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## Indigenous knowledge in using plants for alcohol yeast of the Tay ethnic group in Vietnam: A case study at Ham Yen district, Tuyen Quang province

**Nguyen Van Hop, Chen Chang Xiong, Phan Thi Nhung and Nguyen Van Quy**

### Abstract

The traditional knowledge of making leaf yeast to produce alcohol has a history of thousands of years and is the culinary culture of many Vietnamese people. The Tay ethnic group in Ham Yen district, Tuyen Quang province is one of them but has not been studied. This study aim (1) identifies the composition of forest plants to make leaf yeast, (2) the knowledge of K'Ho people to make leaf yeast for alcohol production, and (3) Challenges in preserving alcohol production traditional. The method of ethno-botany studies by Gary J. Martin (2002) was used in this study. A total of 29 species, 25 genera belonging to 18 plant families were used as leaf yeast by the Tay people. Among them, 16 species are the main ingredients to make leaf yeast. Most of them are distributed in the forest, forest edge, and some planted in the garden. There were 4 life-forms including herbaceous (37.93%), vines (34.48%), shrubs (20.69%), timber (6.9%) were recorded. There were 6 parts used were used by Tay people to make leaf yeast, of which leaves is the most (42.11%), the lowest is fruits and roots (2.63%). The method of making leaf yeast, brewing of leaf yeast, and alcohol production were documented in this study. The challenges of preserving indigenous knowledge about the production of leaf yeast for alcohol production by the Tay people also were discussed.

**Keywords:** Indigenous knowledge, plant composition, leaf yeast, traditional alcohol, Tay ethnic, Tuyen Quang

### 1. Introduction

Traditional fermented foods can be considered as a cultural characteristic for a country and a people. They have created thanks to the exploration and creativity of each nation on the path of development. Besides, they also contain human messages, beliefs, and religions [2]. Alcohol yeast is made from the leaf yeast source material is one of these products.

Leaf yeast (Fruit of leaf yeast or rice yeast, alcohol yeast, medicine yeast) is made from forest plants (mainly leaves, bark, roots, tubers, stems, fruit, etc), rice flour (corn flour), and original yeast. They are made primarily from the leaves of forest trees, so it is called leaf yeast. Characteristics of the leaf yeast, the inside is pure white, outside is straw yellow because it dried with charcoal stoves or rice husks. The composition of leaf yeast differs in each locality, each ethnic group, depending on the composition of the tree species, the ratio of rice flour (corn flour): leaf powder, the size of the yeast, the shape of the yeast, etc.

On the islands of the Adriatic (Croatia) the most commonly used species for flavoring and making alcoholic drinks are *Foeniculum vulgare* Mill., *Myrtus communis* L., *Salvia officinalis* L., *Ruta graveolens* L., *Juniperus oxycedrus* L., *Ceratonia siliqua* L., *Juglans regia* L., *Citrus spp.*, *Ficus carica* L., *Laurus nobilis* L., *Rosmarinus officinalis* L., *Artemisia absinthium* L., *Rosa centifolia* L., *Mentha piperita* L. and *Mentha spicata* L. [11]. In some countries in Asia, alcohol yeasts are made from mushrooms (belonging to Mucorales) combined with rice flour or cassava flour, created alcohol yeast can be used immediately or stored as yeast cake [16]. A total of 60 plant species were identified to be used as starters for brewing glutinous rice wine by Dong communities in Southeast Guizhou, China [4]. Meanwhile, 103 species belonging to 57 botanical families of wild plants were inventoried and documented that are traditionally used as starters for preparing fermented beverages by Shui communities of southwest China [6]. Indonesia uses parts of plants combined with rice flour (cassava flour) to produce leaf yeast: Tubers of *Alpinia galanga* and *Allium sativum*, fruits of *Capsicum frutescens*, and seeds of *Piper nigrum* [12].

In Vietnam, several plants are used to make alcohol yeast such as seeds of *Myristica fragrans* Houtt.; the stem of *Atractylodes macrocephala* Koidz.; Bark of *Cinnamomum cassia* Blume.; Seeds of *Amomum tsao-ko* Crev. et Lem.; roots of *Glycyrrhiza uralensis* Fish.; leaves of *Mentha arvensis* L.; roots and leaves of *Asarum sieboldii* Miq.; stems of *Curcuma longa* L.; flowers of *Foeniculum vulgare* Miller.; and *Syzygium aromaticum* L. [10].

Since ancient times, the custom of drinking alcohol has become the identity and cultural characteristic of each Vietnamese community. Indigenous knowledge on the use of plants to make leaves yeasts to produce alcohol is formed, developed and preserved in the form of "word of mouth". It is a treasure with many things yet to be discovered, with scientific value and practical significance [7]. Making alcohol yeast is a long-standing tradition of Vietnamese people in general as well as ethnic minority communities in particular. This is a product, and also the "secret" of the local people to make the specialty easy-to-drink, fragrant of leaf yeast alcohol, which is a unique culture in the cuisine of ethnic communities [15, 14].

In addition to the culinary cultural value of the alcohol production from leaf yeast, leaf yeast alcohol also has many benefits such as being drunk but not having a headache, just after sleep, you feel comfortable again. Besides, drinking alcohol made from leaf yeast is not poisoned, because most of the forest trees collected by locals are tonic plants, without toxins, which have detoxifying, heat bar, stimulate digestion to restore health.

However, the area of agricultural land limited, forests and forest land strictly managed by the State people's lives face many difficulties. The indigenous knowledge related to making leaf yeast is gradually fading. Because some of the trees that the main components of leaf yeast disappear by human activities: deforestation and cattle grazing, herbicide abuse, climate change, many species regeneration is hard to recover. Moreover, Chinese yeasts flooded on the market with many kinds of unknown yeasts, which are more economical, short time and more effective in fermenting alcohol than traditional yeasts, but contain many toxic substances that affect human health [9]. From a different perspective, due to the process of socio-economic development, the young generation now pays little attention to making leaf yeast, the number of households producing alcohol from leaf yeast is

not much and small [7, 9].

The question is how to improve the lives of the local people and at the same time, forest resources are protected and sustainably managed based on their knowledge [9]. The northwest part of Vietnam is well known for the production of household liquors, which is associated with the region's rich indigenous knowledge system. The Tay ethnic community in Ham Yen Tuyen Quang province has long resided, lived and relied mainly on forest resources. They know how to exploit and use plants and animals to make food, medicines, especially they have a source of knowledge and insights on the use of forest plants to make leaven for wine production. Traditional festivals and drinks daily. Making leaf yeast from the plant, and produce wine is a traditional profession of the Tay people in Ham Yen district Tuyen Quang province. However, it has not yet systematic studies on the plant composition making leaf yeast to produce wine by local people. Therefore, this study aims (1) Identification plant species composition make leaf yeast, (2) identified traditional knowledge about the method of making leaf yeast, and the process of producing alcohol from leaf yeast, and (3) related issues in conservation make leaf yeast and produce alcohol of the Tay people.

## 2. Material and methods

### 2.1 Study site

The study was conducted in Ham Yen district, Tuyen Quang province. Ham Yen district is a mountainous district to the west of Tuyen Quang province, to the North by Bac Quang district (Ha Giang province), to the South by Yen Son district, to the East by Chiem Hoa and Lam Binh districts, and to the West by Yen Binh district, Luc Yen (Yen Bai province). Ham Yen has geographical coordinates: 2204'38'' North latitude 104058'57'' East longitude, an area of 907 km<sup>2</sup>, a population of 109,000 people, including ethnic groups: Kinh, Tay, Nung, Dao, H'Mong. The total natural area of the district is 90,092.53 ha, forestry land 68,193.67 ha accounting for 75.69%, the terrain with a steep slope, rich vegetation with a variety of rare and valuable woods, coverage the forest is 60.03%. The climate has two distinct seasons: the hot season from April to October, the cold season is from November to March next year, the average annual temperature is 22.5°C, the average annual humidity is 87.07% the average annual rainfall is 162.40 mm.

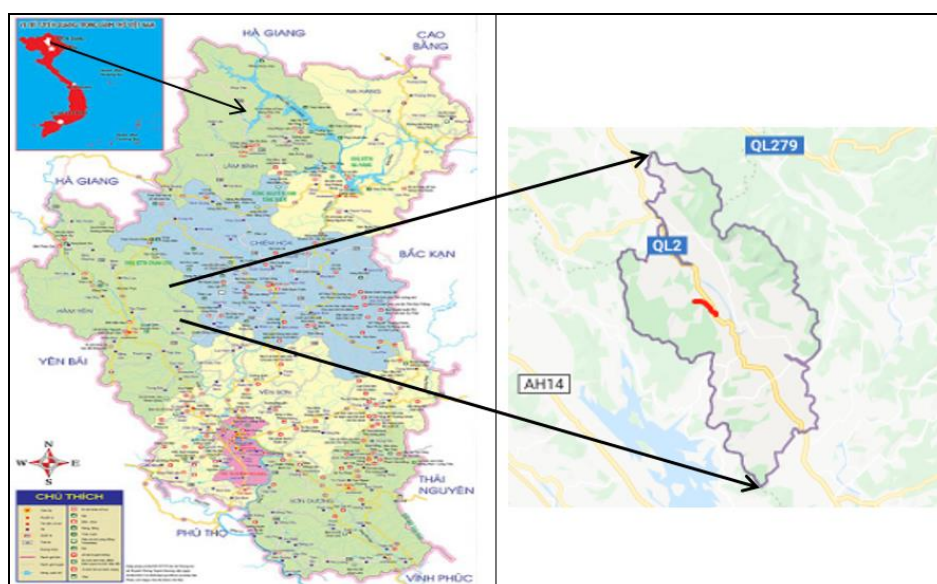


Fig 1: The map of the study site

## 2.2 Study methods

### Fieldwork

Preliminary surveys were conducted in advance. Transects was established goes through different habitats to collect the necessary data. On each survey transect, collect and record the morphological characteristics, statistics of the trees used as leaf yeast, take sample photos under the guidance of experienced people collecting forest trees for leaf yeast. The specimens were collected by the method of Thin NN (1997) [13].

A total of 35 people (over 18 years old) were randomly selected to collect relevant information. The information identified includes local name, Vietnamese name, habitat, processing method, method of making leaf yeast, and brewing of leaf yeast, alcohol production method. The people selected for the interview were experienced people collecting forest trees for leaf yeast, house-holds traditional winemakers from leaf yeast. Information collected based on the method of Gary JM (2002) [3] includes (RRA) Rural Rapid Appraisal and (PRA) Participatory Rural Appraisal.

### Data analysis

The common name of the species was determined by the morphological method. Documents were used to identify species: An Illustrated Flora of Vietnam by Ho PH (1999-2000) [5]; Vietnamese medicinal plants and medicine by Loi DT (1999) [10]. The scientific name of the species was determined based on the website: plantlist.org [17]. The list of plants for making leaf yeast is organized by the method of Brummitt RK (1992) [1]. Plant life-form was determined based on the method of Thin NN (1997) [13]. The data were analyzed and synthesized based on the Excel software version (2010).

## 3. Results and Discussion

### 3.1 Plant species composition was used as leaf yeast to produce alcohol by the Tay people

#### 3.1.1 Plant species composition

A total of 29 species, 25 genera and 18 families belonging to Magnoliophyta were used by the Tay people to make leaf yeast. In which, Dicotyledoneae constitutes the main component 24 species (82.76%) of 15 families, Monocotyledoneae five species (17.24%) of three families. In particular, Piperaceae and Zingiberaceae (three species); Asteraceae, Annonaceae, Fabaceae, Lamiaceae, Rutaceae,

Scrophulariaceae (two species); and ten families of single species: Araceae, Chloranthaceae, Convolvulaceae, Hernandiaceae, Moraceae, Poaceae, Polygonaceae, Ranunculaceae, Smilacaceae, Solanaceae, Verbenaceae.

Among the 29 species was used by the Tay people to making leaf yeast, 16 obligatory species include *Naravelia laurifolia* Wall., *Alpinia conchigera* Griff., *Cuscuta sinensis* Lam., *Mosla chinensis* Maxim., *Desmos dumosus* (Roxb.) Saff., *Mosla dianthera* (Buch.-Ham. ex Roxb.) Maxim., *Homalomena aromatica* (Spreng.) Schott, *Adenosma caeruleum* R. Br., *Wedelia calendulacea* (L.) Less., *Callicarpa macrophylla* Vahl., *Illigera cucullata* Merr., *Smilax glabra* Roxb., *Piper gymnostachyum* C. DC., *Capsicum annuum* L., *Zanthoxylum nitidum* (Roxb.) DC., *Scoparia dulcis* L. Some other places can use nearly 30 different species of plants, the more species in the leaf yeast component, the better and more aromatic.

The composition of the plants was used by the Tay people to make leaf yeast is the tonic medicinal plants so there are also different uses: The group of plants containing essential oils has an important role to create the flavor for alcohol also has antiseptic and anti-flu effects: *Zingiber officinale* Roscoe, *Zanthoxylum nitidum* (Roxb.) DC., *Piper lolot* C. DC., *Piper gymnostachyum* C. DC., *Piper betle* L., *Cymbopogon citratus* (DC.) Stapf, *Alpinia conchigera* Griff., *Acronychia pedunculata* (L.) Miq; The group with thermal and detoxifying effects include *Adenosma caeruleum* R. Br., *Scoparia dulcis* L., *Smilax glabra* Roxb.; *Polygonum odoratum* Lour., *Cymbopogon citratus* (DC.) Stapf, *Alpinia conchigera* Griff., *Zingiber officinale* Roscoe, stimulate digestion; The group of the plant creates typical spicy and hot of alcohol includes: *Capsicum annuum* L., *Alpinia conchigera* Griff., *Cymbopogon citratus* (DC.) Stapf., *Zingiber officinale* Roscoe, *Piper gymnostachyum* C. DC., *Piper betle* L.; *Mosla dianthera* (Buch.-Ham. ex Roxb.) Maxim., *Mosla chinensis* Maxim has the antibacterial, antipyretic effect, especially the ingredient that stimulates the fermentation of microorganisms; etc.

In unfavorable weather conditions, there is not enough time to gather some forest plants to make the leaf yeast, such as *Piper gymnostachyum* C. DC.; *Alpinia conchigera* Griff.; *Capsicum annuum* L.; *Alpinia globosa* (Lour.) Horan. The local people have used similar species to replace, easy to find and can grow in their gardens like *Piper betle* L., *Piper lolot* C. DC., *Cymbopogon citratus* (DC.) Stapf, *Zingiber officinale* Roscoe.

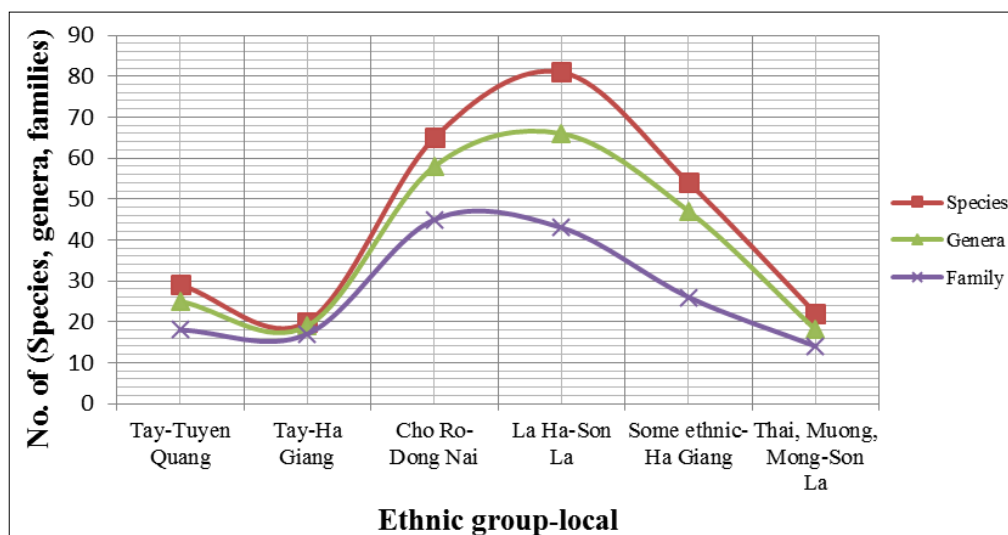


Fig 2: Comparison quantity plants were used by Tay ethnic with another ethnic group

Compared to previous studies, the number of plants used for leaf yeast by Tay people in Tuyen Quan is higher than that of Tay people in Ha Giang (19 species) [14], and ethnic groups of Thai, Muong, Mong in Son La (22 species) [2]. However, this result is less than communities in Ha Giang (54 species) [2], Cho Ro ethnic group in Dong Nai (56 species) [7], and the La Ha ethnic group in Son La (81 species) [9] (Figure 02). The result of the comparison indicated that plant species composition was used to make leaf yeast by Tay people in Tuyen Quang is quite diverse, abundant. At the same time, the quantity and species composition to make leaf yeast for the production of alcohol of each ethnic group are different. This result was explained by each ethnic group has different traditional cultural characteristics (customs, languages, festivals, places of residence, different resources).

### 3.1.2 The distribution of plants according to the habitat

A total of 23 species (79.32%) distributed in forests and forest

edges, followed by the garden with 6 species (20.68%). This result is consistent with the findings of the authors Trang PT and Truong DV (2011), Hung TQ (2013), Hop NV *et al.* (2017), Lien VT *et al.* (2019).

### 3.1.3 Diversity of plant life-forms

Plant life-forms reflect the adaptation of plants to elements of habitat conditions. This is explained by the fact that each plant species has its unique life-form with different biological and ecological characteristics. Therefore, each plant's life form will be suitable and adaptable to each living environment to best grow and develop. Research on life forms of plants to making leaf yeast is the scientific basis of orientation in the management, conservation (cultivation, exploitation, use), and long-term development of source materials not only to meet demand use in the current generation but also to meet needs for future.

**Table 1:** The tree species forest composition were used making leaf yeast by Tay people

No.	Scientific name	Vietnamese name	Local name	Family name	Life-form	Habitat	Parts used
1	<i>Gerbera piloselloides</i> (L.) Cass.	Cúc đồng tiền đại	Nét tỷ	Asteraceae	Herbaceous	Forest, the forest edge	Whole plant
2	<i>Wedelia calendulacea</i> (L.) Less.	Sài đất giả		Asteraceae	Herbaceous	Forest, the forest edge	Whole plant
3	<i>Desmos dumosus</i> (Roxb.) Saff.	Dây dất		Annonaceae	Climber	Forest, the forest edge	Stem, Leaves
4	<i>Uvaria calamistrata</i> Hance	Lá men		Annonaceae	Climber	Forest, the forest edge	Leaves
5	<i>Homalomena aromatica</i> (Spreng.) Schott	Thiên niên kiện	Cô vật vọ	Araceae	Herbaceous	Forest, the forest edge	Tubers
6	<i>Chloranthus spicatus</i> (Thunb.) Makino	Hoa sói		Chloranthaceae	Shrubs	Forest, the forest edge	Whole plant
7	<i>Cuscuta sinensis</i> Lam.	Thỏ ty tử		Convolvulaceae	Climber	Forest, the forest edge	Whole plant
8	<i>Desmodium sequax</i> Wall.	Tràng quả đeo		Fabaceae	Shrubs	Forest, the forest edge	Leaves
9	<i>Derris elliptica</i> (Wall.) Benth.	Dây mật	Khau khùng	Fabaceae	Climber	Forest, the forest edge	Stem, Leaves
10	<i>Illigeria cucullata</i> Merr.	Lưỡi đấng bầu		Hernandiaceae	Climber	Forest, the forest edge	Stem, Leaves
11	<i>Mosla chinensis</i> Maxim.	Lá men trung quốc		Lamiaceae	Herbaceous	Forest, the forest edge	Leaves
12	<i>Mosla dianthera</i> (Buch.-Ham. ex Roxb.) Maxim.	Cây men	Cô mác men	Lamiaceae	Herbaceous	Forest, the forest edge	Whole plant
13	<i>Artocarpus heterophyllus</i> Lam.	Mít	Mác mị	Moraceae	Small timber	Cultivated at home	Leaves
14	<i>Piper betle</i> L.	Trầu không	Nhàu	Piperaceae	Climber	Cultivated at home	Root, stem, leaves
15	<i>Piper gymnostachyum</i> C. DC.	Trầu không rừng	Nhàu pù	Piperaceae	Climber	Forest, the forest edge	Stem, Leaves
16	<i>Piper lolot</i> C. DC.	Lá lốt		Piperaceae	Climber	Cultivated at home	Leaves
17	<i>Cymbopogon citratus</i> (DC.) Stapf	Sả	Chì phéc	Poaceae	Herbaceous	Cultivated at home	whole plant
18	<i>Polygonum odoratum</i> Lour.	Rau răm	Sắc sùi	Polygonaceae	Herbaceous	Cultivated at home	Whole plant
19	<i>Naravelia laurifolia</i> Wall.	Bạch tu lá quế	Quê	Ranunculaceae	Climber	Forest, the forest edge	Stem, Leaves
20	<i>Acronychia pedunculata</i> (L.) Miq.	Bưởi bung	Mác pục	Rutaceae	Small timber	Forest, the forest edge	Leaves
21	<i>Zanthoxylum nitidum</i> (Roxb.) DC.	Xuyên tiêu		Rutaceae	Shrubs	Forest, the forest edge	Stem, Leaves
22	<i>Adenosma caeruleum</i> R. Br.	Nhân trần	Nhân trần	Scrophulariaceae	Shrubs	The forest edge	Whole plant
23	<i>Scoparia dulcis</i> L.	Cam thảo đất	Cam thảo	Scrophulariaceae	Herbaceous	The forest edge	Leaves
24	<i>Smilax glabra</i> Roxb.	Thỏ phục linh	Cầu ngô lức	Smilacaceae	Climber	Forest, the forest edge	Whole plant
25	<i>Capsicum annuum</i> L.	Ớt rừng	Mác phát pù	Solanaceae	Shrubs	Forest, the forest edge	Fruit, leaves
26	<i>Callicarpa macrophylla</i> Vahl.	Tu hú lá to		Verbenaceae	Shrubs	Forest, the forest edge	Leaves
27	<i>Alpinia conchigera</i> Griff.	Riềng rừng	Khá pù	Zingiberaceae	Herbaceous	Forest, the forest edge	Tubers
28	<i>Alpinia globosa</i> (Lour.) Horan.	Sẹ	Khá đeng	Zingiberaceae	Herbaceous	Forest, the forest edge	Tubers
29	<i>Zingiber officinale</i> Roscoe	Gừng	Khinh	Zingiberaceae	Herbaceous	Cultivated at home	Tubers

**Table 2:** Life-forms and parts used of plants making leaf yeast

No.	Life-form	No. of species	Percentage (%)	Parts-used	No. of species	Percentage (%)
1	Herbaceous	11	37.93	Whole plant	9	23.68
2	Shrubs	6	20.69	Leaves	16	42.11
3	Small timber	2	6.90	Stem	7	18.42
4	Vines	10	34.48	Root	1	2.63
5				Tubers	4	10.53
6				Fruit	1	2.63
	<b>Total</b>	<b>29</b>	<b>100</b>	<b>Total</b>	<b>38</b>	<b>100</b>

**Note:** a species can use many parts-used different

Statistical results in Table 2 showed that herbaceous is the most used by the Tay people (37.93%), followed by vines (34.48%), shrubs (20.69%), and small timber (6.9%). This result is consistent with the research results of the authors Chung DH *et al.* (2011), Hung TQ (2013), Lien VT *et al.* (2019), Trang PT and Truong DV (2011).

### 3.1.4 Diversity of plants parts used

A total of six plant parts used were used as leaf yeast according to the Tay experience. Of which, leaves are the most used (42.11%), followed by the whole plant (23.68%), stem (18.42%), tubers (10.53%), fruits, and roots (the same 2.63%) (Table 2). This result is consistent with the findings of the author's Hop NV *et al.* (2017), Chung DV *et al.* (2011), Lien VT *et al.* (2019), Trang PT and Truong DV (2011). Because, leaves that are easily harvested, and can be harvested several times a year (unlike stem, roots, tubers). It also shows the sustainability of exploiting methods of Tay people making leaf yeast to produce alcohol.

## 3.2 Traditional knowledge about produce alcohol (corn, rice) by leaf yeast

### 3.2.1 Source material

Trees forest used making leaf yeast (leaves, bark, roots, stems, tubers, fruits, etc.) including 16 species which are indispensable main ingredients, (corn flour) rice flour, clean water was taken from in a mountain cave, female yeast (old yeast), bamboo string, stove or oven for drying. Especially, leaves are raw material difficult to find and the most important that affects the specific flavor of alcohol.

### 3.2.2 The method of making leaf yeast

After fully preparing the materials, proceed with the following steps:

#### Step 1: Wash the tree (stems, tubers, fruits, etc)

The trees parts were collected from the forest and cleaned, then dried, drained.

#### Step 2: Crush the tree (stems, tubers, fruits, etc)

After completing step 1, the parts of the tree used to making

leaf yeast were put into a large and crushed mortar.

#### Step 3: Filter for water

After the parts of the tree were crushed, add clean water (the amount of water depends on the amount of yeast, the amount of flour, and leaves more or less). Then use a clean cloth to filter and squeeze water.

#### Step 4: Mix juice with cornmeal (rice)

Using the prepared rice flour (corn), pour it into the juice of the freshly squeezed leaves, mix well until the paste becomes a paste. In other localities, they can add a little bit of rice husk to it.

#### Step 5: Squeeze the leaf yeast

After mixing, use your hands to squeeze creates each fruit of leaf yeast (about the size of a small bowl or smaller).

#### Step 6: Use bamboo strings to connect the leaf yeast into chains

Depending on the household, the number of leaf yeast in each chain varies, in some places they string 5 fruits, 10 fruits, or 15 fruits (usually connecting into 10 fruits). Each of these chains (10 fruits of leaf yeast) cooked in a pot of 10kg of rice. Fruits of leaf yeast incubated in an old blanket or clean cloth, after 1-2 days the yeast grows became small white fibers, which means they are fermented, then hanging on the kitchen counter or dried.

#### Step 7: Drying

After using the bamboo string to connect the leaf yeast into chains, each chain of leaf yeast must be hung on the kitchen attic or oven (has a charcoal or rice husk to burn), after about 5-7 days, the leaf yeast will dry yellow the straw is very beautiful. After cooking rice alcohol (corn alcohol), just take the crushed yeast and then mix with rice alcohol (corn alcohol).

**Note:** Use as much as you want to get it, unused yeast should still hang on the kitchen to preserve them (if encountering water or humid environment will be damaged).



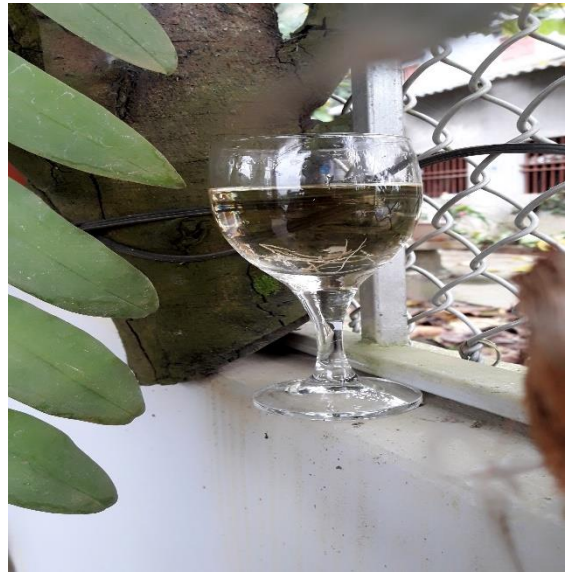
Fig 3: Newly making leaf yeast (white) and finished product (straw yellow)



Fig 4: Using cloth incubate leaf yeast and the corn (rice)



**Fig 5:** Produce alcohol from leaf yeast



**Fig 6:** Finished alcohol  
(Photo by Phan Thi Nhung)

### 3.2.3 Method of brewing (Corn) Rice with leaf yeast

#### Step 1: Wash corn (rice)

Washing corn (rice) is an important step when brewing alcohol and considered a "secret of traditional alcohol production."

#### For corn alcohol brewing

Before cooking corn, the skin of corn cleaned and put in the machine to grind. After the corn pureed, rinse with water about 4-5 times and then soak for a day, remove the water and cook.

#### For rice alcohol brewing:

After correctly weigh the rice (10kg rice/1 pot), use water and big pots to wash away the rice. Rice after washing will be easy to cook and will not be mushy or burnt.

#### Step 2: Pour (Corn) rice into a pot of boiled water

This step is quite simple, just put the washed rice into a pot of boiling water, cooking until the water almost depleted. Then mix the rice, when the water runs out, close the lid, reduce coal so that the rice does not burn.

#### Step 3: Pour (Corn) rice wine into basket or tarpaulin to cool

After the rice cooked, pour it into a clean canvas and evenly strip the rice to cool. The thinner the thickness of the rice, the better the permeability of the yeast will be (this affects the quality of alcohol).

#### Step 4: Mix the yeast

**For rice alcohol:** the ratio of rice and leaf yeast 1: 1. That is, 10 kg of rice requires 10 fruit of leaf yeasts; However, in winter, this ratio of 1: 1.2 (10 kg of rice requires 12 fruit of leaf yeasts). Due to cold weather, the fermentation takes place more slowly.

**For corn alcohol:** the ratio of rice and leaf yeast 1: 1.5 (or 1:1.6). That is, 10kg of corn uses about 15-16 fruit of leaf yeast.

Use a mortar and grind the yeast so smooth. Then sprinkle the yeast evenly on rice (corn), followed by mixing yeast with rice (corn), then put in a barrel (or jar) for brewing.

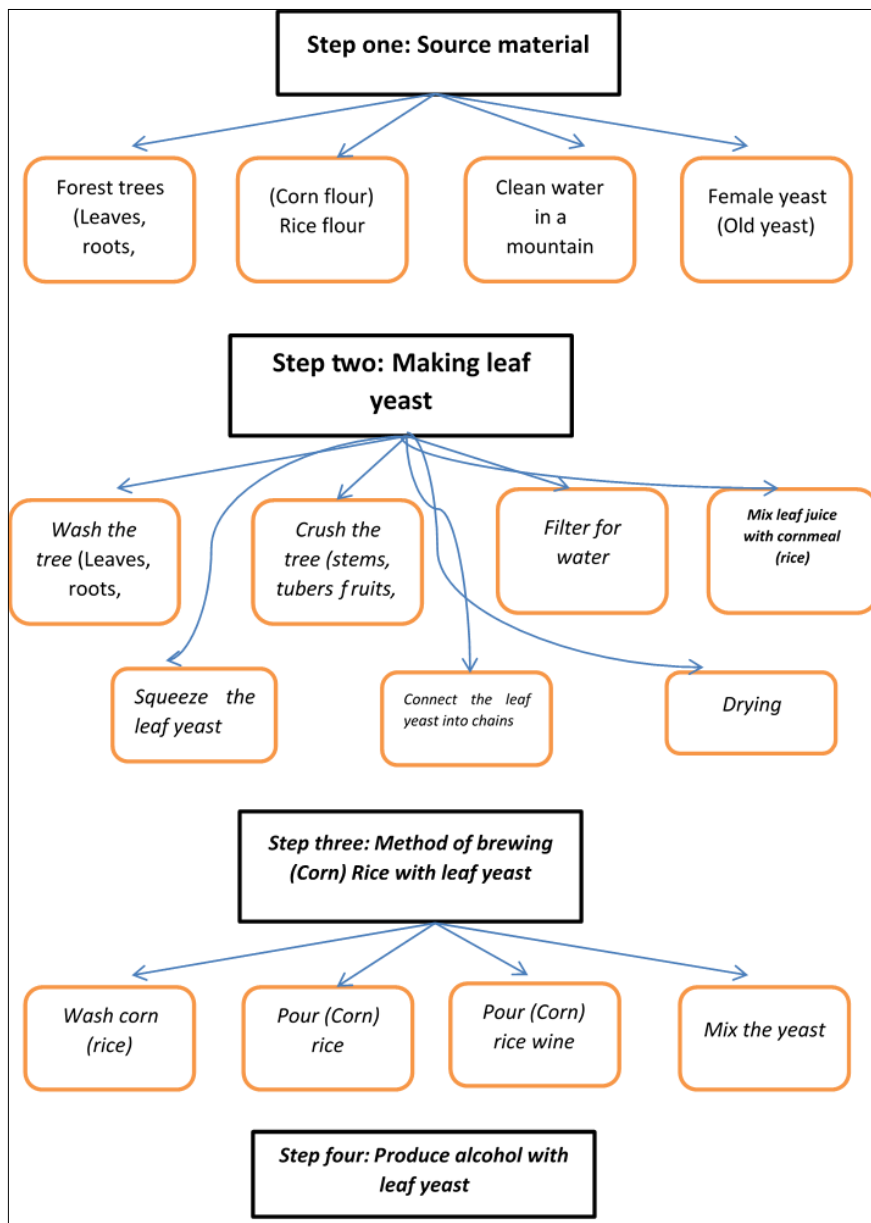


Fig 7: The steps of making leaf yeast alcohol from leaf yeast

### The fermentation time of leaf yeast with corn (rice) depends on the season

#### For rice wine

In the summer, after mixing yeast into rice, put them in barrels (jars), tightly cover, after five days, add about 15 liters of water (amount of water for 10 kg of rice), cover, and brewed for another five days. The total brewing time is ten days.

In winter, the drying period is ten days, then adding water and brewed about 7-10 days (depending on weather) the total brewing time is 17-20 days.

#### For corn wine

In summer, the total brewing time is about 18-22 days, in which dry composting about 9-11 days, then adding water brewed for about 9-11 days.

In winter, the brewing time is 15 days, adding water and brewed for 10-15 days, total brewing time is about 25-30 days (depending on the weather, if the weather is warm, the brewing time will be less, if the weather cold, the brewing time will be longer).

*Note: The cooking time is not enough, low output and the alcohol not be fragrant. During the brewing process, if it is*

*too cold to get plastic (tarpaulins, blankets, old clothes) wrapped around the boxes (jars) of rice/corn, otherwise the wine is easily sour or even damaged. In the summer, it is necessary to place barrels in cool places.*

### 3.2.4 The method of produce alcohol with leaf yeast

For having the best alcohol follow the instructions, this is the most important rule when brewing leaf yeast and directly affecting the finished product. Also, when distilling alcohol, maintain the temperature of the stove, otherwise, the wine will not taste good and may be damaged.

### 3.3 Conservation issues making leaf yeast to produce alcohol

First: Learning the craft of making alcohol from forest trees for sale is very difficult. Because when entering the forest to collect plants can be bitten, squeezed, dangerous. Meanwhile, some species of plants are the main constituents of leaf yeast not found or very little. In previous years, leaf yeast was sold a lot, because, at that time, forest trees were abundant, only one day could gather enough forest trees to make leaf yeast. However, in recent years, many people have come to the forest to collect tonic plants and sell them to traders. As a

result, it is very difficult to find these plants today, and even many species have to find the whole day to collect them.

Second: The number of households making leaf yeast to produce traditional alcohol is very little. Because the production of traditional alcohol made from leaf yeast is very low. If 10 kg of maize (rice) uses either north yeast (China yeast) or probiotics to produce alcohol, more than 10 liters of alcohol can be created. While the use of leaf yeast to produce traditional alcohol can yield 5 liters (in warm weather), if the winter is cold, it may be only 3 liters. Therefore, the average daily income is only a few tens of thousands (several dollars).

Third: Leaf yeast is made very sophisticated, taking a lot of time (the total time to produce alcohol from leaf yeast is about 30-40 days) and effort. The production of leaf yeast has too many complicated steps. A total of nearly 30 different species of medicinal plants were collected from the forest (2-3 days), cleaned them, crushed them to get water mixed with cornflour (rice flour), added old yeast (female yeast), then pressed into individual fruit of leaf yeast, connect fruit of leaf yeast in series (1-2 days). After that, the leaf yeast is dried by hanging on the stove or in the sun (5-7 days). Besides, fermentation time is long, it takes 20-30 days. While probiotics only need a few days of incubation to cook.

Fourth: The production of alcohol from leaf yeast is a traditional profession passed down from generation to generation by the method of "word of mouth", the experience to identify plants, the experience of making leaf yeast and making alcohol are the secrets, often not shared with others. Therefore, maintaining and passing the tradition of making leaf yeast of the Tay people face many difficulties.

These are the challenges that are posed to the conservation of traditional alcohol production from leaf yeast associated with the sustainable conservation of forest resources. The results will contribute to providing a scientific and practical basis in restoring, maintaining and developing traditional alcohol making as well as preserving and promoting the value of cultural identity and raising awareness of the community of people in the conservation and sustainable use of plant resources of "ecological-cultural" here [7, 14].

#### 4. Conclusion

The study indicated that the Tay people in Ham Yen district Tuyen Quang province not only have a diverse understanding of plant species composition to make leaf yeast but also have rich and unique knowledge about how to make leaf yeast, method of fermentation and traditional alcohol production from leaf yeast. In particular, 16 species of plants required to make leaf yeast, most of the plants collected by the Tay people to make leaf yeast are tonic plants with many good effects. Therefore, alcohol produced from leaf yeast is not only detoxifying, clearing body heat, stimulating digestion, antibacterial, treating flu, but also safe for users. The plant species distributed mainly in the forest and near the edge of the forest, a few species are planted in the garden. Herbaceous is the most used of life-form by the locals, the lowest being is small timber. The Tay people have a very sustainable exploitation method, not affect the growth and development of trees, composition, and forest structure. Because they mainly collect and use leaves of tree forest. The difficult and challenging issues to preserve the traditional alcohol production from leaf yeast associated with the sustainable conservation of forest resources in the study area were also mentioned.

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