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*Research Article*

### **Exploring feasibility for production of longan fruit wine as a small scale enterprise in Thailand**

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#### **Abstract**

Longan (*Dimocarpus longan*) is a tropical fruit tree generally grown in the upper northern provinces of Thailand and southern China. The fruit has white edible flesh that is juicy and sweet. Even though it is the leading fruit crop export of the country, there has been an oversupply problem of longan in the market resulting in a significant decline in price. A short harvesting season and its highly perishable nature creates a large, concentrated produce flow to the market with oversupply at the front and significant waste at the end. This reduces farm prices and farmer income. In order to provide a remedy to these problems, many strategies have been devised. Longan processing, e.g. dried and canned, is one solution. Another one that is quite promising is based on laboratory research indicating that fruit wine made from longan could be a good product with commercial added value. The purpose of this study was to evaluate longan wines made from fresh and dried fruit for potential small scale industrial production.

**Keywords:** Longan, *Dimocarpus longan*, fruit wine, winemaking

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#### **Introduction**

Longan (*Dimocarpus longan*) is a tropical fruit tree generally grown in the upper northern region of Thailand and southern China. In China, researchers have been active in studying the production of longan wine [1, 2, 3], while research in Thailand has focused on the microbiology of yeasts [4, 5].

The official harvesting season for longan runs from June to August and it is the leading fruit export crop of the country. The flesh of the fruit is juicy and white, it is edible either fresh or dried, and it is sometimes canned with syrup. Longan plays an important role in developing sustainable production systems in Thailand and the country is the world's largest producer of longan, with earnings of US\$57-\$61 million per year during the 2005-2007 period [6]. Of the overall production area, 95% of the 98,000 hectares are located in the north and the crop yield was approximately 433 thousand tons of longan in 2008 [7]. Important cultivars are *Edor*, *Haeo*, *Biewkhiew* and *Srichomphu*. Seventy percent of the total production was exported as fresh, dried and/or canned longan, while 30% was consumed domestically as fresh [8]. Longan fruit contains a significant amount of polyphenols. A study of longan antioxidant activity found that 4-*o*-methylgallic acid had higher reducing power and 2,2-diphenyl-1-picrylhydrazyl-(DPPH), hydroxyl radical- and superoxide radical-scavenging activities than (-)-epicatechi [9]. One other study of longan extraction by 70% methanol from peel, pulp and seed revealed that the major components were identified as gallic acid, corilagin (an ellagitannin) and ellagic acid [10]. The analyses showed that there was a large variation in the contents of gallic acid, corilagin and ellagic acid in different plant tissues and from different cultivars. The seed contained the highest levels of the three phenolics, while the pulp contained the lowest. Amongst commercial cultivars, *Biewkiew* and *Edor* contained the highest levels of gallic and ellagic acid, while *Srichompoo* contained the highest content of corilagin. The researchers suggested that these three cultivars might be used in directed breeding and cultivation programs and to develop concentrated longan seed extracts to promote good health. Utilization of this by-product material would solve a major problem of thousands of tons of waste longan seeds from the canned longan pulp production.

Longan and Agricultural Produce Lamphun Cooperatives Ltd.( LAPLC) expressed an interest in developing longan wine as a commercial enterprise. The trial commercialization of longan wine as a small scale enterprise was undertaken between Lampang Agricultural Research and Training Centre (LARTC) and LAPLC. In the first phase, research consisted of identification of the appropriate longan must preparation, fruit varieties, production season and type of longan (fresh and dried fruit) to identify a consistent raw material for high quality longan wine production. Importantly, consumer acceptance of longan wine was also investigated.

## Materials and Methods

### Laboratory study

The study of longan wine making process included the following 5 steps.

- Selection of the preparation method for good raw material.  
There were 4 methods of longan must preparation: whole fruit (WL), flesh with peel (FP), flesh with seed (FS) and flesh only (FO).
- Selection of the appropriate yeast strain for fermentation.  
Longan wine quality was compared for two yeast strains, *Saccharomyces cerevisiae* (HK4) and *Saccharomyces bayanus* (EC1118). The quality parameters were rate of fermentation, alcohol content, residual sugar, volatile acidity, acetaldehyde and organoleptic quality.
- Selection of the appropriate food additive addition during fermentation.  
Diammonium phosphate, pectinase enzyme, bentonite, potassium metabisulphite and sugar were added into longan must in order to adjust the appropriate longan must to get good longan wine quality consistently.
- Selection of the best fruit variety and production season for wine making.

Three longan varieties were studied, *Edor*, *Biewkiew* and *Srichompoo*. Both in-season (July-September) and off-season (March-May) fruit were used in the study.

- The quality of wine made from fresh and dried fruit was compared. After selection the best winemaking process, longan wine made from fresh and dried fruit were compared.

### ***Consumer study***

Sampling 210 consumers in Chiangmai and Lampang determined the consumer acceptance of longan wine. Both fresh and dried fruit wine was used as the sample for this evaluation.

### ***Small scale enterprise longan wine production***

A batch of 500 litres of longan wine fermented in a stainless steel tank was run at LARTC and LAPLC. This run gave the basis for determining the size of the capital needed for small-scale sustained production.

### ***Technology transfer***

LARTC staff transferred the know-how gained from the study to entrepreneurs during the two year study period by arranging wine workshops. A workshop on the traditional fermented and distilled beverage industry in Thailand in co-operation with the Department of Biotechnology, Mahidol University, also served as a technology transfer vehicle. Inwent-Capacity Building International, Germany subsidized and helped organize this workshop and during the course of activities know-how from fermentation to product marketing was transferred.

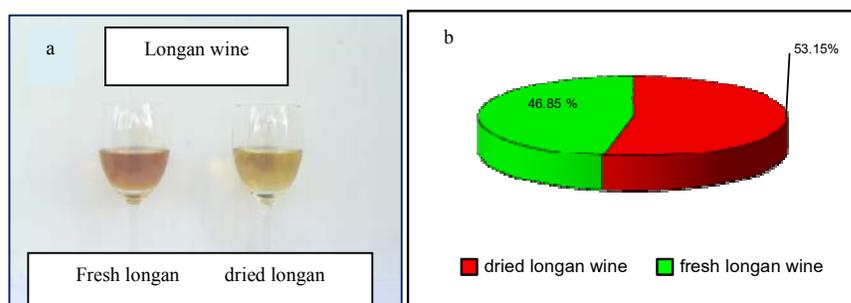
## **Results and Discussion**

### ***Laboratory study***

Fermentation of longan must produces longan wine with a quality that is accepted as a white wine with a typical longan aroma. The most effective process studied was the use of 200 g/l sugar of WL must with EC1118 yeast strain including the adding of 200 ppm potassium metabisulphite (KMS) and 120 ppm diammonium phosphate (DAP). Longan wine made from golden brown dried longan fruit performed as a good white wine (Figure 1 a).

### ***Consumer study***

Fifty percent of the consumers used to sample the wine were male. Some 49% of them were aged between 20-35 years old. Many (48%) of the sample consumers had graduated with a bachelor degree and a large number (35%) were government officials. Their income ranged between 5,000-10,000 Baht/month. Fifty three percent preferred wine made from dried fruit must more so than fresh fruit must. The reason was that the straw colour of dried longan wine approximated that of white wine made from grapes (Figure 1b).



**Figure 1. Longan wine (a) and consumer acceptance of longan wine (b).**

### ***Small scale enterprise longan wine production***

The process of both fresh and dried longan wine making were confirmed at LARTC and produced at LAPLC. It was found that both the wines had the same quality as those from the laboratory study. The capital outlay for the investment of a production run of 80,000 bottles per year (750 ml per bottle) was about 5 million Baht. The cost was 55 Baht per bottle. The investment cost could have a rate of return of 2 -3 years depending on how the marketing is managed.

### ***Technology transfer***

Six staff members from LAPLC were trained for longan wine making and longan wine sensory evaluation at LARTC. After training, LAPLC members produced their own wine, while RMUTL researchers monitored the processing. The members could successfully apply knowledge obtained from the training for longan wine making. However, further study on the market research would help the LAPLC to operate their business autonomously. Development of some instruments is also required in order to reduce the production cost. In addition, a study on longan wine to demonstrate its health benefits would be worthwhile research having the potential of opening another consumer market.

The transfer of know-how to other entrepreneurs was undertaken by a workshop highlighting the following.

- ✚ Basic Knowledge Regarding Fermented and Distilled Beverages
- ✚ *Satho* and Wine Process
- ✚ Spirit Process
- ✚ Quality Control of Fermented and Distilled Alcoholic Beverages
- ✚ *Satho* and Distilled Spirit
- ✚ Application of Beer and Whisky Technology for Local Fermented and Distilled Alcoholic Beverages
- ✚ Management and Marketing of *Satho* and Spirit Business.

There were 40 SMEs in attendance at the workshops. LARTC personnel trained entrepreneurs through consultation and site visits and helped them solve their problems. LARTC staff also consulted on Good Manufacturing Practice (GMP) in their wineries. RMUTL researchers learned of the problems experienced by these wineries during their visits. Some problems were discussed and solved on site with advice from the researchers, while other problems

could be raised for research concept. Furthermore, RMUTL researchers gained more experience through this involvement and they can apply such experience for research work and the fruit wine industry. The involvement of RMUTL and the small enterprise community in this manner serves as an example of practical involvement by universities.

At present some wineries produce longan wine and other fruit wines based on this research technology. Depending on the quality of the fruit the price of longan wine is in the range of 150-350 Baht per bottle. Dried longan fruit as raw material can be used all year round for wine production. It can also help to decrease the problem of surplus fresh longan in season.

## Conclusion

Longan wine made from dried fruit was accepted by most of the consumer panel. Quality of the longan wine was similar to white wine, especially the straw yellow colour. Longan wine making based on RMUTL research was transferred to SMEs and they have used this for their production. Winery members learned from the LARTC workshops and LARTC researchers gained valuable experience through their collaboration. Both the private sector and the university were beneficiaries.

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