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Cultivation Practices and Knowledge of Local Rice Varieties among Benuaq Farmers in Muara Lawa District West Kutai, East Kalimantan-Indonesia

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ABSTRACT

This research aim to study how Benuaq society around Muara Lawa District, manage agriculture system and internal knowledge about rice varieties. This research use ethnobotanical approach: collecting ethnobotanical data of rice varieties and traditional system of swidden cultivation. Data was obtained by using direct participatory technique by interviewing the people (key informants) about their practice and perception. The interviews were unstructured open-ended discussion on knowledge and farming activities including about diversity in rice varieties. Subsequently, quantitative data from questionnaires was combined with depth-interview data from key informants. The Benuaq indigenous systems, practices, and cultivation preferences held by the Benuaq are guarded toward maintaining their rice diversity. The Benuaq systems of upland rice cultivation, site selection for *umaq* establishment, plant species for fertility indicator, and cultivation of wide ranges of upland rice varieties indicate their sophisticate knowledge in agriculture. Unfortunately there has been degradation in the indigenous knowledge among the young Benuaqs.

Key words: Benuaq, ethnobotanical, indigenous, upland rice.

INTRODUCTION

Benuaq is one of the Dayaks in Borneo, particularly the Indonesian part (i.e. Kalimantan). They settled in the southern tributaries of the great Mahakam River, namely the Bongan, Ohong, Jelau, Kelawit, Tuang, Lawa, Pahu and Nyuwatan (all in the Indonesian province of East Kalimantan) as well as in the upper Teweh (Central Kalimantan Province). They are profoundly concentrated in some regions in the West Kutai District, such as Barong Tongkok, Bentian, Bongan, Damai, Muara Lawa, Muara Pahu and Siluq Ngurai. Despite the information that the Benuaq tribe has long been regarded as belonging to the larger Lawangan group (Riwut, 1979). Massing (1981) mentioned that the Benuaq are rarely cited in the literature on the Dayaks of Borneo, thus it has been regarded as the least known tribe. Nevertheless, the Benuaq are the largest Dayak group in the West Kutai district in the Indonesian province of East Kalimantan and have preserved their tradition and customs ("adat") more than any other tribes.

Seeland and Schmithusen (2002) reported that Benuaq Dayak has combined the shifting cultivation and cultivated forest products as their livelihood base. This proves their deep understanding on their surrounding natural resources. The importance of Borneo in the diversity of rice varieties has been recognized by both anthropologists and agriculturists (Sutlive, 1978; Padoch, 1988; Setyawati, 1997). Freeman (1970) and Padoch (1988) reported that Dayak farmers are able to identify and cultivate various varieties of rice. This finding is in accordance with the results of Watson (1984), Fujisaka (1987) and Damus (1995) in some recent studies that traditional farmers in many places in the world are capable in maintaining the genetic diversity of rice varieties in order to match the local environmental conditions. Unfortunately, such studies were rarely gone below the level of the local communities. Despite gathering information concerning the total number of rice varieties known to the community, such researches (such as by Widjaja and Jessup,

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1986) failed to provide an information on the number of varieties that each individual farmer actually planted. This failure raised awareness among agriculturists and anthropologists, who warned that changing economic and environmental conditions may cause loss in germplasm biodiversity, particularly in the genetic resource areas.

Swidden agriculture has been practiced in East Kalimantan for a very long time and it was suspected as a cause of establishment of alang-alang grassland (*Imperata cylindrical* Beauv.) ± 400.000 ha at present and secondary forest presently 2.4 million ha (Kartawinata et al. 1981). In rotational systems, the length of cultivation and fallow periods, and the swiddening techniques determine the development and structure of swidden fallow secondary forest (Schmidt-Vogt, 2001). According de Jong et al. (2001) swidden fallow secondary forest defines as "forest regenerating largely through natural processes in woody fallows of swidden agriculture for the purposes of restoring the land for cultivation again".

The current research was carried out in the Benuaq community of Muara Lawa District, East Kalimantan, Indonesia for six months. Data were collected through five weeks of fieldworks from June to December 2008 proceeded in three villages Dingin, Muara Lawa and Lambing. Data collecting was focused on four specific questions: (i) Why do the farmers select and maintain certain rice varieties? (ii) Do some of the farmers maintain certain varieties that were abandoned by other farmers? (iii) Is the traditional practices effective in conserving the biodiversity? (iv) How are the knowledge of varieties and the seeds themselves disseminated? This current study also attempted to understand the operating mechanisms in the acquisition and maintenance of rice varieties among farmers following the previous example by Vayda (1992).

MATERIALS AND METHODS

This current research was focused on individual knowledge and behavior in farming activities and obtaining explanations for the occurrence of genetic diversity in rice varieties and the dynamics of farmer's knowledge of rice. The ethnobotanical approach was implemented involving collecting data on rice varieties and traditional system of shifting cultivation. Data was obtained using direct participatory technique through interview with the important participants (key informants) regarding their practices and perceptions. The interviews were unstructured open-ended discussion on their knowledge and farming activities including information on the diversity of rice varieties. Two hundreds households of approximately 1000 farmers of shifting cultivation in three areas were sampled. The households selected were those, in which farming is the main livelihood and shifting agriculture have been made in the previous three years.

Quantitative data from questionnaires were combined with depth-interview data from key informants. The interviews cover two important aspects: (i) Shifting cultivation, which includes numbers of rice fields during the last three years and ownership, plants indicator of fertility, land topography and soil characteristics, succession stages, rice cultivation steps, rice growth level, and quantity of harvest. (ii) Knowledge of rice varieties, which covers rice varieties, sources of seeds and individual knowledge. Information obtained then was combined with literature study, ethnobotany of rice varieties, and the local knowledge of environment.

RESULTS AND DISCUSSION

Land-space selection basis and preparatory stages

The result of this current study indicates that the Benuaq cultivates upland rice on annual field (*umaq*). This annual cycle of rice cultivation is the centre of life in the Benuaq societies in the West Kutai district. Among respondents 74.44% own 1 to 2 hectares of annual swidden area, 15.93% less than 1 hectare and only 9.63% more than 2 ha (Table 1).

Table 1. Areas of annual swidden (*umaq*) own by the Benuaq people in Muara Lawa District on planting season of 2006/2007.

Areas of annual swidden	Respondents (N)	%
Less than 1 hectares	43	15.93
1 -2 hectares	201	74.44
More than 2 hectares	26	9.63
Total	270	100

The selection of a suitable site to establish field is carefully and involving consultations and cautious observations. After performed, the shifting cultivation activities are started. These activities are usually started by land clearing in June or July to minimize pests' threats. The future rice fields of different households are planed close to each other. Recently the clearing of primary forest has become very rare as the forest located more distant from village. *Tanyut* (honey trees) as Aput (*Dipterocarpus* spp.), Itir (*Intsia palembanica* Miq.), Jelemuq (*Canarium decumanum* Gaertn.), Jengan (*Shorea laevis* Ridley), Kawang (*Shorea seminis* (De Vriese) Sloot.), Lelutukng metapm (*Alstonia pneumatophora* Backer), Merjaakng (*Sindora leiocarpa* Backer), Ngoiq (*Dryobalanops lanceolata* Burck.), Puti (*Koompassia excelsa* (Becc.) Taub.), Tempudou (*Dipterocarpus confertus* Sloot.), dan Tudak (*Artocarpus* sp) and potential trees (e.g. fruit trees) within the rice field areas are not cleared.

Bordering fields are cleared (*ladekng*) and ignitable materials are avoided in order to prevent unintended fires invading the neighboring fields or forests. Soon after the burning field was hand planted. This is normally done around September.

When rice has grown up reaching knee height vegetables, cassava, banana, chili, sweet potato, eggplant and other perennial crops are planted. The plots are weeded regularly and rice is harvested around March in the following year, while other crops are left to mature. The result of this current research shows that the Benuaq is familiar with the fallow land fertility indicator. The fertility level is checked using certain plants as indicators (Table 2).

The varieties of rice planted vary considerably according to the land need and type. Based on land topography and soil characteristic the Benuaq farmers distinguish land farming into 3 types: (i) *Dempaak*, which are flatlands between two hills. (ii) *Kerebeek* or *kerereng*, which are sloping land but less steep. It is the most commonly used land for rice. (iii) *Payaakq*, which are wet or swampy areas used for wet-rice varieties. *Payaakq* is divided into two subtypes: (a) Common *payaakq*, which is smooth land at lowland level and always soaked with water. (b) *Payaakq belikuq engkok*, which is unsmooth land at lowland level. Only half of the area is soaked with water, the rest is dry land.

According to soil characteristics (color and structures) the Benuaqs distinguish four types of soil: (i) *Tana metapm*, which means black soil. (ii) *Tana meaq*, which means red soil. (iii) *Tana ronan*, which means clay soil. (iv) *Tana one*, which means sandy soil. *Tana one* then is divided into three subtypes: (a) *Tana one lemit* (yellow sandy soil), which is found in riverbank. (b) *Tana one metapm* (black sandy soil), which is found far from riverbank. This type of soil is fertile with degree of fertility based on land succession stage. (c) *Tana one bura* (white sandy soil) usually infertile land kerangas. Other classification of lands is based on features such as the plant species present.

The Benuaqs understood that slash-and-burn events influence the time scale of the subsequent development of each area of fallow land. They use this knowledge to plan their next slash-and-burn event. The result of this current study indicates that base on the differences in the succession stages the Benuaq classify the fallow lands into: (i) The initial stage of secondary growth (aged 1-3 years) is called *urat* and consisting shrubs and herbs. (ii) The young secondary forest which follows *urat* and is called *balikng bataakng* (aged 5-15 years) and consisting of pioneer tree species. (iii) The old secondary forest (aged 20 to 30 years) or is called *bataakng*. (iv) The older stage forest which is called *bengkal tuhaq* (particularly when over-45 years old). This result is in accordance to Okimori and Matius (2000).

The Benuaq farmers have also discovered and maintained a swiddens working system with a certain periodicity. The result of this current study regarded as the most appropriate farming method for local conditions and the economically most profitable. The cycles of shifting cultivation the Benuaqs was presented in the Figure 1.

Rice is a main crop in Benuaq farmers field (*umaq*). It is both praised as both staple food and a cultural representation that determines their way of life. This is accordance with Sellato (1989) that rice is source of entire life aspects for Benuaqs. The Benuaqs rice harvesting cycle is honored with taboo and ceremonies. The Benuaqs categorize their swidden area based on the growth level of rice into 14 levels (Table 3).

The time to maturity for upland rice is about 4 to 6 months depending on the varieties. The Benuaqs use ex-container (i.e. can) of cooking oil to count the crops, in which one equals to 10 kg of dry paddy. One hectare dry field produces 100 to 250 cans or approximately 1 to 2,5 tons of dry paddy. Part of the harvested crops is stored in *kelengkikng* (rice barn), while other part is sold for cash. Harvest usually decreases in the following year, thus farmers move into another land in order to get a fertile clearing land. The Benuaqs acknowledge that their rice productivity is somehow closely connected with the land fertility and in turn the land fertility is related with the stage of forest succession; thus the soil in the previous fields have to be given enough time to recover its fertility.

Table 2. The fertility indicator plants at Benuaq society in Muara Lawa.

Local name	Scientific name	Family
Bateteq	*Hornstedtia* sp.	Zingiberaceae
Belaban	*Tristaniopsis whiteana* (Griff.) Wilson & Waterhouse	Myrtaceae
Belayatn	*Merremia* sp.	Convolvulaceae
Bengkuukng	*Macaranga gigantea* (Reichb. f. & Zoll.) Mull. Arg.	Euphorbiaceae
Beramboyut	*Macropanax dispermus* Bl.	Cucurbitaceae
Biruq	*Licuala valida* Becc.	Arecaceae
Butootn	*Stachypterinum* sp.	Maranthaceae
Isaaq	*Cominsia gigantea* K. Schum.	Maranthaceae
Jaung	*Nicolaia speciosa* (Bl.) Horan	Zingiberaceae
Kayu sirih	*Piper aduncum* L.	Piperaceae
Nagak	*Schima wallichii* (D.C.) Korth.	Theaceae
Pipit	*Lithocarpus elegans* (Bl.) Hatus. Ex S.	Fagaceae
Pisaaq	*Fordia splendidissima* Bl.	Fabaceae
Tempuro	*Dillenia* sp.	Dilleniaceae
Tentaknq	*Campnosperma auriculatum* (Bl.) Hook. f.	Myrsinaceae

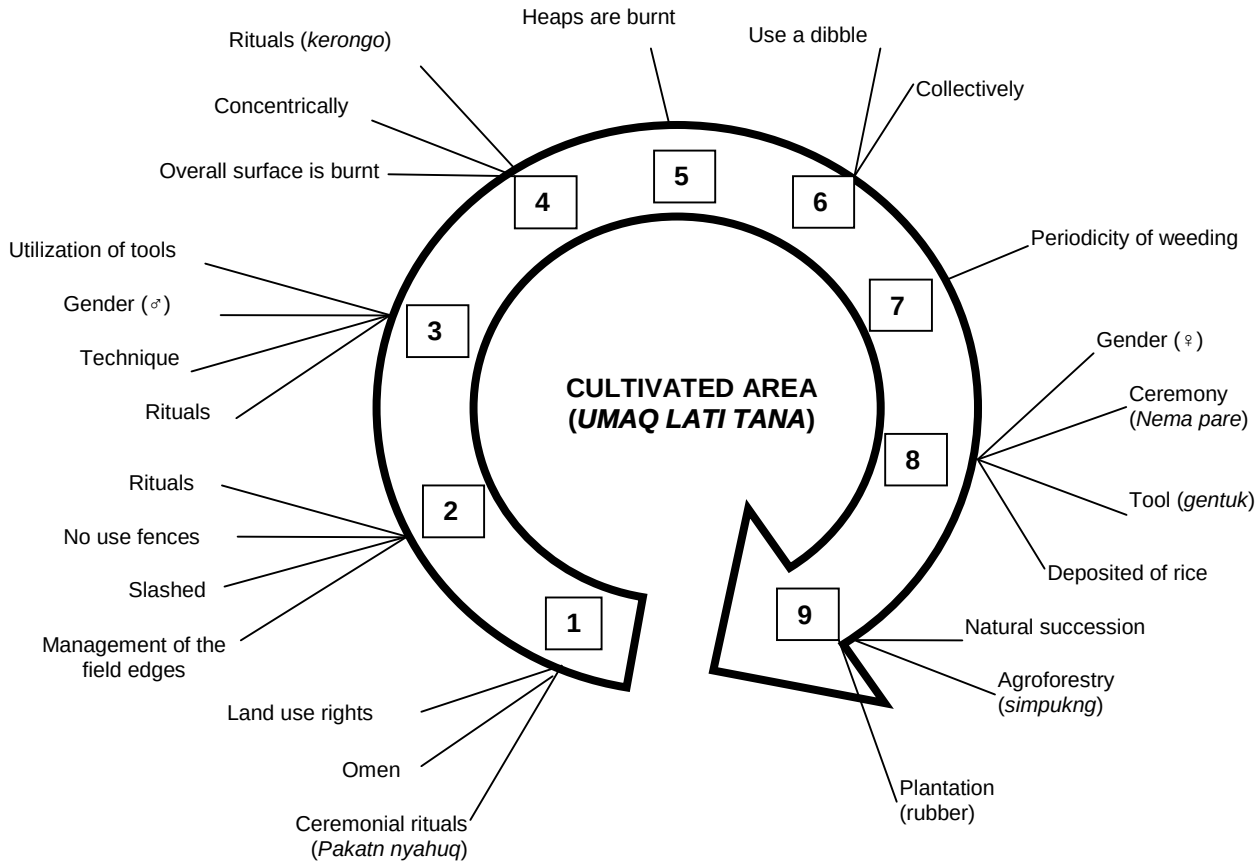

Figure 1. Cycles of cultivation the Benuaqs:

1. Selecting (*Nusaq lati tana*), which is done a year before swidden activity. The Benuaq farmers proceed a ritual ceremony in order to identify a suitable swidden site and the most common ceremonial rituals practiced in this step is *Pakatn Nyahuq* (sacrifice for forest spirit). Accordance to Sellato (1989), who mentioned that most of the Dayaks select time activity based on star and the result of this current study specific star for agriculture is *Bemari star*, for land selecting and *Piyuluq star* (*Pengkuluq*) for sign to begin swidden activities in Benuaqs knowledge.
2. Clearing of scrubs (*Nokap nerap*). The area is slashed around June to July by both men and women Benuaqs. The slashed vegetations are allowed to dry under the sun for a few days for drying.
3. Felling of trees (*Nowang*) and cut into pieces (*Nutu*). It takes place around July to August. Equipment used for cut down trees are adze, axe and chopping knife. Nowadays the use of chainsaw plays an important role for time efficiency. The plot is then left to dry for a period of 4 to 5 weeks. Plots with larger trees and bigger branches require longer time for drying.
4. Burning (*Nyuru*) takes place at September to October. The burning is done concentrically. Ceremonial rituals is performed including creating a human picture (*Kerongoq*), placing it above the *nyiruh* (or winnowing basket for rice) and hanging it in house yard.
5. Re-burning (*Mongkekng*), any leftover branches and logs are collected in piles and a second burning is arranged in which both men and women get involved.
6. Sowing (*Ngasaq Niruk*). This kind of rice planting is done collectively. Men and women in turn are mutually and cooperatively involved *pelo* and *beroh*. Pelo is a kind of mutual cooperative in the pelo members, while beroh is workers thats helps in fields. This step is done by sowing paddy in holes into holes using a dibble (a pointed stick).
7. Weeding (*Ngejikut*) is grasses or weeds clearings. This work is done after rice reaches one to three months old. Before three months old, the work is intensively done in turn by women through a mutual cooperative (*pelo* or *beroh*).
8. Harvesting (*Ngotepm*). The *ngotepm* is started by a harvesting ceremony called as *Nema Pare*, attended only by closely related members of the house (usually one big family). This ceremony is to invite the Goddess of Paddy (*Luwikng* or Dewi Padi in Malay). The harvesting process is usually worked in mutual cooperative by women only that is taking turn between mothers and daughters (*pelo*). The small palm-held reaping knife for cutting rice stalks (*gentuk*) is used. The harvested paddy then is put into bamboo or rattan pouch which is tied up in waist (*gamak*) and carried and deposited in the rice barn (*kelengkikng*).
9. Fallow (*Uraat-bataakng*). The *uraat-bataakng* is the fallow stage of field (*umaq*) following upland rice cultivation. *Uraat* is advanced fallow may have been planted with various fruits, rubber and rattan plants. *Bataakng* is the old secondary forest of successional stage of fallow.

Table 3. The upland rice growth level in swidden of Benuaq people.

Growth level in Benuaq language	Characters
Nokoq	The rice germinates after sowing. The seedling will grow and develop the branched tillers.
Meriwih luang asak	The tillers growth reached 20 cm and primary tillers develop into secondary and tertiary tillers.
Makur lokatn	The tillers growth and reached 40 cm high.
Beramaaq	The clump of paddy growth reached 80 cm to waist height of an adult.
Untuq maih	The clump is pointed up with mature internodes, which are hollow and finely grooved with a smooth outer surface.
Buluq tituknq	The panicle inflorescence is appearing from the top of the internode of the clump.
Entur urakng	The panicle inflorescence bears rice spikelets that develop into rice grains. Although the inflorescence are appearing but not yet spread evenly in the field.
Meetn/*Belampaar*	The spikelets are appearing in full.
Sengayo seloit	Half of the panicle inflorescence begins to bend as the contents (rice grains) have fully developed.
Ngejatas	Rice grains are white as milk.
Ngertak	Filled out rice grains as legumes.
Lemit morakng/*Luai uruk*	Rice grains at the terminal part of the panicle infructescence are yellowing.
Luai tengah	Rice grains at the upper half part of the panicle infructescence are yellowing.
Luai melus	The entire rice grains are yellowing this means the rice is mature, thus time for harvesting.

Farmers knowledge of rice varieties

In general the Benuaqs classify their rice varieties into two: (i) *Pare* (the common rice), which includes 67 varieties. (ii) *Pulut* (the glutinous rice), which includes 36 varieties. Despite these 103 rice varieties, only few observed in this current study. Most of the varieties (97 in numbers) are for dry field farming and can be planted in various topographic conditions, while six can only be planted in wet land or swamp areas. The varieties are mostly indigenous, while few varieties were introduced from other areas. The introduced rice varieties are common in Dayak societies as was discovered by Freeman (1970) in the Ibans. The Benuaqs in Muara Lawa have detail specified terminology for categorizing their rice varieties. Each variety has a local name and the farmers are familiar with the distinctive characters or origin from which the name is derived. Various name and sub name mostly based on the original area of the name. Varieties from other areas can be combined with the local name such as pare *bentiant, pare bogor* or *pare kenyah*. Some rice varieties have connections with the myth in the Benuaq society such as *pare bawiiq* (*bawiiq* means pig in Benuaq language). The Benuaqs believe that the first grain of this rice is found in the intestine of a pig. Other example is *pare tekayo* (*tekayo* means deer in Benuaq language). Similar as in pare bawiiq, but the first grain is believed found firstly from the intestine of a deer instead. The origin of several varieties names remains unclear though.

The Benuaqs prefer local varieties than introduced ones. Although the local varieties are not as productive as the introduced ones, but the indigenous varieties are more resistance to pest, more adaptive to local nutritionally poor condition, and taste better. Indeed, some farmers admitted that they do not like to cultivate the so called wetland rice simply because their family prefers the taste of upland rice.

As nowadays agriculture is in pursuit for sustainable germplasm for increasing harvest and diseases resistance, the Benuaqs' indigenous rice varieties open more plausible possibilities. Studies have given us important information about farmers' knowledge of rice varieties and some researchers have found that farmers maintain genetic diversity of rice varieties in their fields to match local environmental conditions (Fujisaka, 1987; Setyawati, 1997).

Several farmers can identify or recognize the entire 103 rice varieties recorded in this research, while the others can only mention 10 to 40 varieties. In general, all farmers can recognize about 40 % of the existing local varieties. The result of this current study shows that the senior members of the Benuaq society (such as the traditional law leader or the *Mantiq*, his wife, and three senior farmers) have more knowledge in particular domains of expertise than younger members (Table 4). Only the *Mantiq*, his wife, and three senior farmers are able to identify all existing local rice varieties. Other farmers with age more than 40 years old can mention about 60 % varieties, while younger farmer with age less than 30 years old can only identify about 20 % varieties. This clearly shows that the indigenous knowledge in rice varieties in the Benuaqs is degrading.

The knowledge of rice variety can also be achieved from the *pelo* group. In the early cultivation season, the members of *pelo* assemble and discuss

Table 4. Average number of rice varieties known according to farmers age.

Age (years)	Average number of varieties known	Number of respondents (N)
20 -30	18	10
31 -40	25	16
41 -50	43	14
> 50	62	10
Total		50

about the next planting season. The most important agenda is on which rice variety is to be planted for the next season. Thus, farmers develop their knowledge through experience, exchange of knowledge, and careful observation of other farmers' plants.

In each of the planting seasons, most farmers cultivate at least one variety that is different from the previous season and it depends on the harvest of the previous season. If the harvest was successful, the varieties will be cultivated again. If it was the opposite, the new varieties are implemented. Most farmer mentioned that they make plan well in advance including choosing the varieties to be planted for the next season. If the plan is to plant the same variety again, an appropriate quantity of seeds from that variety has to be separated from their harvest. If they want to try another variety for the first time, they must ask or exchange seeds with other farmers. For the Benuaqs harvesting for paddy seeds and rice grains are two different things and have to be done separately. Paddy seeds were harvested from fertile and healthy stalk, thus the quality of the rice can be maintained and increased. The instability of environmental conditions from year to year may encourage the Benuaqs farmers to try many different varieties with hope that some varieties will grow well on the changing soil condition and produce good harvest.

This current study observes that occasionally the Benuaq farmers plant several different kinds of the upland rice. For example in one year planting season the families in Muara Lawa cultivate about 20 different rice varieties. This kind of rice planting is because specific variety grows better in certain environments. Success yield of each variety will be compared between harvests. If one or two varieties grow fertile after closely planted, their seeds will be harvested separately in the next planting seasons. On the contrary, if they are fall to grow, those varieties are not planted in next season. This finding is in accordance with Dove (1988) that the purpose of mix planted was to test the relative benefit of one or more rice varieties.

CONCLUSION

The Benuaq Dayak indigenous systems, practices and preferences are achieved towards maintaining biodiversity. The area of Benuaq's swidden ranged from 1 to 2 hectares, and adapted to the limitation in the manpower. The Benuaq systems of dry field rice cultivation, site selection for *umaq* establishment, plant species for fertility indicator, and cultivation of a wide range of upland rice varieties indicate that they have a sophisticated agricultural knowledge. There are 15 plant species for fertility indicators found. These species are used as guideline for field selection. Other guidelines include land topography and soil characteristic. The Benuaqs understood very well that the slash-and-burn events influence the time scale of the subsequent development of fallow lands and use this knowledge to plan their next slash-and-burn event. The Benuaqs know nine steps for rice cultivation and 14 swidden rice growth levels. Farmers classify rice varieties into two: *pare* (the common rice) with 67 varieties and *pulut* (the glutinous rice) with 36 varieties and totality 103 rice varieties were recorded in Muara Lawa. Unfortunately there has been a degrading in the indigenous knowledge of rice varieties among young Benuaqs.

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