21 Production and management of an underutilized fruit

Aroi aroi (Garcinia forbesii King) in home gardens and orchards

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GPD ‘passport’

<table>
<thead>
<tr>
<th>GPD code:</th>
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<tbody>
<tr>
<td>Focus area:</td>
<td>Production and crop management</td>
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<td>Character:</td>
<td>Process</td>
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<td>Name of location:</td>
<td>1. Kg. Kelatuan, Papar, Sabah, Malaysia 2. Kg. Penampang Baru, Papar, Sabah, Malaysia</td>
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<td>Name of farmer (data resource):</td>
<td>1. Mr Salleh bin Sawal 2. Mr Meon bin Gimbul</td>
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Local context

Garcinia consists of roughly 300 species of trees and shrubs distributed across South America, Africa, Madagascar and southeast Asia. Most of the species diversity in the genus is concentrated in Malaysia, where more than two thirds of the species in the genus are found. Garcinia forbesii King is a lesser-known mangosteen that can be found in the wild in the lowland forests of the foothills of the Crocker Range, and as a semi-wild or cultivated fruit tree in home gardens and orchards.
gardens and orchards in the district of Papar in the state of Sabah, Malaysia. Usually, the trees can grow up to 10 m tall and are conical to broad shaped, with characteristic rose-coloured cherry-like fruits (Plate 47a).

The district of Papar (Sabah, Malaysia) covers an area of 124,320 ha, of which 48.7 per cent is undulating and hilly terrain and 51.3 per cent is coastal plain. The climate is a monsoonal tropical type, with an average rainfall of 3,186 mm per year, the wettest month being November and the driest month being February. The average temperature ranges from 27°C to 32°C. The soil of the site is of the Brantian Association (terrace alluvium) on undulating land. The local population numbers 107,000 people, mostly rice farmers, fisher folk and traders. This district was chosen for study of its tropical fruit trees and good practices for diversity because of the high levels of diversity of fruit trees that can be found here, combined with a wide diversity of plant habitats or ecosystems for various species of plants (including fruit trees) to flourish.

Aroi aroi (G. forbesii King) as a species is popular mainly among the Kadasandusun community of Papar and throughout the west coast of Sabah. It is not used by the general population and, in recent times, even the younger generations of this community are increasingly abandoning use of this species. It is now mainly used only by the older generation for culinary and traditional medicinal purposes. For this reason, there are no marketing facilities or cooperatives for the target product, i.e. fresh fruits and dried rinds of G. forbesii, and as a result farmers arrange their own sales.

Methodology used for data collection

Potential good practices for diversity were identified through a baseline survey using a set of questionnaires developed by the Malaysian Agriculture Research and Development Institute (MARDI) in 2007. The preliminary questionnaire-driven baseline survey was conducted in 24 households in the form of structured questions. The results of the survey were reported under Salma et al. (2008). The results of this survey formed the basis for identifying potential households that could be included in the present full-scale project. The key areas are the diversity of fruit species each household manages and how these fruit species contribute to their daily dietary intake to supplement their nutrition.

The present study is to find out how fruit trees and their species diversity have played a role in the local community towards contributing to their food, income and traditional uses and to know whether these species are being threatened due to the introduction of modern varieties. We also wanted to find out how the elderly population of the community keep records of their traditional knowledge in order to maintain the cultivation of these species. Good practices for diversity (GPD) are one methodology of this project for us to capture the uses and practices of these people so as to enhance or even promote these GPDs for conservation of tropical fruit species.

In the present study, the following methods were used for data collection:
1. A baseline and impact assessment survey was carried out on 52 respondent households (the participating households of the project) and 12 control households before the project commenced. A set of comprehensive survey questions were used to gather information from these participants in these main areas:
   a. Household details
   b. Household income
   c. Fruit species diversity in home garden (diversity, area, tree numbers)
   d. Uses (any GPDs), e.g. food, medicine, handicraft, etc.
   e. How much these species contribute to the household income.

The data collected were used for the action plans to be implemented as the project progressed and to gauge the impact of the project upon completion, to see if the project intervention had a positive or negative impact for the community.

2. A Four Cell Analysis (FCA) was conducted to understand the local context of the community and the diversity of fruit species in their home gardens (Sthapit et al., 2006; refer to Chapter 3 of this book). In particular we were able to understand what the common fruit species are, what fruit species are cultivated for generating income, what fruit species are for household uses and what fruit species are rare and threatened and needing conservation.

3. Genetic Diversity Analysis (GDA) was also conducted to gauge the species diversity, evenness and richness in the home gardens or orchards of the respondents and the control households. Farm walks were conducted to identify species and numbers of individual trees. The data collected were analysed and the results presented as the Simpson’s Diversity Index.

4. Traditional knowledge and GPDs were collected through interviews with the farmers and documented in the form of written records such as the Community Biodiversity Register (CBR), as audio recordings in the form of CDs and also as video.

Culinary, medical and other traditional uses of dried Aroi aroi rind (G. forbesii King)

Aroi aroi rind has been used for generations for traditional culinary and medicinal purposes, such as a means to help women recover after childbirth and as a remedy for coughs and minor stomach ailments. Over the years it has become less popular due to modern remedies, and nowadays Aroi aroi trees are mainly planted by the older generation who still maintain the diversity of the species and the traditional knowledge associated with its cultivation and varied uses. Younger demographic groups tend to rely more heavily on modern medicines than on customary herbal remedies.

There are three varieties or forms of Aroi aroi that most farmers can describe: Aroi Batu (‘batu’ means stone in the Malay language, referring to the hard texture of the fruit rind), Aroi Tulen (‘tulen’ means original) and
Aroi Jambu (‘jambu’ is the local word for guava, which this variety resembles) (Plate 47b). The three varieties have preferred uses. All three are used as a spice. Aroi Batu is the most preferred as a spice, due to the ease of removing its hard rind for drying. However, it is quite rare and therefore more valuable than the other two varieties. Aroi Tulen and Aroi Jambu are more acidic in nature and used as cleaning agents, while all three varieties are also used for medicinal purposes. Aroi aroi rind can also be used as a replacement for asam gelugor or asam keping (G. atroviridis) in the flavouring of laksa (a popular, spicy noodle dish). The rind of Aroi aroi is dried and sold locally in the market as a spice (Plate 47f).

**Processing and use**

The traditional method of processing Aroi aroi involves first washing the fruits and letting them air-dry before removing the rind by cutting the skin around the equator of the fruit with a sharp knife, and removing the pulp and seeds. The remaining rind is spread out on traditional woven bamboo mats for sun-drying (Plate 47c). Farmers still use this simple sun-drying method that has not changed over time, despite modern technological advances in the mainstream fruit processing industry. The local communities were not aware of modern methods for sun-drying until the intervention of this project. This method of drying is highly dependent on local weather patterns, as an afternoon shower can ruin a whole morning’s work.

Once dried, the rinds are packed in plastic bags or containers. The rinds are then predominantly used as a condiment together with fish or other ingredients in local dishes like curries (similar to asam gelugor curry fish dish) or soups to attain a sought-after sour flavour, which is made by cooking the rinds with the other ingredients, grinding the rinds into powder or crushing them into smaller particles mixed into the dish. The rinds are seen as a cheap substitute for tamarind and are used together with spices such as ginger and turmeric.

When used as a cleaning agent, the fresh pulp and seeds, after being separated from the rind, are soaked in water and used to clean bronze by soaking the metal in the mixture. As a medicine, rinds are consumed by slowly boiling them in water so the decoction can be consumed for its medicinal properties.

**Solar drying: an emerging good practice for sustainable livelihoods**

The search for good practices for diversity brought to light two farmers who, in conjunction with the Department of Agriculture in Papar, in 2012, had tested a prototype solar-drying cabinet aimed at improving the processing technique for the rinds to attain higher-quality products for their variety of uses (Plate 47d). The results indicated that the drying time was reduced by 50 per cent, from three days to one and a half days, with the prototype portable solar-drying cabinet. Temperatures inside the solar-drying cabinet can reach
45°C versus the ambient temperature of 31°C. The dried product is very similar to those dried under open sun drying and both farmers found it acceptable.

The Agriculture Department has also helped the local community to develop proper packaging and labelling of the product to add value so as to gain wider market acceptability. The products are packed in 50g size plastic containers and labelled with instructions as well as nutritional value (Plate 47c). The income gained through improved processing and sales of rinds for culinary, medicinal and cleaning purposes has generated interest amongst other farmers in cultivating this particular species.

Impact on diversity

Mangosteen (*Garcinia mangostana* L.) is the preferred commercial species of *Garcinia* that is widely grown in home gardens and orchards of the community. Interspecies diversity has been maintained and increased through the continued use and planting of new Aroi aroi seedling trees (*G. forbesii* King) alongside mangosteen. The Agriculture Department has so far multiplied more than 200 seedlings and supplied to the local community for supplementary planting in their home gardens. Most *Garcinia* spp. can be planted as a mixed crop due to their tolerance to some degree of shading (Dela Cruz, 2001). This practice has improved interspecific richness and evenness in the area and strengthened the use of multiple species in the home gardens to cope with stress conditions and adversity.

From this study, it was found that there is a current research gap regarding the genetic diversity of *G. forbesii*. This species is dioecious, having male and female trees that are normally characterized by high levels of genetic diversity. However, almost all the Aroi aroi trees found locally here are female trees. Seeds from Aroi aroi are apomictic and consequently produce trees that are clones of the female parent, limiting the genetic diversity within its population. However, farmers have distinguished three distinct varieties or forms of Aroi aroi, which may indicate that despite their apomictic character, some genetic diversity is apparent within this species. Further research into the botany of this species is recommended.

This study also found that the Aroi aroi trees cultivated are propagated mainly through seeds. Farmers obtain planting materials by taking seeds from their own trees as well as through the informal exchange of seeds or saplings with other farmers and neighbours. Intraspecies diversity is maintained through the specific uses of the three varieties/forms of Aroi aroi mandated by local custom and culture. As such, farmers are expected to have an interest in maintaining each of the three forms for cultivation, thus helping to maintain richness and evenness within the population of *G. forbesii*.

Impact on livelihoods

On average, home gardens in this area have three to five Aroi aroi trees, each producing 200 to 300 kg of fruit per mature tree and 40 to 50 kg of fruit
per younger tree. The prices for dried rind range from RM15–25 per kg (i.e. US$5–8). Farmers that maintain mature trees can earn an annual income of approximately RM3,000–4,500 even in years of lower yield or sub-optimal harvest.

The hydroxycitric acid (HCA) content of the fruit rinds of Aroi aroi is valued as a souring agent for local cuisines and for other purposes. The introduction of technologies such as solar-dryers has helped improve value-added product quality and reduce potential losses incurred during the drying process due to unfavourable weather. The improved product is drier and less prone to mould, and as a result can be kept for a much longer period of time. The livelihood benefits gained from the introduction of this new technology are lower post-harvest losses and increased value of the final product. Apart from domestic use, households have benefited by generating a secure source of income that is not bound to the commercial fruit season and is more evenly spread out over the course of the year. Further scientific research, particularly regarding the nutritional and health properties of the fruit, is required to support and expand further value-addition initiatives and undertakings. As an example, Rejab et al. (2008) used dried rind powder to make an ointment to treat eczema and other skin-related diseases. Similar alternative options may be explored for diversifying livelihood options.

The establishment of these market channels for Aroi aroi products affects the livelihoods of the community as a whole through the social capital accrued from the exchange of planting materials and the enhancement of human capital through the exchange of traditional and cultural knowledge, as well as the development of processing methods and market outlets. Malaysia has seen a surge in ‘re-discovered and re-invented’ products over the last decades that are based on traditional knowledge, especially those products related to health and nutrition. Given this ongoing consumer trend, a better quality of life for rural communities is eminently achievable, and will result from the increase in income and the availability of locally preferred food and products in the target community and beyond.

**Additional benefits of this good practice for biodiversity: enhanced ecosystem services**

This practice will support the use and benefits derived from multispecies home gardens that were traditionally common in this region but are currently being replaced with cash crops. Multispecies home gardens are an important feature in the local human and natural landscape and provide ecosystem services such as habitats and food for animals and canopy cover to retain shade beneficial for other crops, all the while conserving genetic resources and diversity (Plate 47h).

Nowadays, Aroi aroi cultivation is very much dependent on domestic use, mainly for food and traditional medicine. The older population demographic, through acquired traditions and cultural practices, has played a vital role in
keeping this crop in cultivation. This knowledge has been transmitted to the younger generations in some families that have been cultivating the crop. Families who have the economic incentive of additional income derived through sales are displaying a renewed interest in wanting to continue to plant Aroi aroi in their fruit orchards. Some farmers have started to raise seedlings for replanting as well as for giving to other families who want to plant the crop. In doing so, as well as contributing to families’ livelihoods, the replanting of Aroi aroi may also contribute to the ecosystem services generated by multispecies home gardens.

Factors favouring or hindering successful functioning of the GPD

Local products of Aroi aroi that are available in local markets at present call for value-addition through better processing techniques, presentation and quality enhancement in order to be able to penetrate a wider market. Inroads have already been made by the Agriculture Department to introduce and test solar dryers and a solar drying house as well as packaging and labelling to add value to the products (Plate 47g).

These value-added traits may serve as a driving force for further scaling up and lead to an increase in the volume of national and regional trade. The production of a higher-quality product has been achieved through the use of an ‘all-weather’ drying facility for the community (i.e. the solar-drying cabinets and solar-drying house), allowing processing to continue regardless of weather conditions during the drying stage. Establishing reliable market links or outlets is also crucial to the long-term success of this GPD, which can help distribute the product to an even wider consumer base. The Agriculture Department is working towards involving other agencies such as the Federal Agriculture Marketing Authority (FAMA) and tourism facilities to further favour the success of this practice.

References