

## STUDY ON THE YIELD OF ALCOHOL IN THE PRODUCTION OF WINE FROM DIFFERENT INDIGENOUS FRUITS

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### Abstract

The vast majority of all wine found almost anywhere is fermented grape juice, but wine can technically be made from other fruits. In this research work, grape, pineapple, strawberry, and plum were selected for winemaking. They were purchased from Thirimingalar market. Fermentation was carried out at room temperature by using yeast (*Saccharomyces Cerevisiae*). Yield of alcohol was studied by varying the process condition such as sugar content, dosage of yeast and amount of water. Alcohol content, pH, acidity, sugar content, specific gravity and color of prepared wines were determined. The data obtained from the study suggested that the addition of 250g of sugar, 1.5g of yeast, and 900mL of water to 500g of grape is most suitable to obtain the highest yield of alcohol in the production of wine.

**Keywords :** Wine, fermentation, indigenous fruits, alcohol content

### Introduction

Wine is any fermented fruit juice. People typically associate wine solely with grapes and it's true that the vast majority of all wine found almost anywhere is fermented grape juice, but wine can technically be made from other fruits.

Grape wine is the alcoholic product of the fermentation of grape juice, and the essential feature of this fermentation is the conversion of the grape sugars, glucose and fructose, to ethyl alcohol (ethanol), carbon dioxide (released as a gas), and flavor components. This complex process is accomplished by living yeast cells and is illustrated in the following chemical equation :



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The alcohol produced through fermentation is a wine's major flavor component. It also affects the solubility of many wine constituents. Some is used in forming other flavor compounds. It also enhances wine's resistance to spoilage. Moreover, wines traditionally are classified according to their alcoholic content. Indeed the amount of alcohol formed from a given amount of grape sugar is of considerable practical importance to the wine (<http://scopius.spaceports.com/goodwine/pineapple.htm>).

People's interest in wine is largely focused on its taste, but it probably wouldn't taste very good if it were simply a matter of leaving jugs of grape juice in the basement for a couple of months. There are a lot different factors which go into creating each wine's unique taste. Wine tasting is the sensory examination and evaluation of wine. Wines contain many chemical compounds similar or identical to those in fruits, vegetables, and spices.

The sweetness of wine is determined by the amount of residual sugar in the wine after fermentation, relative to the acidity present in the wine. Dry wine, for example, has only a small amount of residual sugar (Anderson, 1973).

### **Materials and Methods**

The fruits were washed with water. The flesh was cut away from the core and 500g of the flesh was chopped into small pieces. All the juice liberated during chopping was collected. Chopped flesh was put into a nylon straining bag and tied closed. It was then transferred into the primary fermenter and crushed by hand. Sugar was added to the boiling water and it was stirred until sugar was completely dissolved. The sugar solution was poured into the primary fermenter just to cover the fruits and allowed to cool to room temperature. When it reached room temperature, all the ingredients except yeast were added, stirred into bag and tied again. After 24 hr, yeast was added and stirred again. Fermenter was covered and allowed to ferment the must for 7 days, stirring twice daily. Then the nylon bag was taken from the primary fermenter and it was allowed to drip without squeezing. Pulp was discarded and the fermentation was continued for three weeks. Then the clear liquid was withdrawn and investigated for its quality. Alcohol content, pH, acidity, specific gravity, color and sugar content of wines were determined.

## **Results and Discussion**

In this research work, the yield of alcohol in the preparation of pineapple wine, strawberry wine, plum wine and grape wine were studied by varying the amount of sugar, dosage of yeast and amount of water while the amount of fruit, the dosage of sodium bisulfite, ammonium sulfate, pectic enzyme, tartaric acid and fermentation period were kept constant.

The effects of sugar content, dosage of yeast, and water content on the yield of alcohol in the preparation of pineapple wine are shown in Tables (1), (2) and (3), respectively. According to the results it was clearly seen that highest yield percent of alcohol was obtained by using 300g of sugar, 1.5g of yeast, 900mL of water, 0.4g of sodium bisulfite, 0.2g of pectic enzyme, 0.2g of tartaric acid and 1.5g of ammonium sulfate for 500g of pineapple. In the preparation of pineapple wine, it was found that when the amount of sugar was increased over 300g, the yield of alcohol decreased because excess sugar inhibits the growth of yeast and may affect the yield of alcohol (Potter, 1973). If the amount of sugar is less than 300g, the yield of alcohol decreases because the amount of sugar is insufficient for fermentation with respective dosage of yeast. According to Table (2), when the dosage of yeast was higher than 1.5g, the yield of alcohol decreased. This was probably due to the inactivity of yeast inoculated in winemaking. Excess amount of yeast might affect the flavor of wine (Frazer,1981). When the dosage of yeast was lower than 1.5g, no alcohol was observed because of the insufficient dosage of yeast. From the result of the Table 3, if more than 900ml of water were used, the yield of alcohol decreased. But if less than 900mL of water were used, the yield of alcohol also decreased. From this study, it is clearly seen that the yield of alcohol also depends upon the amount of water used.

The effects of sugar content, dosage of yeast, and water content on the yield of alcohol in the preparation of strawberry wine are shown in Tables (4), (5) and (6), respectively. The results shown in these Tables demonstrated that the highest yield percent of alcohol could be obtained by using 350g of sugar, 1g of yeast, 900mL of water, 0.4g of sodium bisulfite, 0.2g of pectic enzyme, 0.2g of tartaric acid and 1.5g of ammonium sulfate for 500g of strawberry. Moreover, the effect of sugar content, the effect of dosage of yeast and the

effect of water content on the yield of alcohol in the preparation of strawberry wine were quite similar to that of pineapple wine.

The effects of sugar content, dosage of yeast, and water content on the yield of alcohol in the preparation of plum wine are illustrated in Tables (7), (8) and (9), respectively. These data suggested that the highest yield percent of alcohol could be obtained by using 300g of sugar, 4g of yeast, 500mL of water, 0.4g of sodium bisulfite, 0.2g of pectic enzyme and 1.5g of ammonium sulfate for 500g of strawberry. The effect of sugar content, the effect of dosage of yeast and the effect of water content on the yield of alcohol were quite close to that of pineapple wine.

The effects of sugar content, dosage of yeast, and water content on the yield of alcohol in the preparation of grape wine are shown in Tables (10), (11) and (12), respectively. The results indicated that the highest yield percent of alcohol was obtained by using 250g of sugar, 1.5g of yeast, 900mL of water, 0.4g of sodium bisulfite, 0.2g of pectic enzyme, 0.2g of tartaric acid and 1.5g of ammonium sulfate for 500g of grape. The effect of sugar content, the effect of dosage of yeast and the effect of water content on the yield of alcohol were also similar to that of pineapple wine.

Optimum conditions for the highest yield of alcohol in the production of wine from different indigenous fruits are summarized in Table (13).

The quality of wines was assessed by some parameters like pH, alcohol content, acidity, and specific gravity. In conclusion, although the quality of prepared pineapple wine, strawberry wine, grape wine, and plum wine are quite different, it was observed that the experimental results are compatible with the literature values and the products can be used as beverage.

Grapes were planted in Myanmar on an experimental scale in 1959 at Kyaukpadaung Township, and Myingyan District, in the dry zone of Central Myanmar. As it was shown that cultivation of this crop was feasible in this climatic zone, planting of grape was extended to Kyaukpadaung, Meikhtila, Nyaung Oo, Yamethin, Pyawbwe and Pakokku Townships. These townships are very dry areas of Central Myanmar. The climatic conditions of grape growing areas of Myanmar are probably different from that of other grape

growing countries. Therefore, cultivation practices for grapes in Myanmar may not be the same as in other countries.

Myanmar is a tropical country, which can be a disadvantage for wine grapes: Monsoons can damage vines, summer days in the region are shorter than in Europe (eight hours compared to 10 to 12), and there is plenty of heat and humidity. In Myanmar, grapes are grown mainly for the fresh fruit market. Grapes are grown not only in state farms but also in private farms. There is not enough wine production for local consumption and export in Myanmar. Fruit wines have traditionally been popular with home winemakers. Fruit wine making is no more difficult than making wines from fresh grapes. The basic process is the same, and consideration is given to the same aspects as when preparing grape juice for home winemaking ( <http://www.eckraus.com/fruit-wine-making>).

Grape, pineapple, strawberry, and plum are commonly grown fruits in Myanmar. Grape from Meiktila, pineapple from Bago, strawberry from Pyin Oo Lwin, and plum from Pakokku Townships were selected for winemaking in this study. Influence of pH, acidity, sugar content, water content, dosage of yeast, duration of fermentation on yield of alcohol were investigated and this study is intended as a guide to optimize these factors by wine composition and quality. These factors must be studied in more detail in order to develop vinification technologies which would ensure production of wine with the best sensory characteristics from locally grown fruits.

**Table 1:** Effect of Sugar Content on the Yield of Alcohol in the Preparation of Pineapple Wine

Weight of Pineapple = 500g      Volume of Water = 900 mL  
 Weight of Yeast = 1.5g      Fermentation Period = 28 days

Sr. No.	Wt. of Sugar (g)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.3	0.78	1.00	4
2.	250	3.0	0.70	1.00	7
3.	300*	3.0	0.70	1.00	8
4.	350	3.4	0.86	1.02	0
5.	400	3.2	0.76	1.06	0

\* Optimum condition

**Table 2:** Effect of Dosage of Yeast on the Yield of Alcohol in the Preparation of Pineapple Wine

Weight of Pineapple = 500g      Volume of Water = 900 mL  
 Weight of Sugar = 300g      Fermentation Period = 28 days

Sr. No.	Wt. of Yeast (g)	pH	Acidity (w/v %)	Specific Gravity	Yield of Alcohol (v/v %)
1.	1	3.3	1.37	1.00	0
2.	1.5*	3.0	0.70	1.00	7
3.	3	3.0	0.63	1.00	5
4.	4	3.4	0.87	1.00	4
5.	5	3.2	0.91	1.00	4

\* Optimum condition

**Table 3:** Effect of Water Content on Yield of Alcohol in the Preparation of Pineapple Wine

Weight of Pineapple = 500g      Weight of Yeast = 1.5 g  
 Weight of Sugar = 300g      Fermentation Period = 28 days

Sr.No.	Volume of Water (mL)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.2	1.30	1.09	0
2.	500	3.1	0.93	1.05	2
3.	700	3.3	0.93	1.01	6
4.	900*	3.0	0.70	1.00	7
5.	1100	3.2	0.71	1.00	5

\* Optimum condition

**Table 4:** Effect of Sugar Content on the Yield of Alcohol in Preparation of Strawberry Wine

Weight of Strawberry = 500g      Volume of Water = 900 mL  
 Weight of Yeast = 1g      Fermentation Period = 28 days

Sr. No.	Wt.of Sugar (g)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.1	0.57	1.00	0
2.	250	3.6	0.69	1.00	5
3.	300	3.8	0.67	1.00	5
4.	350*	3.3	0.69	1.00	8
5.	400	3.3	0.72	1.00	1

\* Optimum condition

**Table 5:** Effect of Dosage of Yeast on the Yield of Alcohol in the Preparation of Strawberry Wine

Weight of Strawberry = 500g    Volume of Water = 900 mL  
 Weight of Sugar = 350g    Fermentation Period = 28 days

Sr. No.	Wt.of Yeast (g)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	1*	3.4	0.6	1.00	6
2.	1.5	3.6	0.69	1.00	5
3.	3	3.5	0.67	1.00	4
4.	4	3.6	0.65	1.00	4
5.	5	3.6	0.67	1.00	4

\*Optimum condition

**Table 6:** Effect of Water Content on Yield of Alcohol in the Preparation of Strawberry Wine

Weight of Strawberry = 500 g    Weight of Yeast = 1 g  
 Weight of Sugar = 350 g    Fermentation Period = 28 days

Sr. No.	Volume of Water (mL)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	4.7	1.05	1.00	0
2.	500	3.4	2.52	1.06	0
3.	700	3.7	1.54	1.00	1
4.	900*	3.6	0.69	1.00	5
5.	1100	3.9	0.71	1.00	3

\* Optimum condition



**Table 7:** Effect of Sugar Content on the Yield of Alcohol in the Preparation of Plum Wine

Weight of Plum = 500g    Volume of Water = 500 mL  
 Weight of Yeast = 4g    Fermentation Period = 28 days

Sr. No.	Wt. of Sugar (g)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.5	0.95	1.03	0
2.	250	3.3	1.43	1.00	3
3.	300*	3.3	1.70	1.00	4
4.	350	3.6	1.38	1.00	1
5.	400	3.5	1.29	1.02	0

\* Optimum condition

**Table 8:** Effect of Dosage of Yeast on the Yield of Alcohol in the Preparation of Plum Wine

Weight of Plum = 500g    Volume of Water = 500 mL  
 Weight of Sugar = 300g    Fermentation Period = 28 days

Sr. No.	Wt. of Yeast (g)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	1	3.2	1.84	1.03	0
2.	1.5	3.3	1.43	1.00	3
3.	3	3.4	1.20	1.00	4
4.	4*	3.5	0.99	1.00	5
5.	5	3.5	0.92	1.00	4

\* Optimum condition

**Table 9:** Effect of Water Content on the Yield of Alcohol in the Preparation of Plum Wine

Weight of Plum = 500g    Weight of Yeast = 4 g  
 Weight of Sugar = 300g    Fermentation Period = 28 days

Sr. No.	Volume of Water (mL)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.4	1.54	1.07	0
2.	500*	3.5	1.28	1.00	3
3.	700	3.3	1.43	1.00	3
4.	900	3.5	1.41	1.03	1
5.	1100	3.7	1.38	1.00	0

\* Optimum condition

**Table 10:** Effect of Sugar Content on the Yield of Alcohol in the Preparation of Grape Wine

Weight of Grape = 500g    Volume of Water = 900 mL  
 Weight of Yeast = 1.5g    Fermentation Period = 28 days

Sr. No.	Wt. of Sugar (g)	pH	Acidity (w/v %)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.2	0.54	1.00	4
2.	250*	3.0	0.58	1.00	4
3.	300	4.3	0.68	1.01	3
4.	350	3.4	0.64	1.00	1
5.	400	3.2	1.43	1.03	0

\* Optimum condition

**Table 11:** Effect of Dosage of Yeast on the Yield of Alcohol in the Preparation of Grape Wine

Weight of Plum = 500g      Volume of Water = 900 mL  
 Weight of Sugar = 250g      Fermentation Period = 28 days

Sr. No.	Wt. of Yeast (g)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	1	3.2	0.56	1.00	1
2.	1.5*	3.0	0.58	1.00	7
3.	3	3.0	0.68	1.00	3
4.	4	3.4	0.60	1.00	3
5.	5	3.4	0.64	1.00	2

\* Optimum condition

**Table 12:** Effect of Water Content on the Yield of Alcohol in the Preparation of Grape Wine

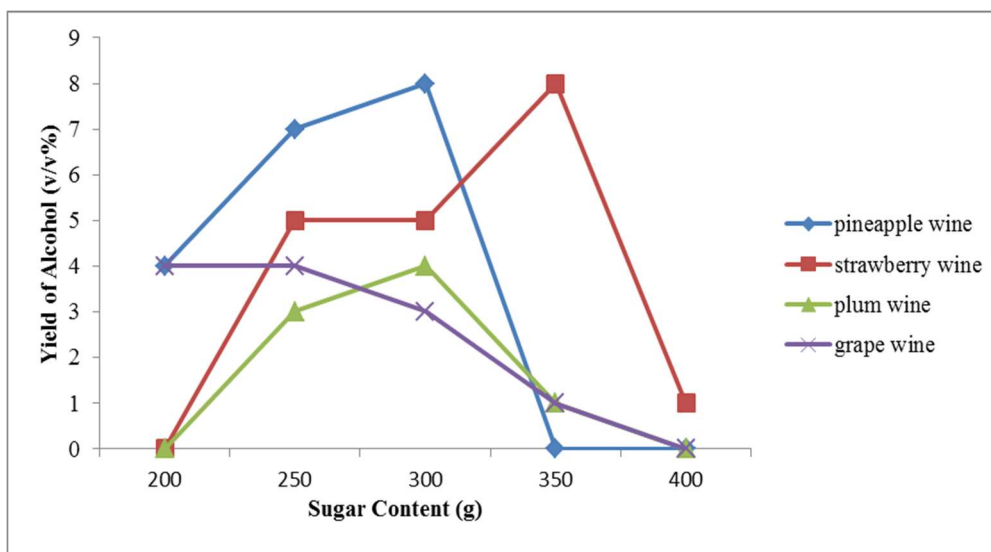
Weight of Plum = 500g      Weight of Yeast = 1.5 g  
 Weight of Sugar = 250g      Fermentation Period = 28 days

Sr. No.	Volume of Water (mL)	pH	Acidity (w/v%)	Specific Gravity	Yield of Alcohol (v/v %)
1.	200	3.3	0.93	1.10	0
2.	500	3.8	1.13	1.02	3
3.	700	3.3	0.71	1.01	4
4.	900*	3.0	0.58	1.00	7
5.	1100	3.3	0.65	1.00	5

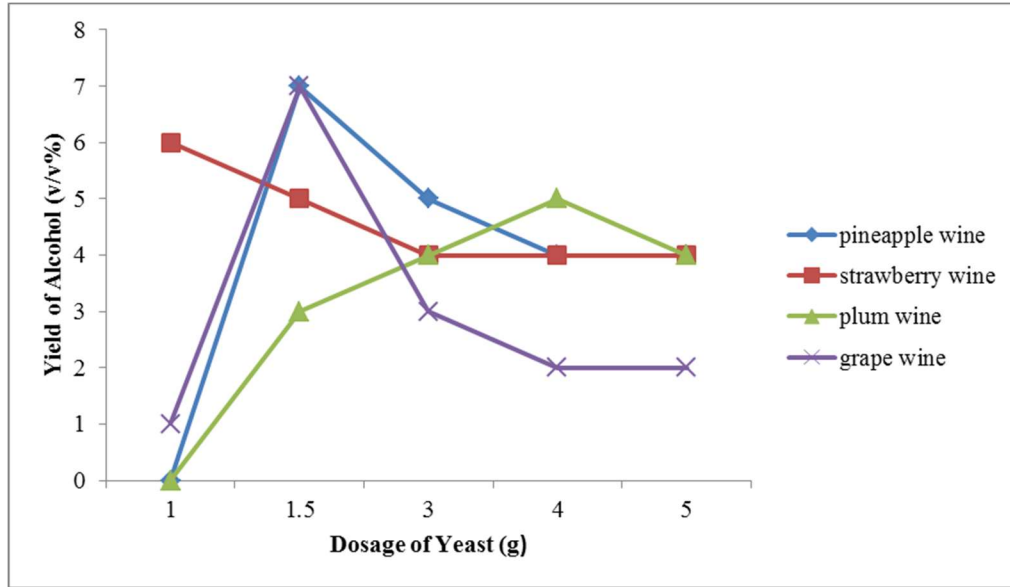
\* Optimum condition

**Table 13:** Production and Analysis of Wine from Locally Grown Fruits  
Weight of fruit = 500g

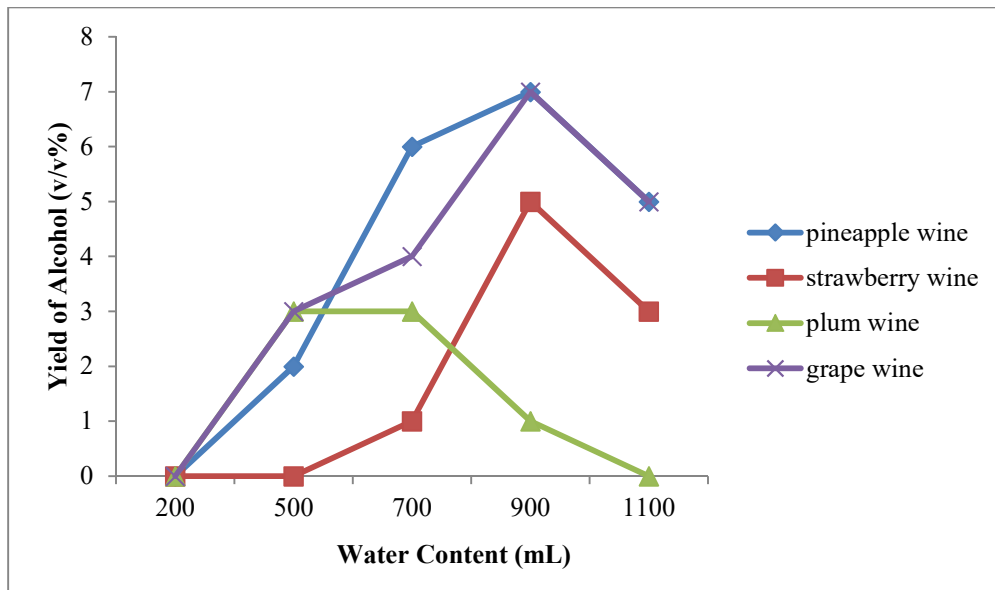
Sr. No.	Fruit	Optimum Dosage of Sugar(g)	Optimum Dosage of Yeast (g)	Optimum Volume of Water (mL)	Color of Wine	Sugar Content (% Brix) of Wine
1	Pineapple	300	1.5	900	White 0.3, Yellow 1.2	5
2	Strawberry	350	1	900	Red 0.9, Yellow 1.8	5
3	Plum	300	4	500	Red 2, Blue 3.1, yellow 0.5	6
4	Grape	250	1.5	900	Red 5, Yellow 0.2	6



**Figure 1:** Effect of sugar content on the yield of alcohol in the preparation of pineapple, strawberry, plum and grape wines



**Figure 2:** Effect of dosage of yeast on the yield of alcohol in the preparation of pineapple, strawberry, plum and grape wines



**Figure 3:** Effect of water content on the yield of alcohol in the preparation of pineapple, strawberry, plum and grape wines

## **Conclusion**

The data obtained from this study suggested that the addition of 250g of sugar, 900mL of water, and 1.5g of yeast to 500g of grape is most suitable to obtain the highest yield percent in production of wine. Pineapple, strawberry, and plum grow extremely well in Myanmar. The quality wines can be produced from these fruits other than grape. The results of this study are significant for improvement of fruit wine production. The factors which determine the quality of fruit wine should also be studied in order to produce the wine with the best sensory characteristics from various indigenous fruits.

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