Fruit Wine Characteristics with Variety of Banana Type along with Banana and Water Ratio

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Abstract：Banana is a fruit that can be used as a source of energy and vitamin content. However, bananas have a fast rate of damage and are easy to change after being harvested. Producing banana wine by fermentation may help to lower crop loss. This research aims to make a banana wine with various types of bananas along with banana and water ratios. Banana wines made of yellow Kepok banana (Musa acuminata x Musa balbisiana) and Mas banana (Musa acuminata Colla) were produced using a variety ratio of bananas and water of 1:2, 1:3, and 1:4. Total soluble solids, pH value, total titratable acidity, alcohol content, clarity, lightness, and color were then analyzed along with the organoleptic test which consist of scoring and hedonic test. The best banana wine was made from yellow Kepok banana with a ratio of bananas and water of 1:3. It has a pH value of 3.29±0.05, a total soluble solid of 9.26±0.05 °Brix, a total titratable acidity of 0.80±0.04%, alcohol content of 10.03±0.00%, a clarity of 90.08±0.43%, has a bright color of 53.64±0.70, and yellow color with a °Hue value of 119.01±7.76. Based on the scoring test, the best wine has a higher scoring value on the taste of the wine and a higher aroma of alcohol. On the hedonic taste, the best wine has a preferred hedonic color value and there is no difference in preference for alcohol aroma and wine taste.

Keywords: banana wine, banana and water ratio, yellow Kepok banana.

Introduction

Banana is one of the horticultural crops that is often consumed in fresh form and has a delicious taste, is nutritious, and has a relatively low price [1]. However, the fast damage rate and easy to change after being harvested due to the high water content is a problem for bananas [2]. The fast ripening activity of bananas after being harvested will decrease the quality of the fruit. This causes a lot of banana waste, and wastage of bananas due to poor handling after being harvested [3]. The bananas can be turned into banana wine through a fermentation process of banana juice to avoid rapid deterioration. This banana juice will undergo a fermentation stage which will later have an alcohol content of 5% [4]. Wine is an alcoholic beverage with a minimum alcohol content of 8% [5]. The characteristic of wine can be affected by the types of fruit, or the material used and the ratio of fruit and water to make juice before going into fermentation [6]. Based on the previous research, banana wine with the use of Saccharomyces cerevisiae and various variations of the ratio of bananas and water of 1:0, 1:1, 1:2, 1:3, 1:4, can produces alcohol levels ranging from 10-14% with 24 days of fermentation [6]. In other research, Mas banana wine with the use of Saccharomyces cerevisiae yeast produces an alcohol content of 8.03%, but it is not organoleptically preferred [7]. The purpose of this research is to make wine from bananas using various types of bananas and the ratio of bananas and water to analyze its effect on the characteristics of the wine and to get the banana wine with the best characteristics.

Materials and methods

Materials and Tools

The main materials are yellow Kepok banana (Musa acuminata x Musa balbisiana) and Mas banana (Musa acuminata Colla) obtained from traditional markets in Pasar Kotabumi, Tangerang. The supporting materials in this study were aquadest, “Rose Brand” sugar, citric acid, “Red Star” wine yeast with the type of Saccharomyces cerevisiae, buffer solution 7.0, buffer solution 4.0, oxalic acid, 0.1N NaOH solution, and 1% phenolphthalein indicator.

The tools used are stove, steamer, blender, filter, “Duran” Laboratory bottle, glass bottle, hose, cork cap, plasticine, glass beaker, measuring cup, test tube, test tube rack, “M37610-33 Thermolyme” vortex, Erlenmeyer, burette, volumetric pipette, measuring flask, spatula, stir bar, watch glass, pycnometer, bulb pump, thermometer, “Atago” refractometer, “744 Metrohm” pH meter, “Ohaus” scale, “WB 14 Memmert” water bath, desiccator, “Memmert UNE 200-800” oven, cuvette, “U-1800 Hitachi” UV-Visible spectrophotometer,
“Konica Minolta” chromameter, plastic petri dish, “Hirayama HL36AE” autoclave, centrifuge tube, and “Hermle” centrifuge.
Methods
The method of this research is an experiment consisting of one stage. This research begins with the process of making banana wine by using different types of bananas and different ratios of bananas and water. The process of making banana wine begins with the selection of raw materials that are yellow Kepok bananas and Mas bananas which are peeled and given steam blanching treatment for 3 minutes. Bananas that have been blanched are mashed with a ratio of bananas and water 1:2, 1:3, and 1:4 with a blender and filtered to produce banana juice. The bananas used in this study have a ripeness level of level 7, with a yellow color and flecked with brown according to the Dole banana chart [8].

The yeast culture was made by pouring the banana juice into a “Duran” laboratory bottle, followed by a pasteurization process at 80°C for 30 minutes and 5% dry yeast Saccharomyces cerevisiae was added when it was cold. The mixture was allowed to stand for 4 hours at room temperature to obtain a yeast culture. Banana juice without a starter is made in a glass bottle with sucrose added until it reaches 22°Brix and citric acid is added until it reaches a pH of 3.6. The mixture was followed by a pasteurization process at 80°C for 30 minutes to obtain banana juice without a starter and allowed to stand until it reached room temperature. The yeast cultures and banana juice without a starter were mixed under aseptic conditions and allowed to stand at room temperature for 9 days as a fermentation process. After 9 days of fermentation, decantation needs to be done to get a clear wine banana. The procedure of banana wine processing can be seen in Figure 1.

![Figure 1. Wine-making procedure flow chart.](image-url)
**Experimental Design**

The experimental design in this study was a completely randomized, two-factorial design with 3 replication. The first factor used is the type of banana with two levels of yellow Kepok banana and Mas banana. The second factor is the ratio of bananas and water with three levels of ratio of 1:2, 1:3, and 1:4. Analysis of Variance, One Way Anova was performed using the SPSS 25.0 software. Significant differences were detected using Duncan's test at the \( p \leq 0.05 \) level.

**Analysis**

The total soluble solids in banana wine were tested using a refractometer. The refractometer must be rinsed clean with distilled water on the prism to remove dirt and wiped with a soft cloth. The sample is dropped onto the refractometer prism. The total value of soluble solids can be seen from the dark and light limits of the refractometer with the unit of observation (ºBrix) [9].

Determination of the pH value in banana wine was determined using a pH meter tool. The pH meter used needs to be calibrated first in the presence of a buffer solution of 7.0 and 4.0. A total of 10 mL of the sample will be put into a glass beaker and the electrode is immersed from the pH meter until it shows a stable number. A constant and stable number will indicate the pH value of the banana wine [10].

The total titrated acid in banana wine was determined by acid-base titration. The total titrated acid calculated in banana wine is lactic acid. 1% phenolphthalein was used as an indicator and 0.1N NaOH as titrant. The Milliequivalent factory used is lactic acid with the number 90.08 [11].

The alcohol content of banana wine can be found through the measurement of specific gravity which will be continued into the calculation of alcohol content. The pycnometer to be used must be clean and dry. The empty pycnometer with the lid was weighed as \( W \). After that, the pycnometer was filled with samples and closed as \( W_1 \). Next, the sample was discarded and rinsed using distilled water and refilled with distilled water and recorded as \( W_2 \). The density of water (d) also needs to be seen based on temperature. The known specific gravity value can be directly applied to the alcohol content formula. Original gravity is specific gravity before fermentation and final gravity is specific gravity after fermentation [12].

\[
\text{Specific gravity} = \frac{W_1 - W}{W_2 - W} \times d
\]

\[
\text{Alcohol content} = \frac{1.05 \times (\text{Original gravity} - \text{Final gravity})}{0.789} \times 100\%
\]

The clarity of banana wine was measured using a UV-Visible spectrophotometer at a wavelength of 660 nm. The spectrophotometer used must be switched on for 30 minutes before use. The sample will be poured into a cuvette and see the percent transmittance value obtained. The higher the percent transmittance value, the higher the clarity value [11].

Color analysis on banana wine was carried out using a chromameter. The sample will be put into a plastic petri dish and will be analyzed by looking at the values of \( L^* \) (lightness), \( a^* \) (redness), and \( b^* \) (yellowness). The \( L^* \) value will indicate the brightness level of the sample with numbers 0-100 indicating the darkest to lightest value. The \( a^* \) and \( b^* \) values obtained will be used to calculate °Hue. The results of the °Hue calculation that have been obtained will be seen further in the °Hue color conversion table [13].

The scoring test was used to measure the level of characteristics of banana wine which included color, banana aroma, alcohol aroma, banana taste, and wine taste. The scoring test is carried out with 1-6 scales as a form of description that will be presented to the panelists. Banana wine samples will be assigned a random code and given to 30 untrained panelists. Panelists are required to taste the sample from left to right without repetition and panelists are required to rinse their mouths with water before tasting [14].

The hedonic test was carried out to measure the level of liking and acceptance of banana wine which was analyzed by 30 untrained panelists. The hedonic test was carried out on color, banana aroma, alcohol aroma, banana taste, wine taste, and overall acceptance. This test uses 1-7 hedonic scales. Banana wine samples will be assigned a random code and given to 30 untrained panelists. Panelists are required to taste the sample from left to right without repetition and panelists are required to rinse their mouths with water before tasting [14].
Results and discussion
The bananas used in this study were identified at the Indonesian Institute of Sciences. Based on the identification results, it is proven that the bananas used in this study are yellow Kepok banana (*Musa acuminata* x *Musa balbisiana*) and Mas banana (*Musa acuminata* Colla). The banana wine produced from the different types of banana and the different ratios of banana and water will be analyzed the effect on wine characteristics.

**pH Value of Banana Wine**
The pH value of banana wine with different ratios of bananas and water can be seen in Figure 2. Based on Figure 2, it can be seen that wine with a banana and water ratio of 1:2 has a significantly higher pH (p ≤ 0.05) when compared with other treatments.

![Figure 2. Effect of different ratios of bananas and water on the pH of banana wine. Different letter notation showed significant differences (p ≤ 0.05)](image)

Low pH conditions can inhibit bacterial growth in wine and inhibit harmful metabolic activities that can affect wine characteristics such as unwanted aroma and taste [15]. The more water used in the banana and water ratio, the lower the pH value due to the fermentation process that forms H₂CO₃ and the acidic atmosphere in the wine that will directly reduce the pH content [16].

**Total Soluble Solids of Banana Wine**
The total soluble solids in banana wine with different types of bananas and different ratios of bananas and water can be seen in Figure 3. Based on Figure 3, the total soluble solids of all wine produced from yellow Kepok banana are lower than all wine produced from Mas banana. The lowest total soluble solids are on yellow Kepok banana wine with the ratios of banana and water of 1:3.

![Figure 3. Effect of different types of bananas and the different ratios of bananas and water on the total soluble solids of banana wine. Different letter notation showed significant differences (p ≤ 0.05)](image)
The decrease in total soluble solids indicates that more materials are fermented and converted into alcohol [17]. Wine using yellow Kepok banana had significantly lower total soluble solids (p ≤ 0.05) when compared to Mas banana. The high sugar content is the remnants of unfermented sugar and is referred to as residual sugar [18]. The difference in the total amount of soluble solids can be caused by differences in the fermentation ability of each type of banana used [6]. The lower the total soluble solids in the wine, the higher the alcohol content will be.

**Total Titratable Acid of Banana Wine**

The total titratable acid of banana wine based on different ratios of banana and water can be seen in Figure 4. Based on Figure 4, it can be seen that wine with a banana and water ratio of 1:4 had a significantly lower total titratable acid content (p ≤ 0.05) when compared to other treatments. The highest content of total titratable acid was in the treatment with the use of banana and water ratio of 1:2 with 0.84%, it had less water usage so that it produced more fermented products and one of them was lactic acid. Lactic acid is an acid that is calculated in the calculation of the total titratable acid and contributes to the overall acidity of the wine [19]. Based on the theory with an increase in the ratio of bananas and water, the fruit content in the solution will be smaller and make the acidity of the solution low [6].

![Figure 4. Effect of different ratios of bananas and water on the total titratable acid of banana wine. Different letter notation showed significant differences (p ≤ 0.05)](image)

The measurement of a low total titratable acid and a low pH value indicates that there is no relationship between the pH value and the total titrated acid. Measurements with the use of a pH meter only measure free hydrogen ions wherein the measurement of the total titratable acid measures free hydrogen ions and hydrogen bound to organic acids. Based on this theory, it can be said that pH is not correlated with the concentration of acid in a sample [20].

**Alcohol Content of Banana Wine**

The alcohol content of banana wine with the use of different types of bananas can be seen in Figure 5. Based on Figure 5, wine with the use of the yellow Kepok banana has a significantly higher alcohol content (p ≤ 0.05) when compared to the Mas banana.

The use of different types of bananas will have different fermentation rate abilities in the banana wine that is made so that it will produce wines with different amounts of alcohol content. The lower ratio of bananas and water being used, the higher the alcohol content [6]. However, in this study, the ratio used did not have a much different range, so that the banana juice produced was not too different in alcohol concentration.

The alcohol content of the wine from the yellow Kepok banana has a higher value and this is related to the lower total soluble solids content in the wine. The lower the total soluble solids in the wine, the higher the alcohol content will be. The alcohol content obtained from the wine with the use of yellow Kepok banana is 10.22% with 9 days of fermentation, which is more better and efficient when compared to the previous studies with 24 days of fermentation [6]. The alcohol content is not much different from the results of the previous studies [6], but it is better with the shorter fermentation time. Based on that alcohol content, wine with the use of yellow Kepok banana has met the SNI requirements. The alcohol content of the Mas banana wine is lower than previous studies, because it only ferments 9 days and faster than previous studies that fermented for 13 days [7]. The variation of the ratios of banana and water does not affect the alcohol content. It can also be seen that the variation of the ratios of banana and water can not increase the alcohol content of the Mas banana wine, referring to previous studies.
Figure 5. Effect of different types of bananas on the alcohol content of banana wine. Different letter notation showed significant differences (p ≤ 0.05)

Clarity of Banana Wine
The clarity of banana wine with the different types of bananas and different ratios of bananas and water can be seen in Figure 6. High clarity is associated with low total soluble solids in wine. Low total soluble solids are the total residual solids that are not fermented and trigger turbidity in wine [18].

Figure 6. Effect of different types of bananas and the different ratios of bananas and water on the clarity of banana wine. Different letter notation showed significant differences (p ≤ 0.05)

Based on Figure 6, the greater ratio of bananas and water used in wine with the use of Mas banana, the greater the clarity value obtained. Wine using yellow Kepok banana with a banana and water ratio of 1:3, had the highest clarity value of 90.08%, but the results were not significantly different (p ≤ 0.05) with the other wine using yellow Kepok banana and also with 1:3 and 1:4 ratios of bananas and water.

Banana Wine Color
The color of banana wine based on the type of banana and the ratio of different bananas and water can be seen in Figure 7. Based on Figure 7, wine using yellow Kepok banana has a color (*Hue) in the range of 107.33-119.01 and is categorized as yellow. Wine using Mas banana is in the yellowish red to a yellow color category, this can be caused by the presence of carotenoid pigments found in bananas [21]. The red color can be caused by a browning reaction in bananas so that it gives a darker color [22]. Polyphenol oxidase enzymes can cause enzymatic browning of the products [23].
Figure 7. Effect of different types of bananas and the different ratios of bananas and water on banana wine color. Different letter notation showed significant differences ($p \leq 0.05$)

Based on Figure 8, it can be seen that the wine with the use of yellow Kepok banana has a significantly higher lightness value ($p \leq 0.05$) when compared to the type of Mas banana. This can be caused by the different types of bananas used to produce different characteristics. Wine with the use of the yellow Kepok banana has a yellow color so that it becomes brighter when compared to wine made from Mas banana with a reddish yellow color which makes it darker.

Figure 8. Effect of different types of bananas on the lightness of banana wine. Different letter notation showed significant differences ($p \leq 0.05$)

**Banana Wine Scoring Test**

The scoring test was carried out by testing the parameters of color, banana aromas, alcohol aromas, the taste of the banana, and the taste of the wine.

Based on Figure 9, wine using Mas banana has a higher color scoring test result. The low clarity of the Mas banana wine will increase the intensity of the color of the Mas banana wine. This is also related to the Mas banana which gives a darker color and lightness to the resulting wine so that it gives a darker color. The wine produced with a banana and water ratio of 1:2 had a significantly higher yellow color intensity ($p \leq 0.05$) when compared to other treatments. However, the treatment did not have a significant difference with the use of a banana and water ratio of 1:3. It's because the smaller the ratio of banana and water being used, the more concentrated the wine sample, and the color will be more intense.
Figure 9. a. The results of the banana wine color scoring test with different types of bananas. b. The results of the banana wine color scoring test with different ratios of bananas and water. Different letter notation showed significant differences (p ≤ 0.05). 1-6 scale for color (very not yellow – very yellow)

Based on Figure 10, the wine produced from yellow Kepok banana has a significantly higher intensity of alcohol aroma (p ≤ 0.05) because it has a higher alcohol content than other treatments. The results of the alcohol aroma scoring test have a low value on wine using Mas bananas and a less ratio of bananas and water. The wine with the lowest alcohol aroma scoring test results was in the wine produced with the use of Mas bananas. Based on previous research, Mas banana wine with *Saccharomyces cerevisiae* has a lower alcohol aroma scoring test value than other treatments [7]. The results of this study indicate that the variation of the ratios of banana and water has not been able to improve the results of the alcohol aroma scoring test of the Mas banana wine. The type of banana affects the results of the alcohol content more, so it also affects the aroma of the alcohol produced in the wine.

Figure 10. The results of the alcohol aromas scoring test on wine with different types of bananas and different ratios of bananas and water. Different letter notation showed significant differences (p ≤ 0.05). 1-6 scale for alcohol aromas (alcohol aroma very not detected – alcohol aroma very detected)

Based on Figure 11, it can be seen that the wine produced from Mas banana has a significantly higher intensity of banana aromas (p ≤ 0.05) when compared to the wine produced from the yellow Kepok banana. The higher ratio of bananas and water being used, the stronger the intensity of the banana aromas. This is because the higher alcohol content in the wine using yellow Kepok banana will decrease the intensity of the banana aromas in the resulting wine.

The higher the alcohol content in the wine produced from the yellow Kepok banana, the lower the intensity of the banana aroma in the resulting wine. Low alcohol content will make the resulting wine has a higher intensity of banana aroma and is seen in wine made from the type of Mas banana.
Figure 11. The results of the banana aromas scoring test on wine with different types of bananas and different ratios of bananas and water. Different letter notation showed significant differences (p ≤ 0.05). 1-6 scale for banana aromas (banana aroma very not detected – banana aroma very detected)

Based on Figure 12, the wine produced from Mas banana has a significantly higher intensity of banana taste (p ≤ 0.05) due to the low alcohol content so that the banana taste will be more pronounced and not covered by the alcohol taste. The wine produced with ratios of banana and water of 1:4 has a significantly higher intensity of banana taste (p ≤ 0.05) due to the lower alcohol content, thus increasing the intensity of the banana flavor in the wine.

Figure 12. a. The results of the banana taste scoring test on wine with different types of bananas. b. The results of the banana taste scoring test on wine with different ratios of bananas and water. Different letter notation showed significant differences (p ≤ 0.05). 1-6 scale for banana flavor (banana taste very not detected – banana taste very detected).

Based on Figure 13, the wine produced with yellow Kepok banana has a significantly higher intensity of wine taste (p ≤ 0.05) because the wine using yellow Kepok banana produces wine with higher alcohol content and makes the intensity of the wine taste stronger. Based on previous research, Mas banana wine with Saccharomyces cerevisiae has a lower wine taste scoring test value than other treatments [7]. The results of this study indicate that the ratios of banana and water have not been able to increase the value of the wine taste scoring test of the Mas banana because of the low alcohol content.

The wine produced using the ratios of banana and water of 1:4 had a significantly lower intensity of wine taste (p ≤ 0.05) because the wine using ratios of banana and water of 1:4 resulted in a wine with a lower alcohol content when compared to other treatments. The lower alcohol content and high total soluble solids value will reduce the intensity of the taste of the wine produced.
Banana Wine Hedonic Test

The hedonic test was carried out by testing the parameters of color, banana aroma, alcohol aroma, banana taste, wine taste, and overall acceptance using 7 favorite intensity scales. Based on the hedonic test, the type of banana and the ratio of banana and water used had no significant effect (p > 0.05) on the hedonic value of banana aroma, alcohol aroma, and wine taste. All test values indicate that the panelists tend to like the aroma of bananas, the aroma of alcohol, and the taste of the resulting wine.

Based on Figure 14, the wine produced from Mas banana and using the banana and water ratio of 1:2 has the smallest hedonic test results in color. The wine produced from yellow Kepok bananas and using the banana and water ratio of 1:2 was significantly preferred (p ≤ 0.05) because the panelists preferred wine with high clarity characteristics.
The hedonic test value for banana aroma is in the range of 4.47-4.77 which indicates that the panelists tend to like the aroma of banana wine produced. Panelists could not see any difference in the aroma produced based on the type of banana and the ratio of banana and water because the wine produced minimized the aroma of the banana so that the panelists still tended to like it.

The hedonic test value for the aroma of alcohol produced is in the range of 4.47-4.73 in all test results, which indicates that the panelists tend to like the aroma of the alcohol produced. Panelists did not see any difference in the aroma produced.

The value of the hedonic test results for the taste of the wine produced is in the range of 4.33-5.23 which indicates that the panelists tend to like the taste of the wine produced and the panelists do not see any difference in the taste of the wine produced. The scoring results obtained on the aroma of alcohol and the taste of wine tend to only smell slightly of alcohol and slightly taste of wine and the results of the banana flavor test tend to be high so that the panelists' preference for the taste of wine is not too high. The type of banana and the ratio of banana and water did not affect the results of the hedonic test for wine taste and the hedonic test value produced was on a neutral scale and kinda like the whole test results.

Based on Figure 15, the types of bananas have a significant effect (p ≤ 0.05) on the results of the hedonic test for banana taste in the resulting wine. The wine produced from Mas banana has a higher level of preference because of the low alcohol content so that the banana taste is more pronounced and is not covered with alcohol. The panelists preferred the banana taste which was described as sweet because of the high total soluble solids content.

**Figure 15.** The results of the banana taste hedonic test on wine with different types of bananas. Different letter notation showed significant differences (p ≤ 0.05). 1-7 scale for color (dislike very much – like very much)

**Figure 16.** The results of the overall acceptance hedonic test on wine with different types of bananas. Different letter notation showed significant differences (p ≤ 0.05). 1-7 scale for color (dislike very much – like very much)
Based on Figure 16, the types of bananas also have a significant effect \((p \leq 0.05)\) on the overall acceptance of the hedonic test results. The wine produced from Mas banana has a higher level of preference because the panelists prefer wines with low alcohol content. Panelists tend not to like wine from yellow Kepok banana because it has a high alcohol content so it has a strong alcohol taste and does not have a dominant sweet taste like wine from Mas banana.

**Determination of Wine with the Best Banana Type and Ratio of Bananas and Water**

Based on the results, the best banana wine was selected based on alcohol content, clarity, color, and organoleptic tests. The best banana wines are those made with yellow Kepok bananas using a 1:3 ratio of bananas and water. This is based on the alcohol content that has passed the SNI requirements with a minimum of 8%. The wine produced from yellow Kepok banana has an alcohol content in the range of 10.22% in all ratios of bananas and water, it has a yellow color range in the color parameter, so it is better than the wine produced from Mas banana which is in the yellowish-red range.

The ratio of bananas and water did not have a significant difference in the alcohol content of the resulting wine produced from yellow Kepok banana, so the banana and water ratio of 1:3 was chosen which had the lowest total soluble solids content. A low total soluble solid is associated with high alcohol content. In the clarity parameter, the ratio of bananas and water 1:3 in wine produced from yellow Kepok banana has a higher clarity value of 90.08% when compared to the ratio of bananas and water and other types of bananas. The banana wine produced can give different characteristics depending on the use of various types of bananas and the ratio of bananas and water. The wine produced from yellow Kepok banana has a higher alcohol content and lower total soluble solids and also has a higher clarity than Mas banana. The use of banana and water ratio of 1:3 has the smallest total soluble solids value and has a higher clarity value when compared to other treatments.

Based on the scoring test, wine made from yellow Kepok banana with a banana and water ratio of 1:3 has a higher scoring value on the taste of the wine. The aroma of alcohol produced is also higher when compared to wine made from Mas banana. Based on the hedonic test, it can be seen that wine made from yellow Kepok banana with a ratio of banana and water of 1:3 has a preferred hedonic color value and there is no difference in preference for alcohol aroma and wine taste.

**Conclusions**

The banana wine produced can give different characteristics depending on the use of various types of bananas and the ratio of bananas and water. The wine produced from yellow Kepok banana has a higher alcohol content and lower total soluble solids and also has a higher clarity than Mas banana. The use of banana and water ratio of 1:3 has the smallest total soluble solids value and has a higher clarity value when compared to other treatments.

The best banana wine is produced from yellow Kepok banana with ratios of banana and water of 1:3. The best banana wine has a pH value of 3.29±0.05, total soluble solids 9.26±0.05 °Brix, total titratable acid of 0.80±0.04%, the alcohol content of 10.33±0.00% which is in accordance with SNI standards and has a clarity of 90.08±0.43%. The best wine has a bright color of 53.64±0.70 and yellow with a “Hue value of 119.01±7.76. The best wine has a higher scoring value on the taste of the wine, and also has a higher aroma of alcohol when compared to the other wine. On the hedonic test, it can be seen that wine produced from yellow Kepok banana with the ratios of banana and water of 1:3 has a preferred hedonic color value and there is no difference in preference for alcohol aroma and wine taste.

**References**

of India, 2012.


