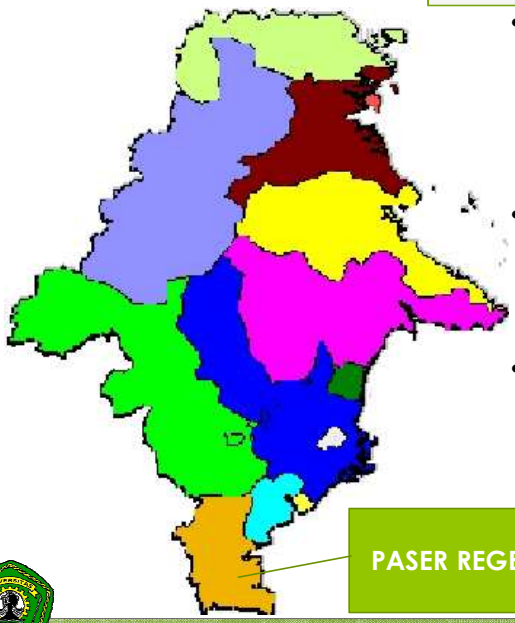
2nd Asean Sago Symposium
29-31 October 2012
DeTAR PUTRA, Universiti Malaysia Sarawak

Regencies in East Kalimantan (EK) Province



- In Southern Part of EK, there are 2 main watershed: Mahakam river and Kendilo
- Along the watershed there are plenty of sago palm
- Some micro holders for sago processing are found

Fact:

- Economic source for local people for generations

Challenge:

- No data for sago potency

Sago Research Design

"Development of sago potency in East Kalimantan Province"

1. Mapping of potencial area for sago plantation
2. Building a pilot project for small sago plantation
3. Making feasibility study for sago plantation and processing
4. Promoting the sago potency of East Kalimantan for bussiness

The purpose of this research

1. To identify the potency of sago in East Kalimantan
   - Types of sago palm
   - Safo starch processing activities
   - Land suitability
   - Public perception on sago development program
2. Design an initial draft of strategy on sago development

Observation / Interviews	Results
This area has potency for sago development	Yes, on pit area.
Priority of development of cultivated plants	Palm trees and rubber trees, while sago is not priority yet.
Sago plant area, number of farmers, and processing plants	No data.
Treatments has to be done when sago is developed to become cultivation plants	Socialisation, superior seeds procurements, counseling for cultivation technique, present of simple processing plant, and marketing of product and its derivatives.
Sago benefits	Starch for food, and sago trees for duck feed.

Sago palm type growing

A

B

C

D

Sosio-economic data

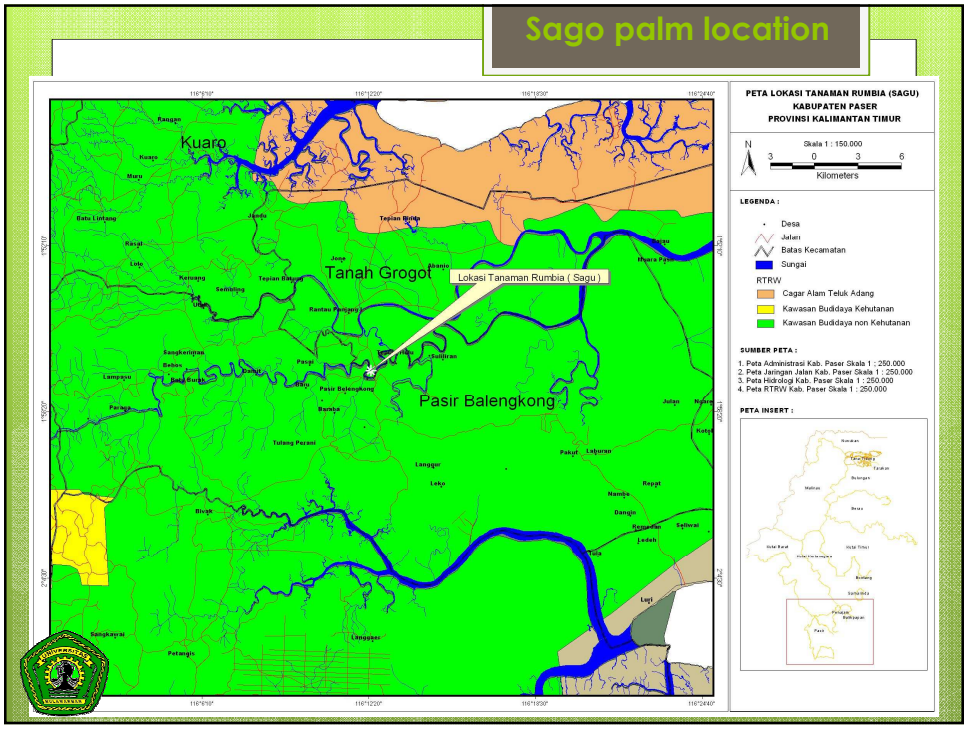
Observations / interviews	Results
Sago trees processed per day	1-2 trees
Productivity	250-300 kg wet (sun dried) sago per trunk
Sago processing	Main job, using simple equipments
Sago selling	Easy, at processing location and traditional market
Sago starch price	Rp3,000-7,000 per kg depend on location
Income in sago processing	Rp300,000-400,000 per day
Obstacles	Processing equipments
Advice	Provide modern processing equipment

Sosio-economic data

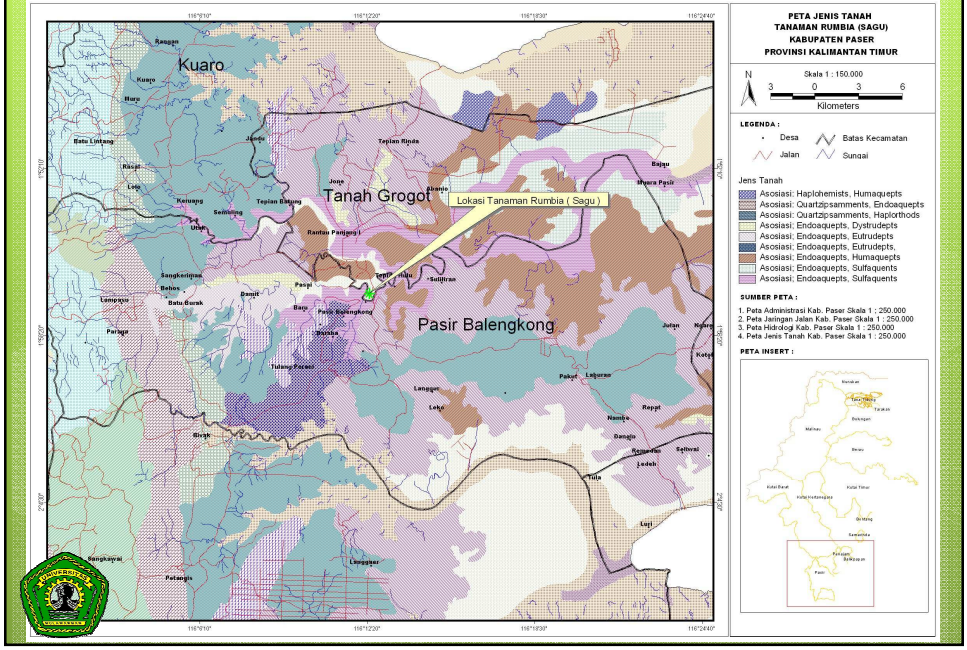
Production Parameters	Values	Notes
Price of sago trunk	Rp30.000	In Tanah Priuk Village – Paser Regency
	Rp50.000	In Babulu Darat Village - Penajam Paser Utara Regency
	Rp150.000	In Bakungan Village - Kutai Kartanegara Regency
Labors	1-2 labors	
Wage labors	Rp75,000 per day	
Work days	3-4 days per week	
Price of sago starch	Rp3,000 per kg	At processing plant
	Rp5,000-6,000	In Tanah Grogot
	Rp7,000	In Samarinda

Sago Processing

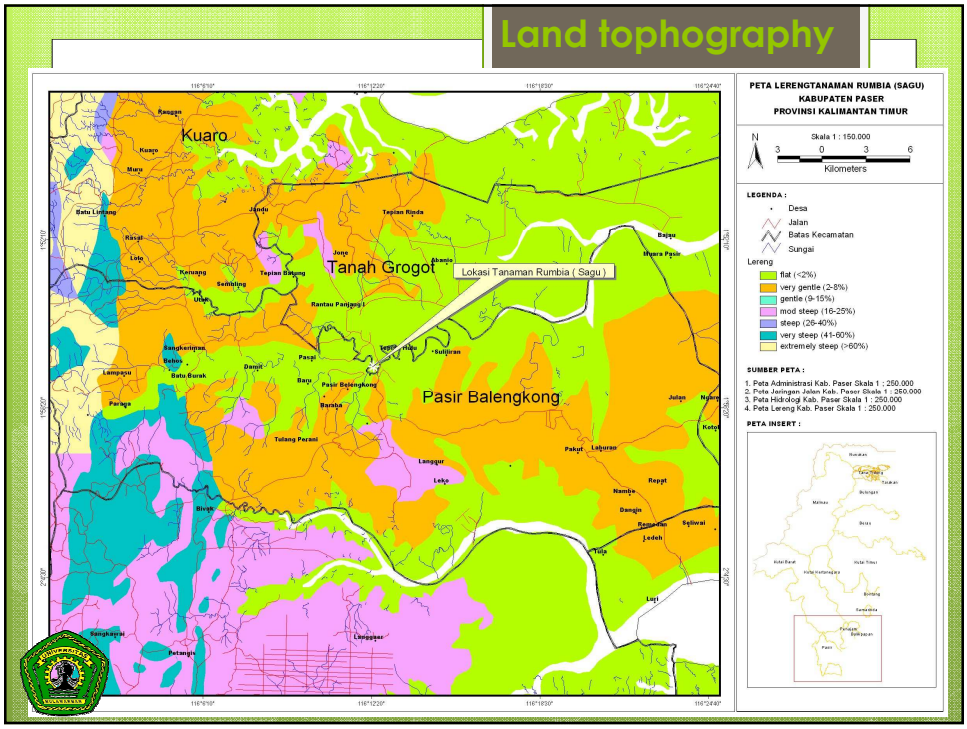
Sago palm location



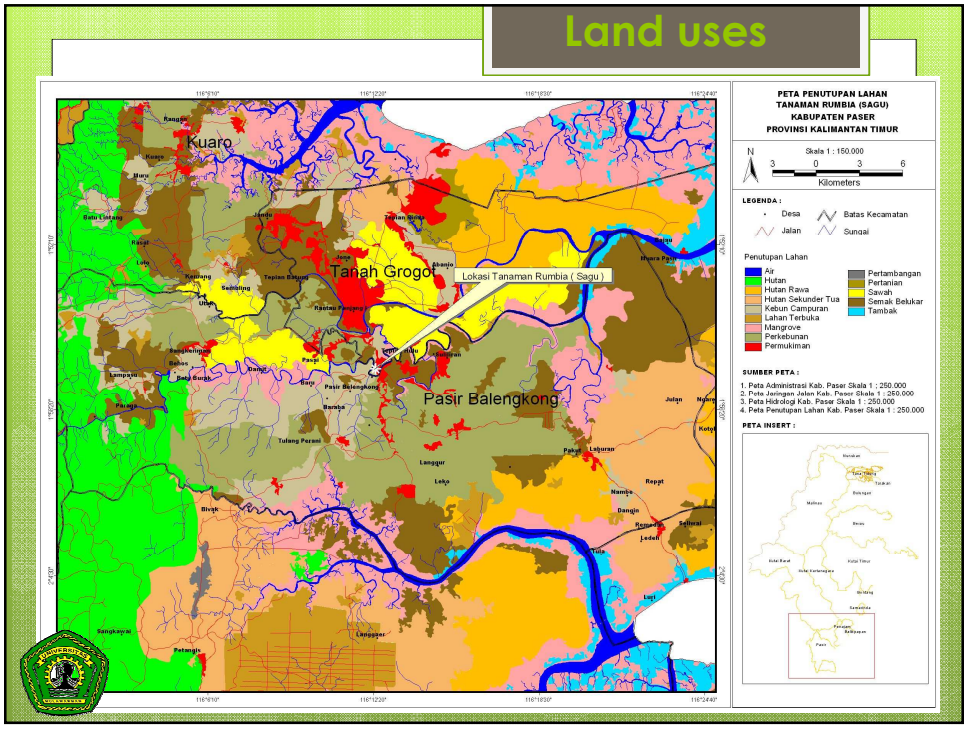
Soil types



Land tophography



Land uses



Culture Perception

- The ownership of sago plant and sago based business activities in the research area were derived from their parents since generations.
- The owner of sago plant strongly agree if sago based bussiness activities infrastructure like sago cultivation, sago processing plant, sago derivating product plant are constructed.

Initial sago development strategy

1. Optimization of marginal land use for business activities based on sago.
2. Create policies that support the development of business activities based on sago.
3. Create a development sago industry road map, including sago derivative product (bioethanol).
4. Provide mentoring to sago processors to increase the sago bussiness scale.
5. Invites investors for sago based bussiness activities.

Initial sago development strategy

6. Give priority to open on farm and off farm business activities based on sago.
7. Provide capital aid for sago processors to expand their business scale.
8. Provide extension and technical mentoring in the cultivation of sago.
9. Provide guidance and mentoring of clean production in sago processing, including product quality standard.
10. Provide guidance and mentoring in the utilization of sago trees and by-product of sago processing.

Initial sago development strategy

11. Build partner co-operation between sago farmers and processors.
12. Introduce the national and international market for sago.
13. Connecting the local sago processor to national and international market for sago.
14. Building the infrastructure that support sago based business activities.
15. Infrastructure development for sago bsed bussiness activities become priority.
16. Provide labor in sago processing from outside the area, which the wages are affordable by the sago processor.

THANK YOU