

Community knowledge of *Amorphophallus muelleri* Blume: Cultivation and utilization in Central Java, Indonesia

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Abstract. Wahidah BF, Afiati N, Jumari. 2021. Community knowledge of *Amorphophallus muelleri* Blume: Cultivation and utilization in Central Java, Indonesia. *Biodiversitas* 22: 2731-2738. *Porang* (*Amorphophallus muelleri* Blume) is a member of the Araceae edible family currently popular on Java island, Indonesia. In the last five years, this plant which has high economic value due to its various benefits as a food plant and medicinal plant has been cultivated in Central Java. This study aims to determine the knowledge of the people in Central Java about *porang* plant, its cultivation, and its use in people's lives. The method used is a qualitative method by applying data collection techniques through interviews, observation and documentation. Besides general interviews, this study gains more information from some informants whose purposively chosen amongst the respondents as people knowledgeable about *porang* in general, and in particular *A. muelleri*. Results showed that people in Central Java do have knowledge about *porang* plant even though it was not used as food ingredient. Public knowledge about *porang* cultivation is obtained from various sources including social media and people who strive for *porang* with success. Therefore, since the community is currently aware of the potential and economic values of *porang*, they have started to cultivate it. *Porang* has enormous potential to be developed in the future and provide welfare for the community.

Keywords: *Amorphophallus muelleri*, Central Java, community knowledge, cultivation, *porang*, utilization

INTRODUCTION

The *Amorphophallus muelleri* Blume plant is a member of the taro family (Araceae). This edible Araceae is a native Indonesian plant that grows wild in tropical forests (Susanto 2020). Generally, people in Java know this plant by the name *porang*. This plant thrives in many lowland areas, mountains, and forests with tall trees (Santosa et al. 2003; Sumarwoto and Maryana 2011). *Porang* grows among tall plants that live around it, such as teak and sono trees as shelter (Santosa et al. 2018; Lontoh et al. 2019). One of the locations in Java as a place to grow *porang* is the plateau in Central Java, Indonesia.

Currently, *porang* plant is popular in Indonesia. In recent years, people have become interested in cultivating *porang*, particularly on the island of Jawa and more specifically in Central Java. The government also pays great attention to *porang* cultivation to be propagated into an export commodity (DPRD-Jateng 2020; Pemprov-Jateng 2020; Pertanian-Jateng 2020). The development of *porang* cultivation is driven by the economic value of the *porang* tuber and its derivative products. The high glucomannan content in *porang* tubers makes this plant in great demand, especially by the food and health industry either in domestic or international trade (Wigoeno et al.

2013). According to Shi et al. (2020) glucomannan is a hydrophilic polysaccharide that can be produced from various natural plants. One of the most famous is the glucomannan konjac. In addition, the tubers are also a source of low calories carbohydrates that are rich in fiber, so they are very suitable for dieting. According to Shi et al. (2019), this plant from the *Amorphophallus* genus is rich in soluble dietary fiber and has long been used as food and traditional medicine in Asian countries. Glucomannan can be an alternative to losing weight and overcoming obesity, especially in adults (Mohammadpour et al. 2020).

Sirotkin (2021) stated that glucomannan contained in tubers of the genus *Amorphophallus* has the ability to reduce the fat storage process through extra and intracellular mechanisms. Thus, *porang* cultivation is a very promising business in the future. Derivative products such as shirataki rice are in great demand by the public (Widjaja et al. 2014), since the *Amorphophallus* tubers act as a "dietary fiber" which may lower blood cholesterol levels (Fang and Wu 2004; Vasques et al. 2008; Chua et al. 2010; Impaprasert et al. 2014; Behera and Ray 2017).

People live and interact with the environment around forests, fields and rice fields by using their local knowledge. Plants can be used as a source of nutrition, medicine and housing needs. In addition, people also use this knowledge to plant and cultivate plants that are

considered important for life. According to Antweiler (1998), local knowledge means knowledge integrated into a culture originating from a certain area or location. Therefore explains logically the relationship between humans and their environment. This knowledge is emic, which means that what is understood from the perspective of local people is part of a long process of human adaptation to their environment (Purcell 1998). Specifically, local knowledge regarding the environment is also known as Traditional Ecological Knowledge (TEK), which means the whole knowledge and practice of the relationship between living things, including humans and their environment, which is passed down culturally (Berkes 2008). From this knowledge, people make use of the *porang* plants living around them for welfare purposes.

Many Indonesians, especially the Central Javanese, live from agriculture. Several Indonesian scholars have written public knowledge about *Amorphophallus* plants. Mutaqin et al. (2020) writes about the use of *suweg* (*A. paeoniifolius*) in the Majalengka community of West Java. Similar research was conducted by Hidayat (2019) on *suweg* that grew under teak plantations. Other research is about the characteristics of glucomannan contained in *porang* tubers (Yanuriati et al. 2017). Meanwhile, research on local people's knowledge about the *A. muelleri* species is still very rare, so this article might introduce how the local people know about *porang* gain a renew.

People in Central Java recognize three other types of *Amorphophallus*, namely *A. campanulatus* var. *sylvestris* (*walur*), *A. variabilis* (*iles-iles*) and *A. paeoniifolius* (*suweg*). These types are commonly known to the public by the names *porang*, *ponang*, *iles-iles*, *suweg* and *walur* whose names are often exchanged in different regions. For example, in Central Java, *porang* (*A. muelleri*) is called *iles-iles*, in West Java it is called *acung* (Susanto 2020) and

in Madura it is called *kruwu* (Sugiyama and Santosa 2008). Morphologically, these plants are very similar to one another, so that it is one of other factors causing different local names in different regions.

This study aimed to determine the knowledge of the people of Central Java, Indonesia about the *porang* plant (*A. muelleri*), its cultivation and its use in people's lives.

MATERIALS AND METHODS

Study area

The research was carried out on communities in the Semarang and its surrounding areas of Central Java Province, Indonesia, i.e., Wonosari Village (Ngaliyan Sub-district, Semarang City), Nongkosawit Village (Gunungpati Sub-district, Semarang City), Bergas Village (Ungaran Sub-district, Semarang District), Tuntang Village (Tuntang Sub-district, Semarang District), Blotongan Village (Sidorejo Sub-district, Salatiga City), and Watulawang Village (Limbangan Sub-district, Kendal District) (Figure 1).

Procedures

The method used is a qualitative method that seeks to explore the experience of the people of Semarang and its surroundings about *Amorphophallus muelleri* Blume (emics), which is then validated using scientific knowledge (ethics). The samples were determined purposively with the criteria of local people who have knowledge and expertise about *Amorphophallus*. In this study, the number of informants interviewed was 20 people consisting of 7 *porang* farmers and entrepreneurs, 6 workers in *porang* agriculture, 6 local communities, and 1 staff from the agriculture and forestry office.

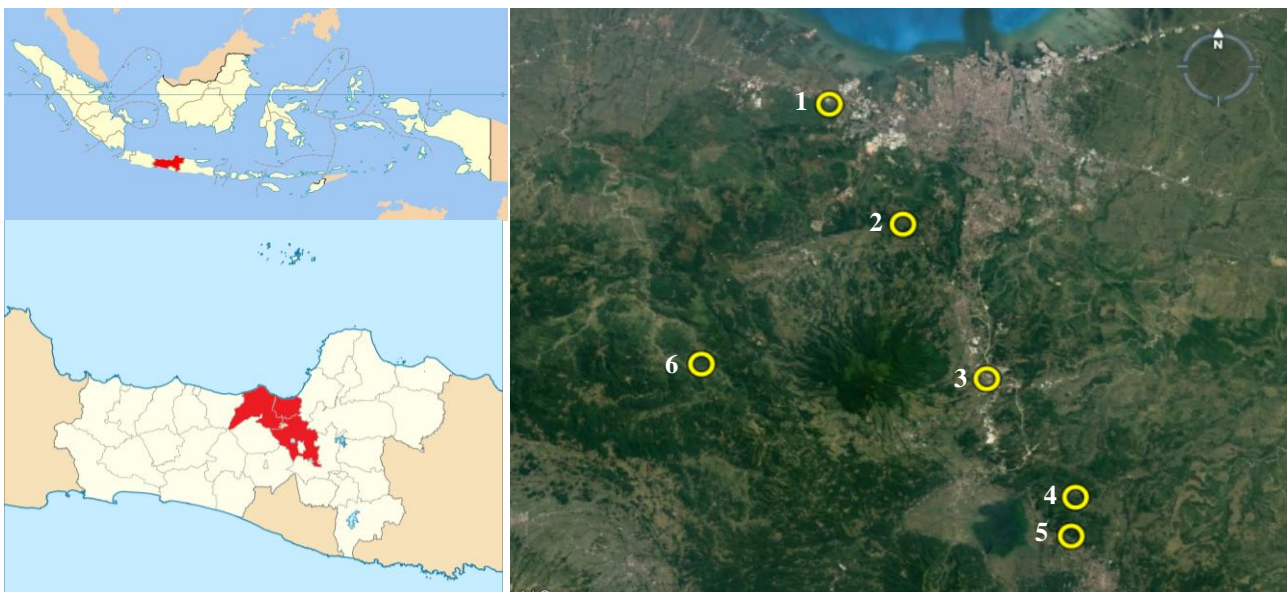


Figure 1. Sampling locations of this study in Semarang and its surrounding areas of Central Java Province, Indonesia, including subdistricts of: 1. Wonosari Village, 2. Nongkosawit Village, 3. Bergas Village, 4. Tuntang Village, 5. Blotongan Village, 6. Watulawang Village, January to February 2021

Data collection was carried out by using semi-structured interviews and field observations. Semi-structured interviews were conducted with snowball sampling technique. The key informants in this study were *porang* farmers from the Limbangan area. The next informant was obtained from the key informant. While the method of observation is carried out by looking at *porang* plants by conducting field observations of the forest, plantation and local community homes.

RESULTS AND DISCUSSION

Research location profile

This research was conducted in several locations to explore people's knowledge about cultivation and utilization of the *porang* plant (*Amorphophallus muelleri* Blume). *First*, Wonosari Village is an area located in Ngaliyan Sub-district, Semarang City. The area and land conditions are very suitable for cultivating *porang* plants. In Wonosari, farmers cultivate *porang* and have started his business two years ago. *Second*, Nongkosawit Village is an area located in Gunungpati Sub-district, Semarang City. In Gunungpati a *porang* community of ca. 20 members has been established. *Third*, Bergas Village is located in the mountainous area of Ungaran Sub-district, Semarang District. The land in this region is very fertile, so it is easy to cultivate *porang*. *Fourth*, Tuntang Village is located in Tuntang Sub-district, Semarang District. There is a farmer and a *porang* businessman who cultivates *porang* on his own land and has several assisted members in this area.

Fifth, Blotongan Village, Sidorejo Sub-district, Salatiga city is located on the Central Java regional route that connects the cities of Semarang and Surakarta. Salatiga is at an altitude of 450-800 meters above sea level (m asl) and is very suitable for cultivating *porang*. *Sixth*, Watulawang Village is located in Limbangan Sub-district, Kendal District. The farmers also selling seeds to outside Java, i.e., Aceh, Palembang, Riau, Maluku, Ternate and North Sulawesi. Many people of Watulawang cultivate *porang* and are members of the assisted farmers.

Community knowledge about *porang* (*A. muelleri*)

According to stories from the local community, the *porang* plant has been known since the Japanese colonial era. At that time, the Japanese ordered people to collect *porang* in the forest, either to be sent to Japan or as a daily food ingredient (Saleh et al. 2015). In addition, *porang* was used as a staple food for forced labor under the leadership of the Japanese colonialists (Romusha). *Porang* is processed simply into food by boiling. Although *porang* was not considered food by Indonesians at that time, in Japan *porang* was a food raw material in traditional food offerings (Mubarok and Santoso 2018; Adachi et al. 2020). Until now, *porang* plants are still easily found in Indonesia and live wild.

The plant has a characteristic of tuber shape and living at an altitude of 300-600 meters above sea level, is also known by the public as "food for snakes". People attach this identity to these plants to explain that this food is only

for animals and is not suitable for human consumption. One of the reasons is because consuming *porang* can cause itching in the body. This causes *porang* not to be included in the category of community food. In Javanese society, using terms or proverbs to describe a prohibition is something common. Therefore, people call *porang* "food for snakes". There are not many research results stating that *porang* is consumed by the community as part of their traditional diet, except for research on the potential of the *porang* tuber as a food ingredient in Balinese society (Asih and Kurniawan 2019).

Porang (*A. muelleri*) is an intercropping plant. In the vicinity of the *porang* plants, several types of shade plants are usually planted. The purpose of this intercropping is to protect *porang* from exposure to direct sunlight, because *porang* cannot grow if the temperature is too hot (direct and excessive sunlight). Other plants that usually shade *porang* cultivation include banana (*Musa paradisiaca*), mahogany (*Swietenia mahagoni*), nutmeg (*Myristica fragrans*) and sengon trees (*Albizia chinensis*).

In the past, *porang* was a wild plant that lived in the forest. *Porang* has been cultivated in Semarang for the last five years. The results of interviews with informants showed that people in the Semarang and surrounding areas generally had some difficulty distinguishing between *porang* and other *Amorphophallus* such as *suweg*, *walur* or *iles-iles*. This is because the morphological characters of these species are very similar to each other in terms of leaves, stems and tubers. From the results of field observations, some *porang* entrepreneurs deliberately planted other species besides *porang* as a learning medium for prospective farmers and entrepreneurs. This is very useful since the attention of related agencies to this horticultural plant is still limited. The results of interviews with informants stated that the agriculture agency's attention was still limited to the socialization of *porang* as a cultivated plant.

Utilization of *porang* (*A. muelleri*)

In addition to its high economic value, the *porang* plant has considerable potential as a medicinal and food plant. The high glucomannan content makes this plant have the potential as an alternative food that is low in calories and good for health. However, from the results of interviews with informants from the community, no one has ever used the *porang* plant as a medicinal and food ingredient. Although several informants knew the benefits of *porang*, it was not commonly consumed by the community. This is somewhat different from the *suweg* (*A. paeoniifolius*) which is commonly consumed by people in Semarang and its surroundings. *Suweg* is consumed with very simple processing, namely by boiling it. The same thing is done by the people of West Java, *suweg* is used as a snack and for religious rituals (Mutaqin et al. 2020).

According to Shi et al. (2019), the genus of *Amorphophallus* plant contains plentiful dietary fiber. *A. konjac* was recorded in Mandarin in 210 BC. for the treatment of wounds, tumors and skin diseases (Liu et al. 1998). In addition, *A. konjac* is said to have anti-obesity, antidiabetic, anti-constipation, anti-hypercholesterolemic

properties and shows potential as anti-lung cancer, as well as a prebiotic agent, most of which have been validated in various animal models and in vitro tests. Clinical trials on human subjects also support its application as a treatment for diabetes and obesity (Khan and Marya 2019). Other species of the genus *Amorphophallus* such as *A. paeoniifolius* (Dennst.) Nicolson (syn. *A. campanulatus* Blume ex Decne) are commonly used in Ayurvedic medicine as well as tribal medicines in India as treating tumors, inflammation, hemorrhoids, vomiting, coughs, bronchitis, asthma, anorexia, dyspepsia, flatulence, colic, anemia and others (Nair et al. 2019). *A. paeoniifolius* tubers also have a hepatoprotective effect in mice (Hurkadale et al. 2012). Hepatoprotective activity is also found in the tuber *A. commutatus*. Raj & Gothandam (2014) stated that the histopathological and biochemical results of the methanol extract of *A. commutatus* showed hepatoprotective and antioxidant activity which the polyphenol compounds may cause in the extract. In addition, *A. paeoniifolius* has the potential to cure hemorrhoids through its anti-inflammatory and antioxidant properties (Dey et al. 2016).

Community's reasons for planting *porang* (*A. muelleri*)

Based on the results of interviews with local people, there were several reasons why farmers started cultivating *porang*. These reasons are subjective and of course, differ from one person to another. The following are the reasons people plant *porang* based on the results of interviews that have been conducted: (i) The success of *porang* farmers in East Java is the main attraction for *porang* beginners in Semarang. Information from various media such as YouTube encourages farmers to plant *porang*. In the past, it was considered as wild food, now *porang* is considered a blessing plant. Semarang and Central Java are generally considered to be lagging behind in *porang* cultivation, so many beginners learn from farmers in East Java known to have cultivated *porang* first; (ii) The COVID-19 pandemic has caused many people to experience layoffs (PHK) so they lose their jobs. This makes some people then look for ways to survive while increasing basic needs. Therefore, the community then decided to start cultivating *porang*. Especially at this time, the selling price of *porang* is increasing; (iii) Intrigued by the high value of *porang* plants. The increasing popularity of *porang* lately makes many people competing to cultivate it. Entrepreneurs and investors have switched to investing in *porang* with their

large capital. This also made the farmers curious and then planted *porang*.

Types and process of cultivating *porang* (*A. muelleri*)

There are generally two types of *porang* cultivated by the people of Semarang and its surroundings, namely the green *porang* (*A. muelleri*) and black *porang* or known as black konjac (*A. konjac*). One of the characteristics that distinguish the two *porang* is the color and motif on the stem. Green *porang* is dominated by green color with white patches, while black *porang* is dominated with white spots. *Porang* only has two colors, in contrast to *iles-iles* which usually has more than two colors. Farmers already know the difference between *porang* and other *Amorphophallus* types from the motif and texture of the stalks. In addition, what distinguishes *porang* from other *Amorphophallus* is the presence of bulbil structures between the leaves. When the leaves are perfectly stretched, bulbil, or what farmers knew as "katak", will be seen. This bulbil functions as one of the reproductive organs in *porang*.

Most of the farmers in Semarang area plant green *porang*, but recently black *porang* has become increasingly sought after because it has several advantages, such as the tubers development process is faster, the tubers produced are usually larger and heavier. And if it is dried, the tuber is heavier. Although it does not really matter in terms of price, according to the farmers, there is the potential for black *porang* to be one of the prime varieties.

The *porang* plant experiences two growth phases that appear alternately, namely the vegetative growth and generative growth phases. The vegetative phase includes the growth of pseudo leaves and stems (stalks). After some time, these vegetative organs wither and the tubers are dormant. When all the leaves have died, there are still food reserves in the tubers and if the growing environment is supportive, the generative phase will begin, namely the growth of compound flowers which in its development will produce seeds. The seeds produced in this generative phase are called spores by farmers.

For cultivation needs, seeds can come from tubers, bulbils (*katak*), and seeds (*spora*) of *porang*. These organs become seeds of different qualities. Usually, seeds that come from tubers are the best choice because they will produce tubers that are larger in size and weight compared to seeds or bulbils (Figure 2).

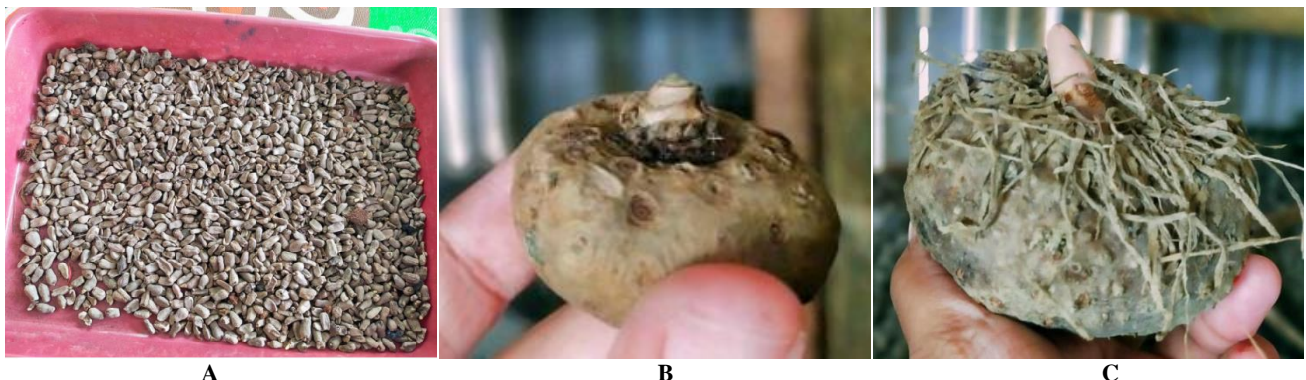


Figure 2. Organs of plant used for reproduction process. A. Seeds spora., B. Bulbil *katak*., C. Tuber



Figure 3. Stages of *porang* (*Amorphophallus muelleri*) cultivation. A. Soil loosening, B. Making beds, C. Hole making using a drill, D. Planting hole, E. Giving compost/manure, F. Selecting seeds from tubers, G. Planting seeds, H. Measuring planting distance, I. Fertilizing at 27 days after planting, J. Adult *Porang* plants, K. Harvested tubers

Porang cultivation is quite popular because it is quite adaptive in nature, easy to cultivate, and has high economic value. *Porang* plants can grow well in the Semarang area known as an area with various ecological conditions. *Porang* can thrive in cool and highlands such as Limbangan and Gunungpati areas as well as in hot lowlands such as Ngaliyan. However, like other members of Araceae, *porang* does not require prolonged exposure to the sun, for optimal growth *porang* must live 40-60% in the shade. In addition, according to Jansen et al. (1996) *porang* requires a good drainage system so that water does not stagnate which causes rot in the roots and tubers.

Porang cultivation process is divided into several stages, namely: land preparation, seed preparation, planting, maintenance and harvesting. The land preparation stage includes clearing the planting area and loosening the soil. In the process of loosening the land, farmers usually use hoes, but some farmers (entrepreneurs) use a drill for practical reasons and time efficiency. After the pulverization process, it is continued with the making of raised beds or by the Semarang community it is known as Guludan/Gulutan. These beds are made in addition to making plants look more regular as well as to prevent inundation and facilitate maintenance such as fertilization, weeding and harvesting.



Figure 5. The *porang* tuber is not in a good condition. A. *Porang* damaged by rot, B. *Porang* damaged due to wrong storage methods



Figure 4. *Porang* storage area

The next step is making the planting hole and inserting the compost into the hole. Besides compost, some farmers also use a mixture of manure. The seed preparation stage includes selecting good seeds from tubers, bulbils (*katak*) and seeds (spores). In addition to planting *porang* in the usual way (one *porang* grows into one living plant), there are also farmers who plant *porang* by propagating it. One *porang* tuber seed from a *katak* can be multiplied into 4 seeds. There is also a special way for farmers to propagate. First, the *porang* *katak* seeds are cut into 4 parts. Then, the seed pieces are soaked in the blended shallot water and closed tightly for ½ day, then lifted and aerated. Next, the seeds are smeared with kitchen ash. Finally, when the seeds sprout, only then are they planted in the ground.

In the planting process, the seeds are planted at a depth of 5-7cm with a side spacing of 45 cm, and 60 cm in stripes to allow a more optimal growth of *porang*. Anturida et al. (2015) stated that spacing in *porang* cultivation affects

plant height, crown width, tuber weight, diameter, and thickness.

The maintenance stage includes fertilization which is done when the *porang* is 27 days old. The fertilizer commonly used by *porang* farmers in Semarang and surrounding areas is POC (liquid organic fertilizer). According to the informant, other maintenance is also carried out by controlling weeds, which is usually done several times, especially when the *porang* plants are 30 days after planting.

Harvesting is usually carried out in the dry season. *Porang* plants ready for harvest are characterized by leaves that begin to dry out and fall to the ground. According to informants, after planted, *porang* begins to grow in the 11th month (November), the 12th month (December), and the 1st month (January). In January, usually, the *porang* will start to grow tall and the leaves appear. *Porang* plants will then collapse and wither in the 5th month (May). In the 6th month (June), the *porang* plants will dry up and the trees will disappear. The 7th month (July) is the time to harvest *porang*. *Porang*'s growth cycle will repeat in such pattern. *Porang* lives between 4 to 6 months to live on leaves and 8 months to live without leaves. The *porang* tubers that are produced really depend on the source of the seeds.

***Porang* (*A. muelleri*) storage**

Rotting of *porang* (*A. muelleri*) tubers is common. Fungi such as *Fusarium solani*, *Fusarium oxysporum* and *Botrytis cinerea* Pers are the main pathogens that cause the decay (Yu et al. 2015). The rot of *porang* tubers does not only occur during planting, but also during harvesting and storage. Harvesting done at the wrong time, for example when the age of the *porang* is too young, will cause rapid decay. This happens because the tubers are still in high water content. In addition, the way of storage can also affect the quality of *porang* tubers. Therefore a good storage method is needed.

The way to store porang is not the same as other types of tubers in general. Porang tubers that are not resistant to moisture should be stored using a different method. Porang farmers usually store porang by aerating it. They make a kind of simple wooden shelf which is spaced between one wood and another. The density level is adjusted to the type of porang stored. For katak tubers and spore flowers, the storage place is in a tampah (bamboo tray). Storage in this way is intended to prevent porang from rotting.

According to Adawiah et al. (2019), places for storage of tubers such as above ground level, floor, or shelves affect the physical properties of porang tubers. Storage of porang tubers on the floor causes the hardness of the tubers to decrease significantly, worse than those stored on the ground. The best storage is on a shelf in order to minimize damage to the tubers.

In the storage process, *porang* are usually grouped by size, ranging from small to large *porang*. The *porang* is grouped starting from the *porang* that is ready for production, tuber seeds, katak seeds, and spores seeds

Treatment of the damaged *porang* (*A.muelleri*)

Not all harvested *porang* tubers are in a good condition. There are also some tubers that are decayed or damaged. This can be caused by mold or the wrong way of storage. For *porang* tubers that are affected by fungus, treatment is carried out by spraying Dithane M-45 to remove the fungus in the tubers. Several farmers in Semarang area explained that for tubers that have gone bad after storage, the rotten part will usually be removed, then put on the ground to dry and the shoots continue to grow. In addition, antiseptic solutions are also given to prevent widespread damage.

Although both methods have been attempted, it is not entirely possible to ensure that the tubers are still in good condition. Some are in complete decay during the treatment process. In the 9th to 11th months, the *porang* tubers can be planted together with the perfect tubers (tubers in good condition, not damaged).

Community empowerment for *porang* (*A. muelleri*) cultivation

Besides planting *porang* for personal business, some *porang* businessmen socialize *porang* cultivation to the local community. They invite people in the neighborhood to plant *porang* because of its many advantages and easy cultivation.

Porang, which is an annual plant and can be planted with an intercropping system, has made it favored by some people. Moreover, currently, *porang* is a commodity that becomes the target of suppliers in factories and businessmen, even being exported abroad. *Porang*, which was originally a wild and worthless plant, has now become a sought-after plant and has a very high selling price.

Initially, the community looked for *porang* plants in the wild or mbolang or pembolang. In one day, they usually get *porang* with an amount of up to 1 ton. Then the people tried to plant themselves on their own land. Moreover, *porang* entrepreneurs have proven that they have successfully cultivated *porang* which has a high selling price.

The process of empowering the local community in cultivating *porang* is carried out in various ways. Some are by providing seeds, selling seeds at low prices, sharing crops, and so on. This activity is expected to help the community's economy. Moreover, in one harvest farmers can get millions of rupiahs. This can indirectly improve the community's economy

The community gets socialization from *porang* entrepreneurs who are considered to have knowledge of *porang*. Then the community planted simultaneously. One of the informants, a *porang* entrepreneur and farmer from Limbangan village, socializes the movement of 1000 *porang* seeds for each house (one family) in Limbangan. The same thing was done by *porang* businessmen from Tuntang area who invited people to plant *porang* in their neighborhood by giving free seeds to the assisted community members, amounting to 30 people. The entrepreneur then buys the farmers' crops at a suitable market price.

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