

Policy Paper

Research and development plan for fruit wine production in Thailand using *Makiang* as a case study

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Abstract

This study records the research and development work that has been undertaken on developing a non-commercial fruit product specifically for wine. The paper details the checkered history of fruit wine in Thailand and proposes the successful development of *Makiang* wine to serve as a model for future research and product development, as well as the potential for participation by growers and production and sales by fruit wine producers.

In addition to recording the work that has been undertaken, the paper proposes some fine tuning of the *Makiang* development process with an emphasis on quality standards and horticultural requirements.

Keywords: *Cleistocalyx nervosum* var. *paniala*, fermentation, tropical wine, microbiology, product development, OTOP, market.

Background

The Centre for Tropical Viticulture and Oenology (CTVO) at Lampang in Thailand has been undertaking research and development on fruit wine for at least a decade. CTVO has collaborated closely with the Geisenheim Research Centre in Germany on this project. The R&D has met with mixed success, mostly due to factors beyond the control of the Centre.

Some ten years ago, the Thai government introduced a policy of One Tambon, One Product (Tambon is basically a collection of 2-3 villages) in order to provide supplementary income for rural communities. The concept was modelled on Europe where a particular village gains a reputation for a particular product and becomes a 'must stop' for travelers. Unfortunately, the OTOP scheme was introduced *en masse* and not as a result of any particular village

traditions. In order to make it succeed, the government also took on the marketing role. At the time OTOP was introduced, the government lifted a ban on domestic alcohol production and also issued approval for 2,000 small or village-level enterprises to produce fruit wine. The thinking at the time was also influenced by fruit growers, particularly in the North, who were seeking a means to dispose of excess crop.

For fruit wine producers at least, the OTOP scheme was a disaster and in the space of a few years, only a handful of producers remained. The main contributors to this poorly conceived idea were; lack of any standards, lack of knowledge of fermentation processes by producers and an uneven supply of raw material (since orchards would not have any excess when prices were good). Also, wine was being crafted from material grown for the purpose of being sold fresh, as opposed to being grown specifically for wine production, thus factors such as ripeness, brix, juice content, etc. varied greatly.

At the time of these developments, vineyards were being established in Thailand to produce grapes for wine. Some poor early attempts plus the fruit wine disaster has since made it difficult to convince consumers in Thailand, even though now grape (and fruit) wine of high quality is being produced.

At the time the government approved, and provided funding assistance for, 2,000 fruit wine producers, Rajamangala University of Technology Lanna (RMUTL) responded by investing heavily in overseas doctorate training for researchers and the establishment of fruit wine production facilities in Lampang.

Faced with only a comparatively small number of producers remaining in the industry, RMUTL has had to reassess the role for the Lampang research centre to maximize the investment in both human resources and equipment.

Current Situation

Through long established cooperation between Lampang and Geisenheim, some successes have been achieved. Many of the remaining fruit wine entrepreneurs have received training from the Centre and some are RMUTL graduates. The Centre has also had moderate success in producing quality wine, particularly from *Makiang* (*Cleistocalyx nervosum* var. *paniala*). Common synonyms are *Syzygium nervosum* and *Eugenia paniala*.

Concurrent with these developments, RMUTL in Sakon Nakhon Province have been working closely with farmers to develop a fruit wine industry based on *Mak Mao* (*Antidesma velutinsum*). This project is based on developing fruit specifically for wine making, improving the tree-stock and providing training for farmers to grow and care for the trees. The wine is produced and marketed by the university. Quality is good and usually consistent and they have had some success.

What is apparent from both of these endeavours is that some fruit bearing trees in Thailand, either introduced or endemic, are well suited to fruit wine production, while at the same time having little or no value in the commercial fresh or processed fruit market.

Makiang

Makiang is spread throughout India, Bangladesh, Burma, Vietnam and as far south as Australia and is usually found in the northern provinces of Thailand [1]. Its importance in northern culture has earned it status as a target for preservation under Her Royal Highness Princess Sirinthorn's Project on Conservation of *Makiang* Heredity. As a natural biological

resource, its utilization is promoted and the fruit has been recognized as a medicinal herb, a functional health food, cosmetic ingredient and for producing health drinks [2, 3, 4]. The attractive properties of *Makiang* juice are typical good flavour and a ruby red colour which is characterized by a high anthocyanin profile [5]. *Makiang* shows great potential for alcoholic beverage production, as demonstrated by the successes at Lampang.



Figure 1. Botanical illustration of *Cleistocalyx nervosum* var. *paniala*.

However, difficulties in obtaining stable quality of the product with resultant consumer satisfaction has been reported by some producers. Such difficulties could be influenced by principal factors, e.g. juice composition, or the microbial strains used in fermentation. As *Makiang* fruit contain high acidity, the addition of water in order to dilute acids contained in the fruit for juice preparation is necessary for winemaking. This acid adjustment decreases essential components needed for microorganism growth during fermentation. Furthermore, added water can also impact the sensory quality of the final product.

As a consequence, the production of fruit juice has to be optimized from the technical side for best-possible extraction of aroma compounds and nutrients which are essential for the activity of fermenting yeasts. In addition, the microbiological step of alcoholic fermentation has to be also optimised to convert the potential fruit quality into a commercially acceptable product, sought after by consumers.

Domestic Market

Locally produced grape wine has already obtained a foothold in the Thai market, mainly due to a burgeoning middle class. It is predicted that this market will grow, albeit slowly. With this growth will come the development of a wine culture, currently not apparent in the country. Grape wine producers have relied heavily on the supplemental income provided through wine tourism to the point where they are now making the transition to successful export. The key to this success has been the establishment of a strong producer's association and the introduction of self-imposed standards to maintain quality.

This success has been achieved in the face of a high government tax on wine, both as alcohol and as a luxury product. This, in spite of increasing evidence of the health benefits of wine consumption.

The future for fruit wine producers will depend on how successfully they can follow this path.

Various unsuccessful attempts have been made by private sector fruit wine producers to form associations. Attempts have been made by foreign investors to develop fruit wine in Thailand specifically for export. These have met with mixed success.

For fruit wine to develop and hold a place in the Thai market, RMUTL needs to modify and expand its role from educator to leader. One already apparent area is in helping to establish standards. This will also entail cellar door sales using the tried and tested tourism model. Private producers of *Makiang* will have to catch up or fall by the wayside. While the CTVO can provide assistance to producers, this will be in a commercial consulting role and will involve producers seeking out such assistance, as opposed to the current situation of Lamphang offering such assistance.

Future Development

Now that CTVO has demonstrated that it can successfully produce *Makiang* wine of commercial standard and quantity, the focus now needs to turn to other more comprehensive aspects of the production cycle to ensure success is maintained for the long-term.

Horticulture

A study is urgently required on the optimum conditions for growing *Makiang* so that its requirements are recorded. This should include soil preferences, water and fertilizer requirements, disease, pests and best horticultural practice. This should also include experimentation with practices such as pruning to ensure the canopies are broader rather than taller for ease of harvesting. Best methods of reproduction should also be examined to obtain fast-fruiting trees.

Maximization of Fruit Quality

The optimum time of fruit harvest needs to be determined and adhered to. Factors which might influence fruit content, such as high rainfall or drought, should be recorded.

Biotechnology

Concurrent with the horticultural work, a study should be undertaken to determine the most desirable fruit attributes for wine production and a selective breeding program undertaken to achieve these.

Outreach

Once the horticultural studies are completed, the possibility of engaging local farmers in growing out *Makiang* trees as an extra cash crop should be examined. This needs to be done in concert with CTVO production capacity and sales. Experience already exists in providing training and tree-stock from the *Mak Mao* model in Sakon Nakhon.

Standards

The introduction of self-imposed standards is critical. For the short-term at least, it is suggested that each 'vintage' be subjected to sensory evaluation by an experienced local panel trained by experts from overseas collaborating institutions, using a standardised score sheet (based on standard methods of sensorial and chemical

analysis). This final score achieved could be displayed on the bottle label. Consistency between bottles needs to be strictly imposed by the winemaker.

Product Improvement

To maintain an edge, work should continue on improving the product quality. This could involve further collaboration with Geisenheim by implementing a HACCP program for flavour development and flavour protection through all stages and steps of fruit production, harvesting and fruit processing to the final bottled product.

The existing product already has attractive bottling, labeling and packaging.

Conclusion

While there remains some ongoing work with *Makiang*, it is already at a stage where it can be used as a successful case study to develop other products. In every case where a fruit proves suitable for winemaking, examination should also be given to its suitability for associated products, such as jams, jellies, ice cream flavouring, sherberts, etc. CTVO is fortunate in working alongside food scientists.

What has not been covered in this paper is the considerable effort that went into experimentation with various yeasts and fine-tuning the fermentation process. This, together with all the other steps in the process, needs to be written up and published. There is a dearth of literature internationally on the production of fruit wine. What published work is available is mostly concerned with the fermentation process/yeast and in most cases the work focuses on fruit that is already commercially acceptable in the fresh market, such as mangoes, bananas, etc. [6, 7, 8, 9].

Once the write-up is complete, CTVO will develop proposals, based on this *Makiang* model, to examine the suitability for winemaking of the huge range of potential endemic and introduced fruit producing trees in Thailand. This will open a large field for practical studies for students and will fortify the theoretical knowledge of Master level students through hands-on experience.

References

1. Gardner, Simon, Sidisunthorn, Pindar and Anusarnsunthorn, Vilaiwan (March 2000). A Field Guide to Forest Trees of Northern Thailand. Korbai Publishing Project, Bangkok, Thailand.
2. Taya, S., Punvittayagul, C., Chewonarin, T., Wongpoomchai, Rawiwan (December 2009). Effect of Aqueous Extract from *Cleistocalyx nervosum* on Oxidative Status of Rat Liver. *Thai Journal of Toxicology*, 24(2), pp 101-105.
3. Sriwanthana, Busarawan, Treesangsri, Weena, Boriboontrakul, Bongkod, Niumsakul, Somchit, Chavalittumrong, Pranee (March 2007). *In vitro* effects of Thai medicinal plants on human lymphocyte activity. *Songklanakarin Journal of Science and Technology*, 29(Sup. 1), pp 17-28.
4. Chaisawadi, Suchada, Methawiriyasilp, Waraporn (2007). Freeze-Dried Makiang Powder Processing. 33rd Congress on Science and Technology of Thailand, Bangkok, Thailand.

5. Jansom, Chalerm, Bhamarapravati, Sutatip, Itharat, Arunporn (September 2008). Major anthocyanin from ripe berries of *Cleistocalyx nervosum* var. *paniala*. **Thammasat Medical Journal**, 8(3), pp 364-370.
6. Reddy, L.V.A. and Reddy, O.V.S. (2005). Production and Characterization of Wine from Mango Fruit (*Mangifera indica* L.). **World Journal of Microbiology and Biotechnology**, 21(8-9), pp 1345-1350.
7. Cheirsilp, Benjamas and Umsakul, K. (February 2008). Processing of Banana-based Wine Product using Pectinase and α -Amylase. **Journal of Food Process Engineering**, 31(1), pp 78-90.
8. Panjai, Lachinee, Ongthip, Khemthong and Chomsri, Niorn (August 2009). Complex Fruit Wine Produced from Dual Culture Fermentation of Pineapple Juice with *Torulaspora delbrueckii* and *Saccharomyces cerevisiae*. International Conference on the Role of Universities in Hands-On Education, Chiang Mai, Thailand.
9. Lee, Pin-Rou, Yu, Bin, Curran, Philip and Liu, Shao-Quan (June 2011). Effect of fusel oil addition on volatile compounds in papaya wine fermented with *Williopsis saturnus* var. *mrakii* NCYC 2251. **Food Research International**, 44(5), pp 1292-1298.