STUDY ON DEVELOPMENT AND STORAGE OF BLENDED PINEAPPLE *(Ananas comosus* L.) MANGO (*Mangifera indica* L.) CRUSH

ABSTRACT

The present research work entitled "STUDY ON DEVELOPMENT AND STORAGE OF BLENDED PINEAPPLE (*Ananas comosus* L.) MANGO (*Mangifera indica* L.) CRUSH" was carried out at Post Harvest Lab, Department of Horticulture, Naini Agricultural Institute (NAI) SHUATS, Prayagraj (formerly Allahabad), U.P, INDIA, during 2021-2023. The statistical design adopted for the experiment was Completely randomized design (CRD) with three replications and Eight treatment combinations and the product was analyzed for quality parameters and sensory qualities at the interval of 15 Days till 45 Days of storage period at refrigerated conditions (4^0C). The present investigation revealed about the quality parameters viz. TSS, Reducing sugars, Non-Reducing Sugars and Total sugars, acidity content during storage of 45 Days .After 45 days of storage, Treatment T_5 (Pineapple pulp 50%: Mango pulp 50%) was found superior having TSS (55.85^{0}Brix), acidity (0.89%), total sugars (45.42 %), reducing sugar (15.88%) and also give better result in sensory evaluation in colour (7.70), taste (8.02), aroma (8.01), texture (7.98), and overall acceptability (8.02) at refrigerated conditions (4^0C). Treatment T_5 performed well in the economic investment with higher benefit cost ratio i.e., 1.83 which is quite higher than other treatments.

Keywords – Pineapple, mango, crush, storage, sensory evaluation, Processed product.

1. INTRODUCTION

The fruit has been a past part of the human diet and dietary supplements over the years. They are good sources of essential elements that are very important for our body to function properly, such as water, antioxidants, vitamins, minerals, and organic compounds **(Khoo *et al.* [1])**. Fruits are highly susceptible to bacterial and fungal contamination because of their perishable nature so it is difficult to keep them for a long time. Fruit can be preserved either by processing into juice, nectar, pulp, or crush and being used as an additive to other fruit juice or pulp.

Mango *(Mangifera indica* L.*)* is the national fruit of India and native to South Asia, the Indo-Burma region and it is one of the most important commercial tropical fruits **(Ahmed *et al.* [2])** India contributes approximately 57.18% of world production. It has a long history of close ties to Indians' economic, aesthetic, and cultural lives **(Parab *et al.* [3]).** Mango is not only delicious but also known for its nutritional value. A very perishable fruit, mango has a very short shelf life and suffers 20-30% post-harvest losses every year. **(Muhammad *et al.* [4]).** Therefore, converting mango into some processed product like pulp, nectar, RTS, jam, crush, etc. is a must to avoid wastage and also to help to increase its availability throughout the year.

Pineapple (*Ananas comosus* L.) is a tropical fruit and has a distinct aroma and a refined taste, and the absence of seeds makes them acceptable worldwide. The historical roots of the pineapple are in Central and Southern Brazil, Northern Argentina, and Paraguay **(Santos et al. [5]).** Pineapple is a good source of carotene and ascorbic acid and is quite rich in vitamin B1 and vitamin B2 **(Chaudhary *et al. [6]*)**. Fresh Pineapple is more fragile and easily damaged; hence it has a shorter shelf life. In Indian market, almost eighty percent of pineapple production is found in processed form, with almost thirty percent going towards canned fruit and 48 percent going towards juice manufacturing (single or concentrated form). **(Saad, [7]).**

In today's Era, the most difficult challenge for the producer is to preserve the fruit in a high-quality state until it reaches to consumer **(Valta *et al.* [8]).** There is tremendous potential to process these fruits and the processed products prepared mainly are mixed juice, squash, slices in tins, refreshing beverages, powder, leather, and jam **(Onyango *et al.* [9]).**

Both fruits are seasonal in nature and available in large quantities in the peak season. However, due to poor practice of post-harvest handling, equipment for processing and preservation of these fruits, a considerable amount is wasted.

This measure also supports the development of the manufacturing industry in the growing areas of the country. Many people, especially children, are more interested in processed products than fresh fruit. Mixed fruit crush can attract the attention of consumers with its deliciousness, attractive color, mixed taste, and aroma. So, it can get satisfactory acceptance from consumers.

Fruit crush is an important beverage that is an intermediator product between squash and syrup. It is currently in high demand in the Indian market. The Pineapple pulp can be used as a crush and mango pulp is used to improve the nutritive value and the organoleptic qualities of the crush. Pineapple pulp can suitably blend with mango pulp and give a delicious taste.

Industries in food processing are rising in India, and the consumption of processed fruit products is increasing day by day.

Taking into consideration important aspects of Pineapple and mango, an experiment "Study on development and storage of blended pineapple mango crush" was carried out with the following objective.

1. To assess the quality parameters of different treatment combinations.

2. To assess the economics of different treatments combinations.

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Cultivar used for the experiment

The cultivar of mango which is used for the study was "Chausa". Chausa also known as "Chaunsa" is one of the leading mango cultivars and indigenous to South Asia. It is mainly grown in India and Pakistan region. The variety was made popular by Indian ruler Sher Shah Suri. The fruit has a yellow-golden colour. It is soft, it has aromatic, sweet and pleasant flavor. Its unique taste, richness in flavor and high nutritional value makes it worldwide acceptable. In India, there are number of varieties of mango but only these varieties are grown in different states i.e., Alphonso, Bangalora, Banganpalli, Bombai, Suvarnarekha, Bombay Green, Dashehari, Fazli, Fernandin, Kesar, Kishen Bhog, Langra, Mankhurd, Mulgoa, Neelam, Chausa, Vanaraj, Himsagar, and Zardalu. Among these, Chausa variety have higher vitamin C content than other mango cultivars. Normally, Chausa season starts in the month of June and ends in the month of august.

The cultivar of pineapple used for the study was 'Kew'. Kew is the leading marketable commercial variety of pineapple in India. Variety 'Kew' is a late-maturing variety of pineapple and is valued particularly for its canning quality **(Tanmay *et al. [10])*.** The colour changes into yellow indicates the ripening stage of the fruit, which is reflected in a strong internal maturity gradient too. The fruit colour is yellow and flesh is firm, close textured, almost fibreless and very juicy with 0.6- 1.2 percent acidity and its total soluble solids content (TSS) varies from 12 to 16 Brix.

2.1.2 Site of experiment

The present investigation was conducted at post-harvest lab, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj (UP), during 2021-2023. The experiment was conducted in completely randomized design (CRD) **(Chovatiya *et al.* [11])** with three replications and eight treatments (T_1 - Pineapple pulp 85% + Mango pulp 15%, T_2 - Pineapple pulp 75% + Mango pulp 25%, T_3 - Pineapple pulp 65% + Mango pulp 35%, T_4 - Pineapple pulp 55% + Mango pulp 45%, T_5 - Pineapple pulp 50% + Mango pulp 50%, T_6 - Pineapple pulp 45% + Mango pulp 55%, T_7 - Pineapple pulp 35% + Mango pulp 65%, T_8 – Pineapple pulp 25% + Mango pulp 75%) were applied and data were analyzed statistically.

2.2 Methods

2.2.1 Selection and preparation of fruits

The fully ripe, fresh and sound pineapple fruits were selected for the preparation of blended crush. The fruits were washed with water to remove dirt and dust. After peeling, the pineapple fruits were cut into slices and core was removed. The pineapple slices were then grind using grinder.

Fresh mangoes were selected for the preparation of blended crush. The fruits were washed with water to remove extra dirt. After that peeling is done with pillar and then fruits were cut into slices and grind using grinder.

2.2.2 Preparation of blended crush

For the preparation of blended crush, the Pineapple pulp and Mango pulp are mixed together in different ratios as per the treatments. After evaluating the blends for the TSS and acidity, a required quality of sugar and citric acid was added to the mixture to maintain 55^0Brix T.S.S. and 1.0 per cent Titrable acidity of the blended crush. The mixture was them heated to dissolve the sugar completely.

2.2.3 Filling and storage of the blended crush

The product was then hot filled in pre-sterilized glass bottles. The bottles were then sealed air tight, pasteurized labelled and stored at a cool and dry place under refrigerated conditions.

2.2.4 Storage behaviour of blended crush

The crush was stored under refrigerated conditions to study the storage behaviour of the product with respect to the change in quality parameters and sensory qualities during storage. The product was evaluated immediately after preparation and at an interval of 15 Day to 45 Days of storage.

2.3 Analysis of blended crush

2.3.1. Total soluble solids

Total soluble solids (TSS) of fruits were determined with the help of Hand refractometer and the values were presented in °Brix (**Rangana [12]).**

2.3.2 Titrable acidity

To determine titratable acidity crush was titrated against standard Sodium hydroxide (0.1N) using phenolphthalein as an indicator. For this 10g of Blended Crush, was mixed with distilled water to made-up volume of 100 ml in a volumetric flask. Then this made-up volume was filtered with Whatman No.1 filter paper. 10 ml juice aliquot was taken in a conical flask from this filtered volume, and titrated with 0.1 N NaOH using 1-2 drops of 1 percent phenolphthalein as an indicator. End point of titration showed light pink colour of the solution.

Calculate the percent Titrable acidity as follow

$$\text{Titrable acidity} = \frac{\text{Normality of alkali X Titre reading X volume made X Equivalent weight of acid}}{\text{weight of Sample taken X volume of sample taken estimation X 1000}} \text{ X } 100$$

2.3.3 Sugars

Reducing, non-reducing and total sugars were determined by using Lane and Eynon method given by **Sewwandi *et al.* [13]** by using following formulas.

% Reducing Sugars = Fehling's solution factor x 100 x dilution/ Vol. of Sample used.

% Total sugars = Fehling's solution factor x 100 x Result and Discussion.

% non-reducing sugar (sucrose) = (%Total sugar-% reducing sugar) x 0.095.

3. RESULT AND DISCUSSION

3.1 Sensory evaluation

The scores sensory evaluation shown in Table 1 were subjected on the basis of hedonic scale **(Prasad *et al.* [14])** and these are the mean values. In case of colour preference among the different treatments. Treatment T_5 has the highest score 8.04 while treatment T_1 secured the lowest score of 5.42. In case of texture preference, T_5 has the most and highest score among eight treatments. T_5 scored the highest score 8.20. In the cause of overall acceptability, T_5 has better overall acceptability but not significantly different from T_4. Similar result was reported by **Lad et al. [15]** in lime cv. saisarbati squash and **Marimuthu and Thirumaran [16]** in jamun syrup and **Shikhare [17]** in kokum sapota blended syrup.

Table 1: - Effect of storage period on organoleptic score of blended pineapple mango crush

Treatment No.	Taste	Colour	Texture	Aroma	Overall acceptability
T_1	6.98	5.42	6.36	6.48	6.98
T_2	7.51	6.39	6.49	6.75	7.22
T_3	7.68	6.58	6.91	7.67	7.68
T_4	8.00	7.68	7.71	7.88	8.00
T_5	8.12	8.04	8.20	8.06	8.12
T_6	7.94	7.56	7.69	7.63	7.95
T_7	7.69	7.40	7.43	7.57	7.68
T_8	7.56	7.33	6.73	7.51	7.56

3.2 Quality parameters

3.2.1 Total soluble solids (T.S.S) (^{0}Brix)

TSS of blended crush increased gradually during storage period up to 45 Day under refrigerated conditions. The maximum total soluble solids (55.85^{0}Brix) were observed under the treatment T_5 (Pineapple pulp 50% + Mango pulp 50%), while minimum (53.01^{0}Brix) was observed under the treatment T_1 (Pineapple pulp 85% + Mango pulp 15%). The identical results were also reported by **Jadhav *et al.* [18]** in ripe karonda syrup during storage period of 240 days.

3.2.2 Titrable Acidity (%)

The acidity per cent in blended crush was found to be decreased under all the recipes with increase in storage period up to 45 Day under refrigerated conditions. The minimum acidity (0.87%) was recorded under the treatment T_4 (Pineapple pulp 55% + Mango pulp 45%), while the treatment T_1 (Pineapple pulp 85% + Mango pulp 15%) showed maximum acidity (1.01%) under the present investigation. **Koargaokar *et al.* [19])** and **Kalunkhe *et al.* [20])** recorded the similar results where acidity was decreased during three month's storage in snap melon syrup and lemon squash cv. Konkan seedless, respectively.

3.2.3 Total Sugars (%)

The total sugars (%) in blended crush increased with increase in storage period up to 45 Day under refrigerated conditions. The maximum total sugars (45.42%) were recorded under the treatment T_5 (Pineapple pulp 50% + Mango pulp 50%), while the minimum (39.25%) was recorded under the treatment T_1 (Pineapple pulp 85% + Mango pulp 15%) under the present trail. Similar results were obtained by **Yadav et.al. [21]** in Guava-mango squash. **Marimuthu and Thirumaran [16])** also reported such results in jamun syrup where the total sugar content was increased from 65.00 to 68.30 per cent during 3 months of storage.

3.2.4 Reducing Sugars (%)

The reducing sugars (%) of blended crush increased gradually during storage period up to 45 Day under refrigerated conditions. The treatment T_1 recorded minimum reducing sugars (12.77%), while the maximum reducing sugars (15.51%) were recorded under the treatment T_5 (Pineapple pulp 50% + Mango pulp 50%) under the present investigation. Such results were also reported by **Reddy and Chikkasubbanna [22]** in amla syrup, where the reducing sugars were found to increase with the advancement of the storage period.

3.2.5 Non-Reducing Sugars (%)

The total sugars (%) in blended crush increased with increase in storage period up to 45 Day at under refrigerated conditions. The maximum total sugars (30.98%) were recorded under the treatment T_5 (Pineapple pulp 50% + Mango pulp 50%), while the minimum (27.20%) was recorded under the treatment T_1 (Pineapple pulp 85% + Mango pulp 15%) under the present trail.

Table 2: - Effect of storage period on Quality parameters of blended pineapple mango crush

Days of storage	Parameters	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	C. D. at 5%	CV
0	**T.S. S (^{0} Brix)**	52.48	53.77	54.03	55.40	55.58	55.37	55.30	55.23	0.087	0.091
	Titrable acidity (%)	1.14	1.11	1.09	1.02	1.03	1.07	1.08	1.10	0.067	3.575
	Total sugars (%)	36.18	36.69	39.46	40.75	42.76	41.81	40.26	39.85	0.106	0.153
	Reducing sugars (%)	10.94	11.09	12.79	13.99	14.11	14.05	13.60	13.25	0.111	0.492
	Non-reducing sugars (%)	25.19	25.60	26.67	27.75	28.65	26.77	26.64	26.60	0.114	0.244
15	**T.S. S (^{0} Brix)**	52.78	54.05	54.21	55.50	55.69	55.48	55.37	55.30	0.106	0.110
	Titrable acidity (%)	1.09	1.07	1.04	0.95	0.97	1.01	1.03	1.05	0.086	4.810
	Total sugars (%)	37.19	37.62	40.56	41.79	43.98	40.16	41.28	40.88	0.113	0.160
	Reducing sugars (%)	11.52	11.69	13.41	14.59	14.76	14.66	14.20	13.86	0.109	0.460
	Non-reducing sugars (%)	25.79	26.38	27.53	28.58	29.46	27.58	27.45	27.38	0.106	0.221
30	**T.S. S (^{0} Brix)**	52.98	54.13	54.30	55.58	55.77	55.54	55.40	55.33	0.091	0.094
	Titrable acidity (%)	1.05	1.02	0.99	0.92	0.93	0.98	0.99	1.03	0.080	4.593
	Total sugar (%)	38.15	38.74	41.75	42.68	44.39	43.75	42.65	41.82	0.154	0.212
	Reducing sugars (%)	12.02	12.31	13.99	14.99	15.26	15.02	14.72	14.49	0.109	0.450
	Non-reducing sugars (%)	26.40	27.18	28.33	29.37	30.26	28.36	28.27	28.19	0.113	0.232
45	**T.S. S (^{0} Brix)**	53.01	54.21	54.39	55.64	55.85	55.62	55.52	55.40	0.107	0.107
	Titrable acidity (%)	1.01	0.98	0.95	0.87	0.89	0.92	0.94	0.97	0.071	4.252
	Total sugar (%)	39.25	39.84	42.84	43.70	45.42	44.51	43.69	42.88	0.105	0.141
	Reducing sugar (%)	12.77	12.95	14.60	15.51	15.88	15.64	15.23	15.13	0.108	0.429
	Non-reducing sugar (%)	27.20	27.98	29.04	30.09	30.98	29.06	29.01	28.90	0.103	0.103

Fig 1: - Final product

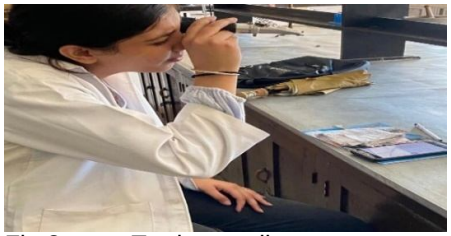

Fig 2: - Testing quality parameters

Fig 3: - Display and organoleptic test of the product

3.2.6 Economics

The data present in Table 3, clearly indicates that treatment T_5 had the highest net return (61,500 Rs/ 500 bottles) when compared to the other treatments where-as Treatment T_1 had the lowest net return (21,500 Rs/ 500 bottles) when compared to the other treatments.

Highest B:C ratio of 1.83 was found under treatment T_5. However, Lowest Benefit: Cost ratio (0.56) was recorded in treatment T_1.

Table 3: - Economics of blended pineapple mango crush

Treatment No.	Gross return for 500 bottles (Rs)	Net Return for 500 Bottles (Rs)	B:C Ratio
T_1	60,000	21,500	0.56
T_2	65,000	27,500	0.73
T_3	65,000	30,000	0.85
T_4	75,000	40,500	1.17
T_5	95,000	61,500	1.83
T_6	70,000	38,000	1.18
T_7	65,000	34,500	1.13
T_8	65,000	36,000	1.12

4. CONCLUSION

From the present investigation, it could be concluded that, all the recipes of blended crush were found to be organoleptically acceptable.

The blended crush prepared from pineapple pulp and Mango pulp was significantly superior with respect to overall acceptability of the product to the straight pineapple crush or straight mango crush.

The Treatment T_5 (Pineapple Pulp 50%: mango pulp 50%) was found to be the best recipe for blended crush with highest organoleptic score for colour, flavour and overall acceptability and higher gross returns on the investment. Mango pulp could use as a stabilizer in 50:50 proportion for uniform dispersion of colloidal particle in the preparation of Pineapple crush.

The crush was evaluated organoleptically by diluting it with chilled water in the proportion of 1:1 and also with ice cream in 1:1. Crush was also served with bread, which is also a good option. It was observed that taste of crush seems better with bread or ice cream other than chilled water.

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