Standardization of pineapple wine by using different concentration of sugar (*Ananas comosus* L.)

ABSTRACT

The study was conducted in Completely Randomized Design (CRD) with 5 treatments & four replications. The treatments were T_1 (pineapple juice (700ml) + Beetroot extract (35gm) + 20° brix + Beetroot extract (35gm) wine yeast (0.133%), T_2 (pineapple juice (700ml) + Beetroot extract (35gm) + 25° brix + wine yeast (0.133%), T_3 (pineapple juice (700ml) + Beetroot extract (35gm) + 30° brix + wine yeast (0.133%), T_4 (pineapple juice (700ml) + Beetroot extract (35gm) + 35° brix + wine yeast (0.133%), T_5 (pineapple juice (700ml) + Beetroot extract (35gm) + 40° brix + wine yeast (0.133%) Total soluble solids, pH and Specific Gravity decreased while the alcohol content, Acidity and the Sensory Qualities increased with increasing length of fermentation. From the above treatments, it is concluded that treatment T_4 was found superior in respect of the parameters like Total Soluble Solids, Acidity, pH, Alcohol content, Specific gravity. With respectively Color and Appearance, Taste, Aroma and Overall acceptability also T_4 was found best. In terms of economical evaluation, Net return and cost benefit ratio was found best in treatment T_4. Since Pineapples contains good sugar proportion which makes it suitable for wine making, while beetroot contains huge amounts of biologically active substances and commonly used in manufacturing as a food coloring agent, the production of wine from this fruit can help increase wine variety and reduce post-harvest losses. This study showed that acceptable wine can be produced from pineapple using yeast especially *Saccharomyces cerevisiae*.

Keywords: Wine, Pineapple, Fermentation, *Saccharomyces cerevisiae*, Sugar, beetroot

INTRODUCTION:

Pineapple (*Ananus comosus* L.), a wonderful tropical fruit belongs to Bromeliaceae family having exceptional juiciness, vibrant tropical flavour and immense health benefits. Pineapple contains considerable calcium, potassium, fibre, and vitamin C. It is low in fat and cholesterol. Vitamin C is the body's primary water-soluble antioxidant, against free radicals that attack and damage normal cells. It is also a good source of vitamin B1, vitamin B6, copper and dietary fibre. Pineapple is a digestive aid and a natural Anti-Inflammatory fruit (Joy PP 2010). A group of sulphur-containing photolytic (protein digesting) enzymes (bromelain) in pineapple aid digestion. Hale LP. (2004). Fresh pineapples are rich in

bromelain used for tenderizing meat. Bromelain has demonstrated significant anti-inflammatory effects, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis and gout also speeding recovery from injuries and surgery. (Rowan AD *et al.,* 1994) Pineapple is an excellent cerebral toner, it combats loss of memory, sadness and melancholy. Pineapple fruits are primarily used in three segments, namely, fresh fruit, canning and juice concentrate with characteristic requirements of size, shape, color, aroma and flavour. The production of pineapple cv. Guangdongpro) wine continued to accumulate in Zhanjiang area, a region of planting area and production accounted for 69.4% and 88.2% of the province and the yield per unit area was significantly higher than other areas in the province. Pineapple has a moderate sugar and acidity, in addition to a strong aroma. So, using pineapple to produce a fruit wine is an attractive direction for deep processing. Pineapple fruit maturity is evaluated on the extent of fruit "eye" flatness and skin yellowing. Consumers similarly judge fruit quality by skin color and aroma. A minimum of 12% SSC is required for fresh fruit in Hawai (Anon. 1968). A sugar-to-acid ratio of 0.9 to 1.3 is recommended (Soler 1992). Fruit do not continue to ripen or sweeten after harvest. Fully ripe, yellow fruit are unsuitable for transporting to distant markets, so slightly less mature fruit are selected for this purpose (Akamine 1963, Cancel 1974). Immature fruit should not be shipped, since they do not develop good flavour, have low brix, and are more prone to chilling injury (Rohrbach and Paull 1982, Paull and Chen 2003).

Beetroot (*Beta vulgaris*) from Chenopodiaceae family is botanically grouped as an herbaceous biennial also known as red beet and edible is a tape root portion of the plant and contains huge amounts of bioactive substances including betalains, it is a water-soluble pigment which is responsible for the deep red colour of beetroot, especially beta-cyaninas and betaxanthins (Vanajakshi *et al.,* 2015; Azeredo *et al.,* 2009). Deep red colored beetroot is popular for human consumption. There is growing interest in the use of natural food color, because synthetic dyes are becoming more critically assessed by the consumer. It is commonly used in food processing to improve the rad colour of tomato pastes, sauces, soups, dessert, jams, jellies, ice cream and in confectionery (Rachitha R. 2016).

MATERIALS & METHODS:

The experiment on **"Standardization of pineapple wine by using different concentration of sugar (*Ananas comosus* L.)"** was carried out under Post Harvest Laboratory in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom

University of Agriculture, Technology and Sciences, Prayagraj in month of December-February during 2021 – 2022. The Preparation of wine from pineapple juice prepared with 5 treatments which were T_1 (pineapple juice (700ml) + Beetroot extract (35gm) + 20° brix + wine yeast (0.133%), T_2 (pineapple juice (700ml) + Beetroot extract (35gm) + 25° brix + wine yeast (0.133%), T_3 (pineapple juice (700ml) + Beetroot extract (35gm) + 30° brix + wine yeast (0.133%), T_4 (pineapple juice (700ml) + Beetroot extract (35gm) + 35° brix + wine yeast (0.133%), T_5 (pineapple juice (700ml) + Beetroot extract (35gm) + 40° brix + wine yeast (0.133%) and four replications. After the preparation of wine that were stored for 90 days under ambient room temperature. The procedure of making Pineapple wine is given below:

Preparation of juice

Extraction of Juice, the pineapple was be washed, then peeled and cored. After chipping and pressing, add 0.1 mg/lit. pectin for enzymolysis and held for 2 hr. in water at 40° C. The slurry was filtered through double folded cheese cloth. Adding SO_2 to the juice immediately to prevent the growth of the bacteria. White sugar was added to the juice, for adjustment of sugar level and citric acid to pH enhance the flavour of the wine. Also caused extract of beetroot in minute amount of 35gm for each treatment were applied to enhance the attractive appearance of wine. Finally, the juice was pasteurized (65° C, for 30 min) (Frazier and Westhoff 1995)

Preparation of yeast

Prepared a specialized yeast medium 1lit. and autoclaved for 15 min at 121° C. After cooling to room temperature, 0.133 % of active dry yeast was added and, activated for 24 hr. at 28° C. Then the culture medium that was prepared by 1lit. pineapple juice was autoclaved for 15 min at 121° C. Lastly, adding 5 % yeast has been activated for 24 hr. at 28° C after cooling to room temperature. (Mc Gregor *et al.,* 1970)

Fermentation of pineapple Juice

The treated juice was added into the fermentation jar, then sugar is adjusted for 20° Brix. The jar was inoculated with 5 % activated yeast and closed. Then the mixture was incubated at 20° C or 7 days. The total sugar, total acid and alcohol content were monitored periodically during the fermentation. When the main fermentation finished, the upper liquid was transferred to the other clean container in order to remove impurities. Then the mixture continued to ferment at 20° C for 10 days. After that, under the storage conditions of 20° C aged for 2 months. The clarifying treatment of the blended fruit wine was followed by the gelatin tannin clarification method. (Chunmei Gu *et al.,* 2011)

Analytical Methods

The total sugar was determined by Fehling reagent method. Total acid was determined by potentiometric titration. With the distillation gravity method, the alcohol was determined. pH was measured with a digital pH meter. The sugar was determined using a handheld saccharimeter. Titratable, fixed and volatile acidities were determined as described by Amerine and Ougb, the aroma components of pineapple wine were analyzed by GC-MS. (Pearson D. 1976)

Sensory Evaluation

The pineapple fruit wine was evaluated with color (30 points), aroma (30 points) and taste (40 points) by a group of 10 experts with relevant experience. The sensory ratings were analyzed using the method (Zhaojian Gao, 2005).

Plate No. 1: Fermentation of wine under BOD Incubator (Bio-Oxygen Demand)

RESULTS & DISCUSSION:

Changes in TSS

In terms of Total Soluble Solids, table no. 3 represent that the lowest score of TSS (15.54, 12.33, 8.46 and 6.11° Brix) at 1st, 30, 60 and 90 days after storage was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° Brix + wine yeast 0.133%), followed by treatment T_3 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 30° Brix + wine yeast 0.133%) with (13.83, 13.27, 11.99 & 7.14° Brix) at 1st, 30, 60 and 90 days after storage, whereas the maximum score was observed in treatment T_5 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 40° Brix + wine yeast 0.133%) with (14.79, 13.29, 12.10 &

10.39 ° Brix) during 1st, 30, 60 and 90 days storage. The decrease in TSS content of wine indicates the utilization of the sugar present in the must during fermentation. Similarity has been seen in Sonar *et al.,* (2004) in jamun wine, Idise *et. al.,* (2010) in pineapple wine, Isitua *et. al.,* (2010) in banana wine,

Changes in Alcohol (%)

In terms of Alcohol content, table no. 4 showed that the highest score of Alcohol content (4.22, 5.50 and 6.26) at 30, 60 and 90 days after storage was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° Brix + wine yeast 0.133%) followed by treatment T_1 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 20° Brix + wine yeast 0.133%) with (3.53, 4.32, and 5.31) at 30, 60 and 90 days after storage, whereas the minimum score was observed in treatment T_5 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 40° Brix + wine yeast 0.133%) with (3.55, 4.53 and 4.57) during 30, 60 and 90 days storage. The increase in Alcohol content of pineapple wine with different levels of wine yeast and sugar during storage may possibly due to the variation in performance of the yeast to utilize the fermentable sugars affecting the ferment ability, hence the varied alcohol product. The above results are similar with the findings of Chowdhury and Ray (2007) in jamun wine, Yadav *et al.,* (2009) in Mahua wine.

Changes in acidity (%)

In terms of Acidity table no.4 represent that the lowest score of Acidity (0.28, 0.35, 0.45 and 0.60) at 1st, 30, 60 and 90 days after storage was observed in treatment T_1 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 20° Brix + wine yeast 0.133%), followed by treatment T_3 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 30° Brix + wine yeast 0.133%) with (0.30, 0.40, 0.54 and 0.64) at 1st, 30, 60 and 90 days after storage, whereas the maximum score was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° Brix + wine yeast 0.133%) with (0.35, 0.51, 0.67 and 0.81) during 1st, 30, 60 and 90 days storage. The increase in acidity may be due to the increased alcohol production from the high initial sugar concentration (Attri 2005). reported that organic acids such as citric, malic, lactic, tartaric, oxalic and succinic acids were produced during fermentation in cocoa beans by S. cerevisiae. The increment of titratable acidity during fermentation is attributed to the production of different organic acids as observed in kiwi wine (Akubor *et al.,* 2003) in banana wine, (Pratima *et al.,* 2006), who reported that level of inoculums had no effect on the TA of fermenting juice.

Changes in pH

In terms of pH, table no.4 represent that the lowest score of pH (4.27, 3.37, 3.14 and 2.52) at 1st, 30, 60 and 90 days after storage was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + 35° Brix + wine yeast 0.133%) followed by treatment T_5 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 40°Brix + wine yeast 0.133%) with (4.63, 3.51, 3.51, and 3.05) at 1st, 30, 60 and 90 days after storage, whereas the maximum score was observed in treatment T_1 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 20° Brix + wine yeast 0.133%) with (4.58, 3.62, 3.42 and 3.25) during 1st, 30, 60 and 90 days storage. The decrease in pH with increase in acidity of wine observed may be due to dissociation of parental acids and formation of hydrogen ions. The above results are similar with the findings of (Reddy and Reddy 2005) in mango fruit wine, (S. K. Panda *et al.*, 2014) in sapota wine. The pH of the wine depends on composition of the must, number of organic acids and sugars present in the wine.

Specific gravity

In terms of Specific gravity, table no. 3 represent that the lowest score of Specific gravity (1.58, 1.24, 1.05 and 0.76) at, 1st, 30, 60 and 90 days after storage was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + 35° Brix + wine yeast 0.133%) followed by treatment T_5 (Pineapple juice 700ml + Beetroot extract (35gm) + 40° Brix + wine yeast 0.133%) with (1.72, 1.36, 1.20 and 1.03) at 1st, 30, 60 and 90 days after storage, whereas the maximum score was observed in treatment T_1 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 20° Brix + wine yeast 0.133%) with (1.74, 1.42, 1.17 and 1.08) during 1st, 30, 60 and 90 days storage. The decrease in Specific gravity of pineapple wine with different levels of wine yeast and sugar during storage may possibly due to the type of yeast used in the wine production. *Saccharomyces cerevisiae* has been reported to reduce specific quality of fruit wines during fermentation. The above results are similar with the findings of (Okafor 2018), (Idise and Odoyo 2011).

Sensory evaluation

In terms of colour and appearance, table no. 1 represent that the highest score of colour (7.71, 7.83 and 8.31) at 30, 60 and 90 days respectively was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° Brix + wine yeast 0.133%), followed by treatment T_2 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 25° Brix + wine yeast 0.133%) with (6.15, 7.12 and 7.55) whereas the minimum score was observed in treatment T_3 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 30° Brix + wine yeast 0.133%) with (6.05, 7.14 and 7.20) during 30, 60 and 90 days storage. In terms of Taste,

the maximum score of Taste (6.64, 7.45 and 8.07) at 30, 60 and 90 days respectively was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° Brix + wine Yeast 0.133%) followed by treatment T_3 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 30° Brix + wine Yeast 0.133%) with (5.43, 6.37 and 7.31) whereas the minimum score was observed in treatment T_1 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 20° Brix + wine Yeast 0.133%) with (5.61, 6.24 and 7.03) during 30, 60 and 90days storage. In terms of Aroma, the maximum score of Aroma (6.48, 7.26 and 8.05) at 30, 60 and 90 days respectively was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° Brix + wine yeast 0.133%) followed by treatment T_2 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 25° Brix + wine yeast 0.133%) with (5.62, 6.43, and 7.38) whereas, the minimum score was observed in treatment T_3 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 30° Brix + wine yeast 0.133%) with (5.65, 6.41 and 6.44) during 30, 60 and 90 days storage. In terms of Overall acceptability, table no.2 represent that the lowest score of Overall acceptability (6.54,7.51 and 8.14) at 30, 60 and 90 days respectively was observed in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + 35°Brix + wine yeast 0.133%), followed by treatment T_2 (Pineapple juice 700ml + Beetroot extract (35gm) + 25° Brix + wine yeast 0.133%) with (5.65,6.63 and 7.41) whereas the minimum score was observed in treatment T_3 (Pineapple juice 700ml + Beetroot extract (35gm) + 30° Brix + wine yeast 0.133%) with (5.72, 6.64 and 6.58) during 30, 60 and 90 days storage. Similarity related to sensory evolution has been also reported by **(**Zhaojian Gao, 2005).

Economical evaluation

In terms of Cost Benefit Ratio, The Cost Benefit Ratio showed that there were significant differences among all the treatments in Cost Net Return, Gross Return and Cost Benefit Ratio of different treatments. The Gross return of Rs. 2100 and Rs.1950 is recorded in T_4 and T_2 respectively, but highest Net Return Rs.1253.89, Cost Benefit Ratio 1:2.48 was recorded in treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° brix + wine yeast 0.133%), followed by Treatment T_2 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 25° brix + wine yeast 0.133%) with Net Return of Rs.1108.39 and Cost Benefit Ratio 1:2.31 whereas lowest Gross Return Rs.1800, Net Return Rs.951.64 and Cost Benefit Ratio 1:2.12

was recorded in treatment T_5 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 40° brix + wine yeast 0.133%).

Table 1: Effect of different level of sugar concentration (*Ananas comosus* L.) on Colour appearance, Aroma. during storage

Treatment	Treatments combination	Colour And appearance			Aroma		
		30 days	60 days	90 days	30 days	60 days	90 days
T1	Pineapple juice (700ml) + Beetroot (35g) + Sugar (20°Brix) +Wine year (0.133%)	6.05	7.04	7.50	4.75	6.15	7.31
T2	Pineapple juice (700ml) + Beetroot (35g) + Sugar (25°Brix) +Wine year (0.133%)	6.15	7.12	7.55	5.62	6.43	7.38
T3	Pineapple juice (700ml) + Beetroot (35g) + Sugar (30°Brix) +Wine year (0.133%)	6.05	7.14	7.20	5.65	6.41	6.44
T4	Pineapple juice (700ml) + Beetroot (35g) + Sugar (35°Brix) +Wine year (0.133%)	7.71	7.83	8.31	6.48	7.26	8.05
T5	Pineapple juice (700ml) + Beetroot (35g) + Sugar (40°Brix) +Wine year (0.133%)	5.66	6.75	7.26	5.53	6.30	7.31
F test		**S**	**S**	**S**	**S**	**S**	**S**
C.D. @ 0.5		**1.11**	**0.22**	**0.34**	**0.58**	**0.45**	**0.46**
S.Ed.		**0.51**	**0.10**	**0.15**	**0.26**	**0.20**	**0.21**
S.Em		**0.36**	**0.07**	**0.11**	**0.19**	**0.14**	**0.15**

Fig. 1 Graphical representation of Colour appearance, Aroma

Table 2: Effect of different level of sugar concentration (*Ananas comosus* L.*)* on Taste and Overall acceptability during storage

Treatment	Treatments combination	Taste			Overall acceptability		
		30 days	60 days	90 days	30 days	60 days	90 days
T1	Pineapple juice (700ml) + Beetroot (35g) + Sugar (20°Brix) +Wine year (0.133%)	5.61	6.24	7.03	5.48	6.45	7.28
T2	Pineapple juice (700ml) + Beetroot (35g) + Sugar (25°Brix) +Wine year (0.133%)	5.26	6.34	7.27	5.65	6.63	7.41
T3	Pineapple juice (700ml) + Beetroot (35g) + Sugar (30°Brix) +Wine year (0.133%)	5.43	6.37	7.31	5.72	6.64	6.58
T4	Pineapple juice (700ml) + Beetroot (35g) + Sugar (35°Brix) +Wine year (0.133%)	6.64	7.45	8.07	6.54	7.51	8.14
T5	Pineapple juice (700ml) + Beetroot (35g) + Sugar (40°Brix) +Wine year (0.133%)	5.51	6.35	7.04	5.57	6.48	7.20

F test		**S**	**S**	**S**	**S**	**S**	**S**
C.D. @ 0.5		**0.40**	**0.42**	**0.26**	**0.48**	**0.24**	**0.21**
S.Ed.		**0.18**	**0.19**	**0.12**	**0.22**	**0.11**	**0.098**
S.Em		**0.132**	**0.139**	**0.086**	**0.15**	**0.07**	**0.069**

Fig. 2 Graphical representation of Taste and Overall acceptability

Table 3: Effect of different level of sugar concentration (*Ananas comosus* L.*)* on specific gravity and TSS during storage.

Treatment	Treatment combination	Specific gravity				TSS (%)			
		1 days	**30 days**	**60 days**	**90 days**	**1 Days**	**30 days**	**60 days**	**90 days**
T_1	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (20°Brix)+Wine yeast (0.133%)	1.74	1.42	1.17	1.08	14.35	13.14	11.90	10.37
T_2	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (25°Brix)+Wine yeast (0.133%)	1.73	1.32	1.14	1.08	12.97	12.50	11.92	9.69
T_3	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (30°Brix)+Wine yeast (0.133%)	1.68	1.34	1.20	1.05	13.83	13.27	11.99	7.14
T_4	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (35°Brix)+Wine yeast (0.133%)	1.58	1.24	1.05	0.76	15.54	12.33	8.46	6.11
T_5	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (40°Brix)+Wine yeast (0.133%)	1.72	1.36	1.20	1.03	14.70	13.29	12.10	10.39
	F test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	C.D. @ 0.5	**0.21**	**0.16**	**0.07**	**0.11**	**1.62**	**0.42**	**0.74**	**0.97**
	S.Ed.	**0.09**	**0.07**	**0.03**	**0.05**	**0.74**	**0.19**	**0.34**	**0.44**
	S.Em	**0.06**	**0.05**	**0.02**	**0.03**	**0.52**	**0.13**	**0.24**	**0.31**

Fig. 3 Graphical representation of Specific gravity, TSS (%)

Table 4: Effect of different level of sugar concentration (*Ananas comosus* L.*)* on Alcohol, Acidity, and pH during storage.

Treatment	Treatment Combination	Alcohol%			Acidity %				pH			
		30 days	60 days	90 days	1 day	30 days	60 days	90 days	1 day	30 days	60 days	90 days
T_1	Pineapple juice (700ml)+ Beetroot 35g) + Sugar (20°Brix)+Wine yeast (0.133%)	3.53	4.3	5.3	0.28	0.35	0.45	0.60	4.	3.62	3.42	3.2
T_2	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (25°Brix)+Wine yeast (0.133%)	3.54	4.2	5.1	0.27	0.38	0.54	0.66	4.	3.88	3.38	3.1
T_3	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (30°Brix)+Wine yeast (0.133%)	3.53	4.5	5.2	0.30	0.40	0.54	0.64	4.	3.65	3.43	3.1
T_4	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (35°Brix)+Wine yeast (0.133%)	4.22	5.5	6.2	0.35	0.51	0.67	0.81	4.	3.37	3.14	2.5
T_5	Pineapple juice (700ml)+ Beetroot (35g) + Sugar (40°Brix)+Wine yeast (0.133%)	3.55	4.5	4.5	0.30	0.37	0.54	0.68	4.	3.51	3.51	3.0
	F test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	C.D. @ 0.5	**0.40**	**0.1**	**0.3**	**0.12**	**0.05**	**0.09**	**0.05**	**0.**	**0.33**	**0.19**	**0.0.**
	S.Ed.	**0.18**	**0.0**	**0.1**	**0.05**	**0.02**	**0.04**	**0.02**	**0.**	**0.15**	**0.09**	**0.0**
	S.Em	**0.13**	**0.0**	**0.0**	**0.04**	**0.01**	**0.03**	**0.01**	**0.**	**0.10**	**0.06**	**0.0**

Fig. 4 Graphical representation of Alcohol, Acidity (%), pH

CONCLUSION

Based on findings of the present experiment, it is concluded that treatment T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° brix + wine yeast 0.133%) was found superior and best in respect of the parameters like TSS, Acidity, pH, Alcohol %, Specific gravity. With respectively, Color and Appearance, Taste, Aroma and Overall acceptability. In terms of economic analysis, the highest Net Return Rs.1253.89, Gross return Rs.2100 and Cost Benefit Ratio 1:2.48 was also found in T_4 (Pineapple juice 700ml + Beetroot extract (35gm) + Sugar 35° brix + Wine Yeast 0.133%).

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